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ISMAILITICA.

BY
W. IVANOW.



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ISMAILITICA.

By W. IVANOW.

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The present publication of a small text, containing an exposition of some secret Ismaili doctrines, as well as a few notes on the present state of the sect in Persia is chiefly calculated to facilitate further research. Those who have an opportunity of residing in a country where the followers of this sect are to be found would render invaluable services to the study of this important branch of Muhammadanism if they were to spare a little of their time and energy in order to obtain some more precise information about this mysterious religion. The scattered material given occasionally by the historians, travellers and theologians, even were it much richer than it actually is, cannot compare in value with the genuine documents of the sectarian literature. But even these materials come to an end shortly after the time of the Mongol invasion which destroyed the political power of the Assassins. A period of over five hundred years in the life of the sect is left blank, and we know about the modern history of the community little more than nothing, i.e. only the fact that Ismailism still exists as a religion in some parts of Asia, such as Syria, Persia, Central Asia and especially India. It is remarkable that European scholars though always taking a keen interest in the history of this sect never, or almost never,* tried to make direct research among its followers. It is quite clear however that the fact of the great and prolonged vitality of this religion and its stability in spite of persecution will not allow us to think that its literature perished entirely, or that during these five hundred years there was no attempt made to re-establish or continue literary activity. Therefore there is no reason to doubt that energetic investigation would yield some very valuable materials.

The greatest difficulty in the research itself lies in the method of starting it. Entire success often depends on the possibility of choosing a suitable ground to approach the sectarians. Everybody who has had some experience of this sort knows well how much tact is to be displayed and how often in spite of all efforts nothing is obtained from the obstinate lovers of mystery. My own seven years' experience amongst various sectarians in Persia absolutely proved that the

* As far as I know there were some Russian travellers and officials who studied occasionally the Ismailis in the Upper Oxus region and even succeeded in obtaining their sacred books. Such were Count Bobrinski, A. Polovtsev, A. Lutschg, A. Semenoff, etc.

most effective, if not the only way to make progress in this case, is to be able to show some previous knowledge of the subject. Even quite insignificant material can sometimes be of great help, being used as a means whereby to draw up a corner of the "veil of mysteries." And I hope that the present publication, touching the most essential questions in the Ismaili system, will give enough material of this kind.

I am quite conscious of the defects of the present work. The original text is mutilated in many places by the mistakes of ignorant copyists. But no attempt at amendment by collation with another manuscript can be made because there are no more copies of this treatise known in any of the European libraries. My notes on the Persian Ismailis, made in very unfavourable circumstances, are not as complete as I would like them to be. But it is quite certain that to postpone the publication until another copy of the "Book of Recognition" may be found or till such time as I may have a better chance to explore the Ismailis in Persia, would mean simply to lose them entirely. Therefore, believing that a little is better than nothing, I offer this paper as a contribution to the study of present-day life in the Eastern countries.

I take this opportunity of expressing my greatest thanks to Lieut.-Col. G. Ranking, I.M.S., for his great assistance with my English and for important suggestions in the analysis of the Persian text, as well as to Mr. A. H. Harley, M.A., who has gone through my paper.

I. BOOK ON THE RECOGNITION OF THE IMAM.

I. ORIGIN AND DESCRIPTION OF THE MANUSCRIPT.

This concise but clear exposition of some Ismaili doctrines of which the text and translation are given here, was found in the regions of the Upper Oxus in Rūshān or Shughnān. It was brought in 1916 from that country by a Russian traveller, I. Zarobin, who collected all the religious writings of the local sectarians of which he could hear. As far as he is aware his collection, however small it may seem, represents the whole Ismaili literature actually existent and current amongst the followers of this sect in that remote corner of Asia. All the manuscripts passed into the possession of the Asiatic Museum of the Russian Academy of Sciences and a concise description of them was published by me in Russian in the April number of the "Bulletin de l'Académie Russe des Sciences," 1917, pp. 359-386, under the title "The Ismaili Manuscripts in the Asiatic Museum." Those who cannot read Russian may be referred to a review of this paper of mine by Sir E. Denison Ross in the Journal of the Royal Asiatic Society, 1919, pp. 429-435.

The treatise in question occupies folios 17 verso-32 verso¹ of a Majmū'a (No. 4 of the collection) which is composed of some nineteen different articles mostly in a very fragmentary state, bound together only because the leaves they were written on were of more or less the same size.² The handwriting of this copy bears distinct traces of Indian influence, if not origin in that country. The paper can be taken as Indian almost for certain. Judging from the general appearance of the manuscript, it seems to be not older than 50 or 60 years. Neither the date nor the name of the copyist is given.³

The book begins with what can be taken as a title: فصل در بیان شناخت امام‌الجم

It ends without colophon in the usual تمام شد.

The measurements are: outside 210 × 115 mm., and inside 150 × 85 mm., 11 lines to a page.

II. DATE OF COMPOSITION OF THE TREATISE.

The author's name is not mentioned in the text and of course it would be hopeless to trace it anywhere else. Fortunately, although the date of composition does not appear, it is possible to fix it within certain limits with some degree of certainty. This can be deduced from the occasional allusions of the author to

¹ In the present publication I give separate pagination, beginning with fol. 1v.

² This is quite a common thing in Central Asia, and occasionally one finds a big volume which on examination appears to consist of absolutely unconnected fragments of various works bound together.

³ The sectarians in this part of Asia, as I was told, regard copying their sacred books as a pious and religious act and therefore they usually very carefully state their names in the colophon.

his epoch, as well as from his poetical quotations from persons whose time of life is known.

The date *before which* the treatise was composed is probably 1000 A.H. This is clear from what the author says on fol. 13*v.* about the "period of Muhammad in which we are living."⁴ This period is nothing else, as one gleans from the context, than the millennium at the beginning of which Muhammad appeared.⁵ It is difficult however to say whether the starting point of this millennium in the sectarian belief is the day of the flight (Hijra), or some other event in Muhammad's or (it is as possible) 'Ali's life. Anyhow it cannot be very distant on either side from 1000 A.H.

Much more difficult is it to fix the latest date *after which* the book could have been written. There are some historical allusions but the latest, whose time can be fixed, is the question about Nizār's not being acknowledged as an Imam by a section of the believers (fol. 3*v.*). Another allusion to a certain occasion when "the Imam disappeared entirely from the believers but afterwards was recognised by the Ḥujjat" (which means probably in ordinary language that the line of descendants was interrupted) occurs on fol. 3*v.*, but it is too obscure to allow any dating.⁶

Of much greater use however is the fact that the author, who seems to be very fond of poetry, usually gives the name of the poet to whom the quotation belongs.⁷ Many of them are quite well-known personages and their biographies are available. Amongst these there are Nāṣir-i-K̲h̲usraw (fol. 14*v.*); Sanāī (f. 6*v.*); Shaykh 'Aṭṭār (f. 6*v.*); Jalālu'd-Din Rūmī (f. 6*v.*, 7*v.*); several times he cites verses from Nizārī, who died in 720 or 721 A.H. (ff. 3, 7*v.*, 9*v.*, 12*v.*); a part of a *qaṣīda* in praise of the Imām

⁴ As he says *دورهٔ محمدی که ما در آن داخلیم*.

⁵ Cf. what he says about the establishment of the laws for the whole millennium (fol. 13, 13*v.*).

⁶ He refers occasionally to the "books of this sect" (f. 10), or the "majority" of them (f. 7), or the "blessed books" (f. 11*v.*) but never gives their title. It is strange that he should call a "book" *کتاب*, which word means a chapter. There may be probably some religious prejudices about this. It is interesting to note that the fragments published by S. Guyard are styled in this fashion also (cf. pp. 17, 101). Our author quotes also the Quran (ff. 7, 12) and some traditional stories about Salman Farsi, etc., of obviously very spurious authenticity.

⁷ Except in cases where the poetry is either obviously of popular origin or is simply a versified proverb.

⁸ The author merely mentions Sanai and 'Aṭṭār, without citing their poetry.

⁹ Cf. Grundriss d. Iran. Philologie, v. II, p. 257 and E. Browne's "A History of Persian Literature under Tatar Dominion," 1920, p. 154-5. Regarding this poet I may add to what is said in these two books that an excellent old copy (beginning of IXc. A.H.) of his "Kulliyāt" exists in the Imperial Public Library at Petrograd. The late Prof. C. Salemann intended to publish some of the mathnawis contained in that copy. A large part of the manuscript was photographed and copied by me in January of 1915. The War and difficulties of printing caused postponement of the publication. It appears from one mathnawi, a sort of "Safar-nāma," (as far as I can remember it has no title) that Nizārī belonged to "good" society. He describes his travels from Qubistan (where he mentions Rirjand, Khusp, Qain, etc.) to the Northern Azarbayjan and Armenia. His heart however was not with his companions and he was longing and pining, until (as one may conclude from his symbolic language) he apparently was converted (?) to some Sufic or Ismaili teachings by a "pir." It happened in these northern regions. The other MS. of Nizārī's poems and *mathnawis* is preserved at the Asiatic Museum of the Russian Academy of Sciences. It is a part of an old *biyāḍ* and contains apparently the *Dastūr-nāma* described by Sprenger (as far as I can remember at present). I must say however that I have serious reasons to fear that the natural expectations of scholars to find there much biographical material or something about Ismaili doctrines will be rather disappointed. From what I read of his *mathnawis* it seems that the author uses such symbolic language that to decipher it one must possess a good knowledge of all these things already.

'Ali by Amīr Sayyid 'Ali-i-Wā'iz (f. 8.), who is apparently no other than the son of Ḥusayn Wā'iz al-Kāshifī, the author of the well-known Anwār-i-Suhaylī. His son was a poet with the *takhalluṣ* "Ṣafī" and died in 939 A.H.¹⁰ And finally the author cites one verse from what he calls the "qaṣīda of Iskandar" by "Ḥakīm" "Thanāī (f. 9v). This poet of no great renown came from Khorasan to India in the time of Akbar, the Great Mogol, in praise of whom he composed some poetry and a mathnawi with the title "Iskandar-nāma."¹² He died in 996 A.H.

The matter is somewhat obscure. The verse, which is quoted, cannot belong to a mathnawi, because it has no internal rhyme. Besides it is of different metre from the "Iskandar-nāma." I have examined two MS. copies of the Diwan of this poet and could find no poem with the rhyme and metre of the verse cited. It is quite a common thing that some "over-educated" students of Persian literature try to spell in this way, i.e. *ثنائی*, the name of *سنائی*.¹³ That the author should mention the title "hakīm" with the name Thanāī is also suspicious. Therefore I examined also the Diwan of Sanāī but could not find any poem the metre and rhyme of which are the same as those of the verse cited. Moreover, there is no indication of any important person called Iskandar in praise of whom Sanāī could compose poems.

It is quite probable that this poet as well as many others of whose biography practically nothing is known except a few facts may have composed many poems which were not preserved in the ordinary copies of his Diwan. Therefore it would be inadmissible to deny the possibility of the quoted verse being genuine. The coincidence of these two names of Thanāī and Iskandar cannot be disregarded, and if this poem was really composed in praise of Akbar in whose reign the poet came to India from his native Khorasan, it was not before 963 A.H., i.e. the date of Akbar's accession to the throne.

Thus the date of the present treatise may be fixed between 963 A.H. and 1000 A.H. In favour of this assumption there are several considerations. In the end of the treatise the author says that he has composed his book "in language understandable to every body in order that even uneducated people (who cannot read Arabic?) may not remain without their share in its benefit" (f. 16v.). These words may prove that the need for such a book either was really felt among masses of the population or the author believed that it must be so. And that he was not alone in this opinion is proved by the existence of at least two more books in the same collection, which were composed approximately at the same time, i.e. Haft Bāb (No. 3

¹⁰ Cf. Grundriss d. Ir. Ph. v. II, p. 332. This identification is confirmed by the fact that this poet is very popular amongst the sectarians. Another book of the same collection (Haft Bāb, f. 54) quotes his *لطائف اطراف* (about this see Grundr. d. Ir. Ph., *ibidem*). I could not identify the present quotation because there is no copy of his Diwan (which is very rare) available to me at present.

¹¹ This title is applied usually to great Persian poets only. The present case is probably the result of confusion of this poet with Sanāī.

¹² About the poet see Rieu, Supplement to the Cat. of the Pers. MSS. in the Brit. Mus., 309. About his Iskandar nāma see E. Sachau and H. Ethé, "Cat. of the Pers., etc. MSS. in the Bodleian lib.," v. I, 1048-9.

¹³ I have even seen an advertisement of a lithographed Indian edition of *حديقة ثنائی*!

of the collection)¹⁴ and an anonymous book of Ismailitico-Sufic discussions as to the importance of a "pir" (No. 5 of the coll.), composed apparently in 959 A.H.

This revival of the literary activity may prove some awakening of the religious interest. And it finds some explanation in the sectarian doctrines about millennial periods, on which the author lays some stress in his book. According to these ideas the "period of Muhammad" was close to its end and then a new glorious epoch, the "Sabbath of the Faith," when the Imam would appear in the full greatness of his person, would arrive. This may be the reason why it seemed desirable to refresh one's knowledge of the religious doctrines.

To finish with quotations I may add that the author refers occasionally to or cites the poetry of some persons who are apparently purely sectarian saints and writers. Such are سيدنا (ff. 7, 7v.) who is obviously the famous Ḥasan Ṣabbāḥ¹⁵; a poet¹⁶ called Ra'is, Ra'is-i-Ajall and Ra'is-Ḥasan¹⁷ (ff. 2v., 5, 5v., 9v., 12v.). Several times the author quotes poetry of خواجه نصير (ff. 5v., 10, 16) who may be نصير الدين طوسي¹⁸ and خواجه قاسم تشترى (f. 10), whom I could not trace anywhere.

III. THE PECULIARITIES OF THE LANGUAGE.

It is not easier to arrive at a definite conclusion as to the country where the book was composed. There are no geographical names¹⁹ mentioned in the text and the only arguments for any decision regarding this question may be derived from the analysis of the language.

In this connection all that can be obtained from a close examination of the text may be divided into two chief categories: (a) the archaic-like, and (b) other unusual

¹⁴ Its authorship is ascribed to Nāṣir-i-Khusraw, but this is obviously wrong because there are mentioned many events and persons who were living several hundred years after that poet.

¹⁵ This title of Ḥasan Ṣabbāḥ is very commonly mentioned in many accounts of Ismaili history given by Muhammadan writers. It is used in a sort of official way even in the title of his biography called 'Sar-gudhasht-i-Sayyid-nā,' see E. Browne, "A Lit. Hist. of Persia," v. II, pp. 142-3.

¹⁶ That one person only is mentioned under these names is clear from ff. 5 and 5v., where the author says رئيس حسن دارد (f. 5) and in the next citation on the other side of the same leaf و هم رئيس دارد.

¹⁷ The surname *ra'is* or شيخ الرئيس is usually applied in Muhammadan literature to Avicenna (Abū 'Ali Sinā). He composed some poetry, and also had a very doubtful reputation as regards his orthodoxy. There was even a real sectarian (عن الغلاة الكبار) living at a still earlier period, Abū 'Abdu'l-lah al-Kandi, who was surnamed شاه رئيس (see *معرفة اخبار الرجال* by Muḥammad b. 'Umar b. 'Abdu'l-'Aziz al-Kāshī, an early Shi'ite writer, *Print. Bby.* 1317, p. 324). The sectarians in Persia to whom I showed this treatise were paying special attention and respect to the poetical quotations from this person, who seemed to be in their opinion a very prominent personage in the history of the sect. But they flatly refused to tell me any particulars about him. From this, as well as the subjects discussed in his poetry and the fact that قيامت روزگ is mentioned in connection with them (f. 9), would it be possible to suppose that this Ra'is Ḥasan was the well-known Ḥasan 'alā dhikrihi's-salām? He composed treatises on the sectarian doctrines as is mentioned in *Ta'r. kh-i-Guzida*, *Ḥab:bu's-Siyar*, *Rauḍatu'ṣ-Ṣafā*, etc., and it is not improbable that his essays were in versified form.

¹⁸ He was a poet as well as a scholar as is stated by some biographers (cf. E. Browne, "A Lit. Hist. of Persia," v. II p. 485. on the authority of Ibn-Shākir's *Fawātu'l-Wafāyāt*). I found an Indian lith. edition of the "Diwān of Naṣiru'd-Din Tūsi" (Lith. Bby, not dated), but on examination it proved to be the poetry of another poet, probably of Tūsi (who died in 869 A.H.), mentioned in Rieu's "Catalogue of Pers. MSS. in the Brit. Mus.," p. 735. In my copy I could not find the verse cited by Rieu and therefore I cannot be quite certain about their identity.

¹⁹ Once (f. 8) Mount Sinai (کوه طور موسی) is mentioned but not in the sense of a place.

forms of the language, which may be considered partly as vulgarisms and partly as being simply a result of the author's insufficient familiarity with Persian.

The archaic-like forms are so numerous that if it were not possible to ascertain the date of the treatise it would be quite easy to mistake it as having been written at a very early period, several hundred years indeed before it actually was composed. Such are not only the author's usual way of writing می separately, ست instead of است for idāfat after consonants, usual in Khorasan, but also ک written together with a foregoing word instead of که as frequently همچنانک, زیراک, کسبک, etc.; and even کی instead of که, if this be not simply a fault on the part of the copyist. Very often he writes به with the following pronoun inserting the archaic د as in بدر (f. 16), بدین (ff. 8, 11, 11v., 13v.), بدان (f. 14v.), بدیشان (f. 3), etc. He uses the particle را with the preposition به (f. 4) in پی به جسم امام را (although this use of the را is common in the colloquial). There are archaic words used, as گاه instead of وقت (f. 7v.); به از (f. 15v.); سنور (fol. 14v.) for 'a riding animal'; verbs or verbal forms as زبند (f. 15) from زبندن instead of در میارند (f. 11v.), etc. The form می نموده اند (f. 4), in which می is used with the perfect tense, could be looked upon as a genuine old one,²⁰ if it were not more probably due to the author's particular idea of the use of this particle. Another example of what can be regarded as archaisms, but may also be common in dialects and vulgar language, is the confusion of به and با²¹ as in the examples: (f. 10v.) یکی دعوت با (به) دیگر کند (f. 3) یک کس (به) الا با (f. 15) با (به) ضعیفان (f. 15v.) به نیکان . . . با بدان (f. 16) probably instead of بجهت (although it may be also a *lapsus calami*). An indication of dialectic form may be seen in هی می گذاری (f. 3, in an anonymous poetical quotation), which is common in Bukhara instead of می.²²

The peculiarities of the other category show that Persian cannot readily be regarded as being the author's mother-tongue. He was writing at the time when Persian literature had already reached its culminating point and a real native of Persia, even not much educated, would not make the numerous mistakes found in this text. His style is particularly clumsy and the use of که is unlimited. He introduces it pleonastically, as a copula and even in the sense of امّا as in (f. 14) باطلند (که = امّا). Very often he uses همچنانک without its correlative همچنین.²³ The order of words is somewhat archaic Khorasani, e.g. اگر نه یکی باشند (f. 10v.), اگر نه ایشان یکی باشند (f. 11). Against the rules of standard Persian we find here a plural verb with a collective noun; two instances occur, viz. حیوان شریکند (f. 11v.) موجودی از (f. 3v.) شریکند. Sometimes instead of آنها the author uses ایشان (f. 6v.). As is common in the vulgar language, دارد is used instead of است on many occasions.

²⁰ Cf. R. N. Nicholson's edition of Attar's *Tadhkiratu'l-Awliā*, v. II, p. 8 (of the Preface). I may say however that similar forms are very common in the vulgar colloquial, especially in Eastern Persia and Bukhara.

²¹ This is quite common in vulgar Persian, although indeed it may be traced in many old books. It is quite common to hear *bā ū guftam*, *bā ū dādam*, etc.

²² In Eastern Persia it is not so common, although used to express very long duration: *hay miraft-u hay miraft* "he was going a very long time," etc.

²³ Sometimes the author uses it in the sense of "only" (f. 12, 13).

Many irregularities of the author's Persian are confined to the various verbal forms. *می* is used wrongly sometimes: *می شناسد* (= *بشناسد*) (f. 2); *اورا بقتل میبرساند* (f. 7); *در جواب میگفت* (= *گفت*) (f. 13v.); *کرد* (= *میکرد*) (f. 14); *باز می ماند* (f. 14); *کمال حاصل می افتادند* (= *افتادند*) (f. 10), etc. But sometimes this particle is wanting as in *کمال حاصل کرد* (f. 7v.) where from the context *میکرد* could be expected.

An example of the use of *به* with the definite future appears on fol. 16 *بخواهد افتاد*. I can remember only one similar case of this use from Anṣārī's *Ṭabaqāt* (V c. A.H.) written in the colloquial form of Persian as spoken at that time at Herat.²⁴

The prepositions also are not always correct. The author says *داعیان که بحق بودند* instead of *برحق* (f. 3v.). Sometimes a very strange use of *از* instead of *با* can be found: (f. 4v.) *همه ظاهریان از (با) همه ظاهریان*, and (f. 12) *از او یکی = او یکی*.

There may be a question if Persian was not the author's own tongue why in this case he writes in this language, and especially why he calls it understandable to the uneducated people (f. 16v.) obviously in his own country. The explanation however may be found in the fact that although not a Persian, he was in any case an Eastern Ismaili, and in the countries where the followers of this branch of the sect are living, Persian not only at that time but even now is considered often as the only written language. Such is the case with the sectarians living in the regions of the Upper Oxus, and not long time ago it was the same with the whole Muhammadan population of India.²⁵

A little word occurring in the text, if it is genuine and belongs to the author himself, may shed some light on this question. He calls Gabriel *مهتر* (f. 7) applying this term obviously in the sense of a honorific epithet. I have not made special historical research into the use of this word, but I cannot remember at present any purely Persian book where it is employed in the same meaning. Its evolution from expressing the idea of a "chief, senior" to its present use as an equivalent for "a groom" (in Persia) or "a sweeper" (in India) is very curious. But it is a well-known fact that this word is still in common use in its original sense in the hilly regions between the Upper Oxus and the Indus, where even nowadays it means "a chief." That it was quite the same at the time when the author was composing his treatise we can see from the books of his contemporary, the well-known Peshawari Saint, Akhūnd Darwiza Ningarhāri, who applies this term invariably to the names of all the angels.²⁶

Summarising all these deductions and observations it is possible to say with a degree of certainty that the author was a native of the same country where his book was found recently, i.e. the regions of the Upper Oxus. His antiquated forms of the language are quite typical of the Indian literature of his time, which, using Persian

²⁴ MS. of the As. Soc. of Bengal, D 232, f. 26v. *بخواهدفت صورت*

²⁵ Even now in Persia the tribes speaking dialects of Persian or even Kurdish, Baloochi and Arabic, consider their own tongues as incapable of being written and therefore they use even in the most intimate correspondence Persian only.

²⁶ For instance such is the case in his *شرح صالی* (MS. of the As. Soc. of Bengal, Ad 17, f. 28v.) *بعضی ورافض مهتر*. *جبرئیل علیه السلام را و بعضی مهتر عزرائیل علیه السلام را بلفظ نسبت میکنند*

only as a literary tongue, preserved many old fashioned expressions which long before ceased to exist in Persia proper.

IV. NOTES ON THE CONTENTS.

Whatever may be the opinion of an unprejudiced reader about the contents of the present treatise, it is to be borne in mind that the doctrines expounded here exercised for more than a thousand years great influence over the large masses of the population of the East. Born in the purely political struggle for the rights of Ali and his descendants to the throne of the head of the Muhammadan Empire,²⁷ these doctrines were carried through the ages in an atmosphere of the greatest mystery, jealously guarded by the highest religious exaltation of the believers, in their enthusiastic spirit of self-sacrifice ready to face and fight desperately all their religious enemies. No religion, except perhaps the Manichean, was persecuted with such hatred and bloodshed. But in spite of this the sect has still many thousands of followers, and their pious exaltation is still alive even in such a late book as the present treatise.

As long as the materials about Ismailism remain scarce it is absolutely impossible to find the exact position which this book occupies in their system. The only genuine dogmatic text which has been so far published by St. Guyard^{27a} consists of small fragments, and notwithstanding its comparatively large size gives but few essential details. It represents the beliefs of the western branch of the sect in their comparatively late form, and it would be difficult and practically useless to analyse here the divergencies of the two branches, because any such discussions based on obviously insufficient material may misrepresent the real state of things.

The secondary sources which can be found in the works of historians, travellers, refutators, etc., chiefly Muhammadan, also afford insufficient material, and besides refer mostly to the early period of the sect.²⁸ Therefore it is difficult to explain

²⁷ Tabari (I, 2942) categorically ascribes the origin of the Shi'ite doctrines to a Jewish convert to Islam called عبد الله ابن سبأ whose intrigues in Egypt were, as he says, the chief cause of the movement which ended with the murder of 'Uthmān. (Cf. about عبد الله ابن سبأ Shahrastani's *كتاب الملل والنحل*, ed. Cureton, 1846, p. 132). In what degree this tradition is correct it is difficult to say without special inquiries. It is remarkable that tradition makes one of the founders of the Qarmatian and Ismaili sect also a Jew. (This 'Abdu'l-lāh ibn Saba is probably the same person as the legendary عبد الله ابن صباح of Ummu'l-kitāb and صباح in the writings of the Nusayris, as in E. Salisbury's *كتاب الباكورة* etc. J.A.O.S., v. VIII, p. 242.)

^{27a} Stan. Guyard, "Fragments relatifs à la doctrine des Ismaélis," 1874, (Notices et Extraits, v. XXII).

²⁸ The books which were published in Europe or the East and can therefore be procured are of different value. The most important are: *الفرق بين الفرق* by عبد القاهر البغدادي (died in 429 A.H.), Cairo, 1910; *كتاب بيان الإديان* (written in 485 A.H.) by ابو المعالي محمد ed. by Schefer, *Chrestomathie Persane*, v. I (1883), p. 158 sq.; *كتاب الملل والنحل*: *كتاب الملل والنحل* by the famous Ibn Hāzīm (d. 456 A.H.), the portion dealing with the Shi'ite sects is pp. 179-188 of Cairo ed., (v. IV, 1321). These books deal with the earliest period of the sect. Of the later sources for the study of the Eastern branch of Ismailism the most important remain still unpublished such as the part of the history *Jahān-Gushā* by Atā Malik Juwayni, dealing with this sect, and the similar part of *Jāmi'u't-Tawārikh* of Rashidu'd-Diū. The MSS of both are rare. *Ta'rikh-i-guzida* of Qazwini gives not very much (ed. E. Browne, in facsimile Gibb M.S. v. XIV, 1910, pp. 509-527). The books of the later period usually repeat only what was stated in the earlier, and the difference consists chiefly in the sources they used. *Maqrizi* (d. 845 A.H.) in his *Khitaṭ* (المواعظ والاعتبار في ذنر الخطط والآثار) print. in Cairo, 1326), based on some early and good sources, gives little yet precious

many allusions and obscure places which are numerous even in a small book like the present. This may be postponed until more is known about the various departments of the sectarian literature.²⁹

The peculiarities of the author's doctrines are discussed as far as it was in my power in the footnotes to the translation of the text, where I tried also to point out the kindred features in the other sects (within the limits of the references available to me at present). It will be quite sufficient therefore to formulate here only cardinal principles of the beliefs expounded.

The doctrine which may be called the most essential to Ismailism (or at least to its eastern branch) and which can be regarded as its *differentia specifica* in comparison with the other sects of Shi'ism, is the teaching of the 'Hujjat,' a medium between mankind and the Deity, partaking of both essences. His "instruction" (تعليم) seems to be in fact even more essential than that of the Imam himself,³⁰ contrary to other Shi'itic sects, where the revelation is attributed only to the Imam, who however except on the "day of Faith"³¹ does not appear in his perfect supernatural essence and cannot be recognised amongst mankind without the help of his Hujjat. At the same time without his manifestation the world or, as the sectarians say, the "three worlds" cannot exist,³² and, for the sake of the "world's harmony," they make the Imam to be manifested not only in this world and in Paradise, but even in the realm of Evil.³³ The Imam, who takes entirely the place of Allah of the orthodox, is regarded, as in many extreme Shi'ite systems, as eternal,³⁴ omnipresent,³⁵ the real

information about the various sects (v. IV, pp. 164-180). *Dabistān* is interesting chiefly for a few notes on the state of the sect in the author's time (printed and lith. many times in India, transl. by D. Shea and A. Troyer, v. II, 1843, p. 397 sq.). Quite different are the biographical works dealing with poets, who discuss Ismailism when relating the biography of Nasir-i-Khusraw, such as Dawlat-Shah's "Tadkiratu'sh-Shu'arā," ed. E. Browne, 1901 (Pers. Hist. Texts, v. I, pp. 61-64), and Ateshkadah (Bby 1277, p. 187 sq.). Amongst the still later books of some use may be *بوستان السيادة* by زين العابدين شيرازي (lith. Tehran, 1310, pp. 35-41), and *طرائق الحقائق* (lith. Tehran, 1318, v. II, pp. 106-109). For a summary of what has hitherto appeared in European literature E. Browne's "A Lit. Hist. of Persia," v. I, pp. 406-415 and v. II, pp. 197-199 may be recommended, as well as "Assassins" in "the Encyclopaedia of Islam," v. I, pp. 491-492, and for the early history of the sect C. Huart's "Histoire des Arabes," v. I (1912), pp. 330-350. In these works the old bibliography is given.

²⁹ In all my attempts to secure the help of a learned Ismaili in Persia I failed entirely, perhaps because such a man does not exist there at all.

³⁰ The significance of this principle was apparently appreciated even at a very early period and was the chief reason why this sect is frequently called "Ta'limiyya" besides the usual term "Bāṭiniyya."

³¹ Cf. fol. 2 of the text.

³² Cf. ff. 4v., 6, etc.

³³ Cf. fol. 14v. It is a remarkable belief and may be a result of long philosophic work over the principles of this religion.

³⁴ Cf. f. 8.

³⁵ Cf. f. 9. This belief is one of the most popular in all the extreme Shi'ite sects. As an illustration of its being quite concrete to the believers can be quoted the old opinion of some sects that a marriage can be legally performed even if there be no witnesses assisting at the ceremony because "Ali and his descendants are present unseen" and therefore are the witnesses: *قال بعضهم إن النكاح بغير الشهود جائز لأن علياً واولاداً يحضرون*

النميد في بيان التوحيد see *بر شکر محمد الکشي السالمي* (fifth c. A.H., see Brockelmann, I, p. 419), MS. of the library of the Asiatic Soc. of Bengal Ae 11/440, fol. 167. (There is also another MS. of this interesting and rare book in the same library Ae 12/507, although its title is shown wrong in the printed "Catalogue." Besides the copies mentioned by C. Brockelmann, there is an old copy in the Asiatic Museum at Petrograd. No. 759 of my Bukhara collection. There is a very rare lith. edition of 1269 A.H., Indian, but the place is not stated. I have seen only one copy of it and failed in all my endeavours to find another).

Architect and Creator of the world,³⁶ etc., and, as in all the sects of this type, appears to be an incarnation of a supreme, absolutely abstract, attributeless Deity,³⁷ (a vague conception resembling to a certain degree the Greek Moira or Manichean Zervan Akarana). The real relation of the Imam to that Deity is the object of the most secret speculations and is veiled in impenetrable mystery.

To reveal all these matters and to point out the person of the incarnate God to the believers, so that they could attain "perfection and salvation in the future life,"³⁸ is the duty³⁹ of the Ḥujjat, his "Proof" or "Gate." He is also pre-eternal, his essence or "meaning" (معنى)⁴⁰ is one with that of the Imam and this is why he knows all his mysteries.⁴¹ Logically this principle would necessitate an assumption that this supernatural ability must be confined to a "chain" of lineal descendants of the first Ḥujjat only as in the case of Imamāt, but one gleans occasionally from the text that in fact the capacity of the "Proof" was regarded as attainable by everybody⁴² and it was apparently only shortly before the author's time that it was appropriated by the descendants of Ali.⁴³ As far as I could find, the Ḥujjats do not inherit their position and, strangest of all, in the sectarian pedigrees there were some instances where, contrary to theory,⁴⁴ the Ḥujjat and the Imam were joined in the same person.

Unfortunately, the text gives no hints as to the history of these doctrines, and the personages reproduced here all belong to the earliest period of Islam, long before Ismailism appeared as a sect. The chief of them is the archetypal Ḥujjat, who accompanied Ali himself; he is a popular figure in the Muhammadan world, and at the same time the so mysterious Salman Farsi.⁴⁵ Historically only a miserable

³⁶ Cf. f. 7v.

³⁷ This doctrine, common to all the extreme Shi'ite sects, appears very early. It is mentioned as one of the essential doctrines of the Bāṭinis as early as by an author of the end of the IV and the beginning of the Vc. A.H., 'Abdu'l-Qābir al-Baghdādī (died in 429 A.H.) in his book الفرق بين الفرق, Cairo, 1910, p. 269. It is remarkable that the sectarians based their quite "heretical" doctrine on the Qoran, and it is best expressed by the above mentioned Abū Shukūr as-Sālim, al-Kāshī in his book بيان التوحيد في إيمان التوحيد in which he quotes their words: *الله تعالى إيسى بقديم بل قديم من كان قبله و اسمه الأول* (Qoran, LVII, 3), MS. of the Asiat. Museum, Petrograd, collect. W. Ivanow, No. 759, f. 52. This principle is discussed at length in the other sectarian book, Haft-Bāb, ff. 74v.-75, besides numerous allusions in Ummu'l-Kitāb. It is also common to the kindred sect of Druzes, cf. S. de-Sacy, "Exposé de la religion des druzes," 1838, v. I, p. 2.

³⁸ Cf. f. 6, 10. I could not find anywhere in what concretely consist these *نجات و كمال آخرت*. So much was always talked about Ismaili ideas of Paradise and even its counterfeit reproduction by some Ismaili rulers that it would be extremely interesting to find the original sectarian beliefs regarding this (Cf. H. Yule, the Book of Ser Marco Polo, 3rd ed. (1903) v. I, pp. 139-140).

³⁹ Fol. 6.

⁴⁰ Fol. 6, 10v., I could not find from the sectarians in Persia what is the difference between "meaning" (معنى) and *ذات* which is mentioned in the text also (f. 3v, 9, 10v.).

⁴¹ Fol. 10-10v., because God cannot be known from the creation (f. 10v.).

⁴² Fol. 15v.

⁴³ Fol. 4.

⁴⁴ Fol. 10v., 11.

⁴⁵ It seems that there is but little doubt that this personage really existed (this is the opinion of such an authority on matters of Muhammadan history as Prof. W. Barthold, Member of the Russian Academy of Sciences). Many things however are very strange about him. Even the earliest writers as Ibn Sa'd. (v. VI, p. 9) who died in 230 A.H. (Brock. I, 136), represent him as "reading books and searching after knowledge" before he embraced Islam. Still more interesting may be the words of such an early and critical author as the great Al-Birūni (Chronology, etc., transl. Sachau, 1879, p. 27), who says that Manicheans tried to appropriate this saint as their own and mentions their "Gospel

“barefooted”⁴⁶ slave of Muhammad, he in the sectarian representation becomes superior to his master beyond comparison,⁴⁷ and is the real author of the Prophet’s pretended message from God.⁴⁸ He, according to Ummu’l-kitab, “the Old Testament of Ismailism,” was something like the Manichean “Prime Man” (الانسان الأول), who in the pre-eternal time fought the powers of Darkness created by Ahriman (or ‘Azāzil) and after his victory, quite in Manichean fashion, created the material world from the subdued spirits of Evil.⁴⁹ There were many examples in history of slaves becoming kings, but hardly any one of them could dream about such an extraordinary career.

Of the other persons, historical or legendary, the author mentions prophets, angels, Abū Bakr and ‘Umar,⁵⁰ ‘A’isha, Imams Ḥasan and Ḥusayn, one of the Shi’ite saints Abū Dharr,⁵¹ and a very mysterious personage “Mast-‘Ali”, who is a “bodily” descendant of Ali and as such may be either the third son of Ali, Muḥammad ibn Ḥanafīyya,⁵² or one of his indirect descendants.

It is obvious that similar obscure allusions in a considerable degree depend on the fear of persecution in case the book should fall into the hands of the orthodox. The author even tried in some places to cipher the names and some terms, but very naively and (fortunately for the reader) simply by replacing the letters with figures by “abjad.” However it would not be quite useless to mention that the popular forms

of Seventy,” “which,” as he says, “is attributed to one Balāmis and in the beginning of which it is stated that Sallām bin ‘Abdu’llah bin Sallām, wrote it down as he heard it from Salman Alfarisi.” The Manicheans hardly would do this unless this saint enjoyed great repute even at that early time. On the whole however his biographies, which are extremely numerous, are exceptionally vague, and even the ardent and learned Shi’ite author of *Majālisu’l-Mu’minin* could not collect any details. It is strange again that all the Muhammadan authors attribute to him a somewhat long life between 250 and 1500 years. The most modern and critical of them however are inclined to think that “the former is more true.” I may add here that when staying at Shiraz in 1914 I heard many local legends about him (he is believed to be originally from Dasht-i-Arjang near Shiraz). Unfortunately I could not appreciate them at that time and therefore did not record this interesting tradition.

⁴⁶ Fol. 8v.

⁴⁷ Fol. 7v.

⁴⁸ Fol. 8, 9. Because he was the real Gabriel to whom Muhammad attributed bringing it from Allah. (The author however y no means denies the existence of Gabriel and even admits his appearing to Muhammad in a human form, f. 8).

⁴⁹ His worship is common to all the kindred sects, as Nusayris, Ali-ilahi, etc. In Nusayri doctrines he partakes in the Divine triad of عيسى (ع م س) i.e. Ali, Muhammad and Salman. His incarnation in pre-eternal time created the world, (see E. Salisbury, *كتاب الباكورة* J.A.O.S., v. VIII, 244). In Ali-ilahi beliefs he is identified with Pir-Beniāmin who is both the creator of the world and the teacher (مرشد) of God. (About this sect little is known so far. The bibliography is given in the *Encyclopaedia of Islam*, v. I, p. 292-293, “Ali-Ilahi,” by C. Huart, who based his article chiefly on de-Gobineau’s *Trois ans en Asie*, p. 338-371. The best, as based on the writings of the sectarians themselves, is the book of V. Minorsky (in Russian) under the title “The people of Truth or Ali-Ilahi,” Moscow, 1911. I hope to publish also my materials which I collected in Persia).

⁵⁰ Through hatred towards them the author (or copyist) writes these names upside down.

⁵¹ Fol. 7, 7v. Also questionable as a historical personage and also enjoying great popularity and reverence since the earliest times. The above mentioned author of Vth cent. A.H., Abū Shukūr Sālīmī (op. cit., f. 19) says that amongst Shi’ites there was a ḥadīth that the Prophet said:— *روى عن النبي أنه قال أن لله مقرين في الدنيا خيبر من الملائكة*

His biography is very vague and even Tabari, III, 2347-8, tells very little.

⁵² This third son of Ali was especially often chosen by the early Shi’ites as an object of their worship (cf. the rising of Mukhtār in Kufa). Even now he is very important in the doctrines of the Nusayris, who always add to his name an epithet سرّ الخفي the “silent mystery” (Salisbury, op. cit., pp. 270, 274, etc.) The sectarians in Persia, whom I consulted, could not (or did not like to) tell me who is meant by this name, but there is no doubt that this symbolic designation is also intended as a sort of “cipher” to conceal one of the most important saints.

of so-called "orthodox" Shi'ism in Persia hardly differ very much from these speculations. The less educated men amongst the Persians to whom I showed this book were by no means scandalised at its heretical tales. We need not wonder at this if we bear in mind that the numerous "martyr" stories about the same Imams, Salman, etc., recited by the mullas of the most unsuspected religious opinions, relate extraordinary miracles and deeds of these saints compared with which the theories of our author appear as a standard of moderation.

The matter might be slightly different if the opinion of a Sunni Muhammadan were consulted about this treatise. But even he could not raise many objections if it be remembered that almost exactly the same fantastic stories are told about Muhammad or Nūr-i-Muḥammad, with regard to his pre-existence, etc., as are told about Ali, or that instead of making Salman the object of these attributes they employ Gabriel. And these beliefs are particularly popular among the masses of the population in all Muhammadan countries as is proved by numberless booklets, "Nūr-nāmah," used everywhere, in which these stories are told.⁶³

Remarks on the Translation and the Text.

In the translation I have tried to render the text as closely as possible, so that it might afford some help in reading the original which has suffered at the hands of the copyists and is therefore often not easy to understand. In the text I endeavoured to introduce as few alterations as possible, emending only those places which were obviously incorrect.

V. TEXT.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فصل در بیان شناخت امام که مظهر^۱ امر است، و حجّت که مظهر عقل گنست، و داعی، و مأذون اکبر، و مأذون^۲ اصغر، و مستجاب^۳ که مظهر^۱ نفس کلّ اند، و اهل تضادّ (که) مظهر جسم کلّ اند،
 اول در شناخت امام شروع مینمایم، و آن آنست که بدانیم (sic) که امام مردی را میکویند که گاهی او را به او شناسند، و گاهی به حجّت او، و شناختن او روز شنبه دین ست * [تا جمعه] فاما باید دانست که هر روز دین هزار سال دنیا ست، و هفته او هفت هزار سالست، و از این هفت روز روز دین یک روز بیش نیست و شش دیگر شب دین ست، و روز دین را روز شنبه میکویند که در آن روز خورشید دین که امام است آشکارا میشود، و بآن سبب ست که گفته اند، همه حکما از جای به (sic) شود و حکم شنبه از جای [fol. 2.] نشود، و شش روز دیگر شب دین میکویند، و سبب آنست که در آن شش روز شریعت پیغمبران حجاب امام

Fol. 1

Fol. 2.

⁶³ I have not made special research, but it seems to me that these fantastic speculations become more and more current after VIth cent. A.H. And there is nothing impossible in the supposition that they received currency through the help of the influential writings of Ibn al-'Arabi, as did many other doctrines.

¹ Here مظهری with the *idāfa* represented with a long vowel. ² مأذون.

³ Cf. translation, footnote 5a. + A sentence probably left unfinished.

* I have to warn the reader that I use the round brackets as meaning "to include into the text" and the square brackets "to exclude from the text."

است، همچنانکه شب دنیا حجاب خورشید دنیا است، اما همچنانکه خورشید پنهان میشود ماهی دارد که قایم مقام اوست، همچنانکه (sic) امام هم پنهان میشود حجّت دارد (که) قایم مقام اوست که بندگان او که اهل ترتب⁶ اند بغور تعلیم او امام را می (sic) شناسند، و این نیز باید دانست که در این شش هزار سال⁷ (که) شب دین (است) هم گاهی ظهور میکند، اما ظهور او معنوی نیست، شناخت بحقیقت حاصل نمیشود بخلاف هزار سال روز شنبه که در آن روز چون ظهور او معنویست شناخت بحقیقت حاصل میشود، پس در این شش هزار سال شناخت حاصل نتوان نمود چنانکه [fol. 2v.] رئیس اجل دارد * بیت *

ظهور غیب است شکای بهیچ باز میند، که پیش مرد قیامت چه غیبست (و) چه حضور⁸ و آن هم محالست که خواصان (sic) ترتب را که غرض از آفرینش موجودات حاصل شدن شناخت ایشانست بی شناخت بگذارد⁹، اگر گذارد نعوذ بالله بخیل باشد پس ناچار درین شب ماهی میباید که ظهور معنوی دائمی داشته باشد، و دیگر آنکه در ظهور معنوی ماه شناخت حاصل نکند در ظهور شکای خورشید که نور ندهد چه حاصل خواهد کرد، چنانچه (sic) عزیزی دارد * بیت *

ظهور معنوی امروز اگر ندارد سود، ظهور شکای فردا چه سود خواهد کرد،
و جای دیگر فرماید * بیت *

ظهور معنوی (که) قائمست دعوت او، در آنچه هست نه افزون شود نکرد کم،

دیگر باید دانست که درین شش هزار سال شب دین هر کاهیکه امام ظهور شکای میکند [fol. 3.] حجّت ظهور معنوی ندارد چون در زمان حضرت امیر که ۴۳۶ ان¹⁰ اظهار دعوت نمیکرد آلا با یک کس، اما در پنهان بودن (sic) امام دارد، و محالست که شکل امام و دعوت او هر دو پنهان شود، خلقانرا بهلاک¹¹ اندازد، و آنکه گاهی ظهور شکای میکند و ظهور معنوی حجّت را بر طرف میسازد و سبب آنست که بندگان قابل در آن زمان نباشند نعوذ بالله، چنانچه حکیم نزاری دارد * شعر *

ظهور معنوی در پرده راز، مگیر از آرزومندان خود باز،

از این پس باب رحمت در بلندی، اگر سهوی رود بر ما میندی،

پس ثابت¹² شد که بجهت سهو و غفلت و کذا کاری بندگان است که گاهی در¹³ رحمت و باب

معرفت خود را در می بندد و ایشان را بدیشان میکند * بیت *

اگر ما را بماهی¹⁴ میگذاری، بیاز تا چه خواهی تا چه داری،

دیگر باید دانست (که شناخت¹⁵) ۱۴۱ ۱۴۰ ۱۳۹ ۱۳۸ ۱۳۷ ۱۳۶ ۱۳۵ ۱۳۴ ۱۳۳ ۱۳۲ ۱۳۱ ۱۳۰ نوع¹⁶ است [fol. 3v.] یکی شناخت ۴۶۳¹⁶ او که درین حیوان هم شریکند، دیگر شناخت ۶۱ م¹⁷ وی که درین اهل تضاد هم شریکند، یکی

⁶ Sectarrians in Persia spell it ترتیب. But in our text it is everywhere written like this.

⁷ In the text where سالست probably is a simple lapsus calami.

⁸ بهلاکت⁹ . سلمان = م. 40 = ل، 30 = م. 60 = ن. بگذرد perhaps instead of بگذرانند⁷ . حظور⁶

⁹ ثابت¹⁰ . دری¹⁰ .

¹¹ Probably a peculiarity of Bukhara Persian می می = می می، which is still in use at present time.

¹² Added under the line. اسم¹¹ . جم جم or جمد¹⁶ نور¹⁵ . (چهار) جبار¹⁴ امام¹³ .

شفاخت ۴۱۴ ت^{۱۹} از که درین اهل ترتب هم شریکند، یکی شفاخت ۴۱۷^{۱۹} از که خاص بحجت اوست، دیگر باید دانست که اهل ترتب که عبارت از داعیان و باقی حدود که زیر اویند همیشه بکواه^{۲۰} دو دلیل که یکی نص و دیگر ولادت است پی بجسم امام میبرند، و خاص که حجت است بمعجز علمی و ولادت او را از ازل شفاخته است، و درین چند جامه که گذشت بعضی داعیان بحق^{۲۰} که در جسم غلط نکرده بودند، سبب وجود آن شرط بوده اند [که] و بعضی داعیان ناحق که غلط کرده اند، سبب آن بوده که همین ولادت تنها منظور^{۲۱} داشته بوده اند و شاه نزار را بامامت برداشته بودند، سبب آن بوده، و درین دو جامه که آن دو دلیل را بر طرف نمود اول حجت را آشکارا نمود و معین ساخت، [fol. 4.] و بعد از آن دو دلیل را بر طرف ساخت و بصورت شکلی هم از جسم اهل ترتب نهان شد و بعد از آن باشارات حجت و دلیل او قویان^{۲۲} اهل ترتب از روی تحقیق پی بجسم امام را (sic) بردند، و بعضی ضعیفان که دلایل حجت را استماع ن نمودند یا از دریافت دلیل عاجز بودند از روی تقلید^{۲۳} دیگر باید دانست که فرزند ۴۱۴^{۲۴} ۲۱۵۳^{۲۵} نوعست یکی آنکه بشکل از اوست پس چو مست علی و یکی آنکه بمعنی اوست، پس چون ۴۳۶^{۲۶} ان و یکی آنکه (به) شکل^{۲۷} و معنی هر دو ازوست چون امام حسن که او را امام مستودع میگویند، و یکی آنکه بشکل و معنی (و حقیقت)^{۲۱} ازوست چون مولانا حسین که او را امام مستقر میگویند، و چون ثابت^{۲۸} شد که حجت فرزند معذوم اوست پس درین ایام که امر حجتی بفرزندان جسمانی خود می نموده [fol. 4v.] اند، امر عام بوده (sic) نه خاص، (امامرا^{۲۹}) همیشه امر عامی و خاصی بوده و هست و امر عام نسبت بر مردی واقع میشود (sic) که ظاهر مطلق است، و در آن از همه ظاهریان، پس امر خاص بر مردی واقع میشود (sic) که باطن مطلق است و در آن از همه^{۳۰} باطنیان، پس^{۳۱} تا مصلحت هر دو کون بجای باشد چنانکه بعد از این شرح بمحل خود مذکور خواهد شد، دیگر باید دانست که امام را در هر سه کون ظهور واجب است زیرا که واجب الوجود بحقیقت اوست و هر چه غیر اویند (sic) ممکن الوجود، (و ممکن الوجود)^{۳۲} وجودی را گویند که بسر خود موجود نتواند بود و حالا آنکه ممکنات موجودند پس امام را از جنس ایشان در هر دو کون ظهور هست اگر نبودى اکوان موجود نبودى اگر کسی گوید که موجود محالست زیرا که طرف وجود عدم ممکنات مساویست و نه متصرف وجود خود میتواند^{۳۳} برد نه عدم بخلاف واجب الوجود، و اگر گویند موجودند اما سبب یکدیگر و این همه محالست، پس [fol. 5.] ثابت شد که امام را در هر دو کون^{۳۴} که یکی خلقی^{۳۵} و جسمانی است و دیگری (sic) امری و روحانی است و هر سه کون (که) در عالم امری ثابت میشود ظهوری میباید، اولاد خلقی و جسمانی بجسم موافق اند همیشه یعنی پسرا بجای پدر میباید نشست و در امر^{۳۶} و روحانی که درین ست^{۳۱} و اهل تضاد که از شریعت میگویند و [با] اهل ترتب از تعلیم (و) اهل وحدت که حجت است از تأیید، فاما این نیز

^{۱۹} اصامت . ^{۲۰} In the text داعیان که بحق ^{۲۰} Not clear. Perhaps follows یا or نه . ^{۲۱} مذکور . ^{۲۲} قوی یان . ^{۲۳} Something is omitted ? ^{۲۴} امام . ^{۲۵} چهار - چهار . ^{۲۶} سلمان .

^{۲۷} شکلی . ^{۲۸} Added afterwards . ^{۲۹} سابت . ^{۳۰} Not clear . ^{۳۱} برای ؟ ^{۳۲} Follows

^{۳۳} بیش . ^{۳۴} Added above the line in different hand . ^{۳۵} خلق . ^{۳۶} Better امری ؟ ^{۳۷} Added above the line.

^{۳۸} Crossed and added in different hand . ^{۳۹} کوری . ^{۴۰} Better امری ؟ ^{۴۱} Added above the line.

باید دانست که ظهور او درین اکوان اضافی است نه حقیقی، بودی حکم ممکنات داشتی، و اضافی³¹ چیز را میگویند که بجزیی مانند داشته باشد لیکن آن چیز نباشد چون سراب که بآب مانند دارد و صورت در آئینه، اما هیچ کدام نیستند، و حقیقی چیز را میگویند که آن چیز باشد چون آب و صورت در آئینه³² چنانکه رئیس حسن دارد

* شعر *

وجودی خلق خلقی را بچشم خلق در دنیا،
 تو هم با صورت خلقی و هم با خلق می مانی،
 و بی زویی حقیقی را (sic) در آئی پیش خلقیان،
 [fol. 5v.] بذات پاک بیچونت منزله زین (و) هم ز آئی،
 اگر خلقتست دگر خلقی و کر امر ست دگر امری³³
 وجودش هم تو می بخشی و حکمش هم تو میرانی،

Fol. 5v.

* شعر *

و هم رئیس در قصیده دارد
 شده ست ترا صفات اضافی از آن سبب³⁴،
 که هریک از امم حق و باطل و بد و نیک،
 ز نامها و نشانها که در میان آمد،
 توئی درین همه داخل بیک حساب ز تست،
 توئی بچشم حقیقت بمعنویت خویش،
 و خواجه نصیر دارد

بدین طریقه فزون از شمار این³⁵ درگاه،
 رهی گرفت بنامی³⁶ دگر³⁷ بخواند ترا،
 نهال باغ تکفون گرفت نشونما،
 وجود این همه در کائنات مستوفی،
 منزهی³⁸ بیقین زین صفات و زین اسما،

* شعر *

ای در وجود رحمت تو کون را مکان،
 از روی شکل مظهری انوار کردگار،
 آئی³⁹ ز روی ظاهری⁴⁰ در چشم گل خلق،
 ای هر سه کون با تو و تو بوده با همه،
 [fol. 6.] دیگر باید دانست که ظهور امام در این اکوان سبب این اکوان ست نه چیز⁴¹ دیگر،
 ری در پناه حضرت تو خلق را امان،
 وز راه عقل مصدری انواع کن فلان،
 باشی بحکم باطن و از عقل گل نهان،
 ری هر دو عالم از تو تو دوری⁴² ازین و آن،

Fol. 6.

و چون شناخت امام ثابت شد بعد از این در شناخت حجّت شروع می (sic) نمایم، بدانکه حجّت کسی را میگویند که معنوی او و امام از روز ازل یکی باشد و ظهور او درین عالم بجهت اهل ترتب باشد یعنی ایشانرا بادای تعلیم خود بمعرفت امام عارف سازد زیرا که امام از ادا⁴³ و قبول هر دو منزله است و حجّت اگرچه از قبول مستغنی ست اما از ادا نیست، و داعی و سه حدّ زیر او هیچ کدام مستغنی نه اند و مستجاب [او] در امر مرخص نیست و در قبول محتاجست، پس ثابت⁴⁴ شد که حجّت با داد و تعلیم⁴⁵ و بعضی با داد و قبول⁴⁶ و بعضی بقبول تنها محتاجند و اگر در عالم ظهور نکند و تعلیم نکند اهل ترتب از نجات و کمال

37a ? ضافات 37a

40 بنام .

46 چیزی .

39 Added in different hand آئینه بیرون .

41 دیگر .

47 ادای .

42 معنوی .

43 صابت .

43 ? آهی .

45 بادی تعلیم .

39 No metre.

44 against the metre .

45 بادی تعلیم .

39a Here زین .

46 دور .

46 Obvious mistake .

آخرت باز [fol. 6 v.] مانند و فایدهٔ آفرینش عالم‌ها باطل شود، و دلیل بر آنکه بی حجت امام را نمیتوان شناخت هم از عقلی و هم از نقلی بسیار است، اما عقلی آنست که در هر⁶⁰ موجودی که در وجود باشد بی تاثیر غیر آن کمال از او از قوت⁶¹ بفعل نیاید و اگر آمدی بایستی که همه جسمها با آنکه حرکت که کمال ایشان ست [و در ایشان] بقوت ایشان بی تصرف غیر که ما ورای ایشانست، بعضی روح نباتی (و بعضی روح حیوانی و روح انسانی، بفعل⁶² آمدی، و چون در جسم که مثالست نمی آید (در) روح متعلم هم (که) ممثلست حرکت روحانی⁶³ که ترقی از⁶⁴ نقصان بکمال ست و ادا کردن با قبالن بی حجت بفعل نمی آید، و از نقلی، اولاً (خواه) از ظاهر شریعت که کلام خدا و رسولست، که در میان ظاهریان مشهورست خواه قول اهل حق که بر ضد⁶⁵ ایشان⁶⁶ گفته باشند چون حکیم سنائی و محقق رومی و شیخ عطار و غیره و خواه قول اهل باطن که خداوند بر زبان [fol. 7.] ایشان رانده باشد (sic) تا هم بقول خود باطل شوند بخود از آن واقف نشوند، و از باطن حقیقت خود سخنانیست که امام (در) زمان⁶⁷ ظهور معنوی خود فرمود، یا حجت که همیشه ظهور معنوی اوست، اما از ظاهر شریعت قرآن ست (و) مهتر جبرائیل و میکائیل و اسرافیل و عزرائیل و تأویل و ممثل آن حجت ست زیرا که در حد تأویل فرشته اهل وحدت را میکویند و آن حجت (است) کسی دیگر نیست، و هر جا که ذکر داعی گذد عبارت از پیغمبر ست مثل این آیت قوله تعالی، و داعياً إلى الله بإذنه سر اجاً مفیداً، و آنکه از جبرئیل تعلیم میکرفت یعنی داعی بود که از سلمان تعلیم میکرفت و این سخنان پیغمبر کوا (بر) اینست که گفته اند، (لو علم ابو ذر ما فی قلب سلمان لقد کفر) ⁶⁸ یعنی اگر بو ذر⁶⁹ بداند (sic) که در دل سلمان چیست او را بقتل میرسانید (sic)، چون از سیدنا پرسیدند که ⁷⁰ خبر رسول [fol. 7v.] چه معنی دارد، سیدنا بجواب فرمود که اگر سلمان به بو ذر⁷¹ گفتی که مرتبه من بالای پیغمبر ست و مولانا علی خالق و مصور عالم ست او را کفر آمدی و قصد سلمان کردی، و از حضرت امیر، سلمان بنا اهل البیت و شمس من نور الله و شقنا من قلب المؤمن نور الله و المؤمن لا یقدر قدره و المؤمن حی فی الدارین، از سخنان محقق رومی که در باب خضر و موسی گفته که موسی از خضر کمال حاصل کرد و در اول که هنوز تعلیم از نیافته بود سری از کار او بیرون نمی آورد چنانکه مثنوی دارد

• مثنوی •

آن پسر کش خضر ببرد (ست) ⁷⁰ حلق، سر او را در نیابد عام خلق،
و هم موسی با همه علم (و) ⁷¹ هنر، شد از آن محجوب تو بی پر مهر،

• بیت •

و حکیم نزاری دارد
اگر آسان توانستی بدان سر چشمه را بردن، کلیم الله کی از (آن) ⁷² خضر بر کشتی بحیرانی،

و بهشت آدم و کشتی نوح و دیدن [fol. 8.] ابراهیم و عیسی و مریم و کوه طور موسی و جبرئیل مصطفی همه حجت ست و همه اهل ظاهر بدین قایلند و از تأویل این بیخبرند، چنانچه امیر سید علی

1. ؟ ردّ ، or زد⁶⁴ ؟ او⁶⁸ . روح انی⁶² ؟ بعقل را⁶¹ . قوه Sic⁶⁰ . هر دو⁶⁹ .

؟ (اشارت =) ایشارت⁶⁶ . امام زمان در ظهور⁶⁷ May be also .

زر⁶⁹ . پرسیدنک⁶⁸ . زو⁶⁷ . فی قلب اعلم ابا ذرّ و فی سلمان بقتله⁶⁸ .

⁶⁰ My conjecture. Otherwise against the metre.

⁶¹ The same.

⁶² The same.

واعظ (که) یکی از ظاهریان بود در قصیده که در مدح حضرت علی گفته⁶³ که یک روز⁶⁴ نشسته بود و جبرئیل در پهلوئی او که حضرت امیر از در آمد و جبرئیل جهت او تعظیم کرد و رسول گفته چه حرمت است که داری برای کودک ما، جبرئیل بجواب گفت که او معلّم من بوده است در مبداء، باز رسول گفت از ابتدای آفرینش تو چند گاه ست، جبرئیل گفت

* شعر *

اگرچه من عدد سال خود نمیدانم، ولی ستاره دانم که هست عرش آرا،
ستاره یست که هر سی هزار سال یکی، طلوع میکند از عرش اعظم اعلا،
ازان زمان که شدم من ز قدرتش موجود، همین ستاره نمودست سی هزار بار مرا⁶⁵

Fol. 8v.

دیگر میگوید که اگر (چه) جبرئیل بصورت مرغست مثل باقی فرشتها آن روز بصورت مردی [fol. 8 v.]
بر رسول ظاهر شد و وقتی که در پهلوئی مصطفی نشسته بود مردی بود، و حال آنکه همیشه امام که اصل ست
و جبرئیل که بعد ازوست و مصطفی که بعد از جبرئیل ست هوسه بصورت مردانند و معنی ایشان در آخرهم که
مصطفی بدعوت حجّت رسید یکی شد، و نه همین مصطفی که قوی تر اهل ترتب اند (sic) بایشان یکی
میتوانند شد که باقی حدود که در زیر اویند چون بیک معرفت عارف شد یکی میتوانند شد، و از جمله حکایت
مشهور که در میان ظاهر یانست دیگر آنکه یکی از عائشه سوال کرد که پیغمبر راست میگوید که در فلان شب
بآسمان رفتم و آن حالات مشاهده نمودم، عائشه بجواب گفت که همین دیدم که او از خانه بیرون رفت و زود از
در درآمد چنانکه از کوزه آبیک در محل رفتن دامن او بران خورده بود هنوز آب میرفت، و آنکه میگوید
جبرئیل بمن پیغام می آورد هیچ نمیدانم الا ۵۱۴۳۶⁶⁶ یا برهنه که گاهی می آید و سخن میگوید نهانی و یک
[fol. 9.] زمان فاصله میشود میگوید جبرئیل آمد و بمن از زبان خدای (sic) این و آن گفت،

Fol. 9.

القصة تمام سخنان اهل ظاهر بر این کواهست که جبرئیل سلمانست و خود خبر ندارد (ند)⁶⁷ و سخنان
اهل حقیقت سراسر کواهست که امام میفرماید که سلمان⁶⁸ منّی و انا من سلمان (sic) یعنی سلمان از منست
و من از سلمان، و جای دیگر میفرماید که سلمان⁶⁹ باب من ابواب الجنة⁷⁰ یعنی سلمان دري از درهائی
بهشت ست، چون در⁷¹ بهشت مردی باشد، پس گاهش هم مردی باشد، و جای دیگر میفرماید که سلمان
در⁷² بهشت ست نه که جان بهشت ست، و جای دیگر میفرماید که من نزدیک دوستان خودم هر کجا مرا
طلبند خواجه در کوه خواجه در دشت خواجه در هامون و غیر هامون، و چنین کسی را که ظاهر گردانیدم برو ذات⁷³
خویش، یعنی معرفت خویش، او محتاج نیست به⁷⁴ نزدیکی مکان و اینست قیامت بزرگ، و جای
دیگر میفرماید، اطعني اجعلك مثلي، [fol. 9 v.] یعنی فرمان من بر تا مثل من شوی چون سلمان، و رئیس
حسن دارد

Fol. 9v.

* شعر *

توئی که حجّت باب ترا در این عالم، بصد هزار زبانست همسر و همتا،
مقام اوست که ممثل قاب قوسین ست، خرد حکایت او کرد در⁷⁵ خلا و ملا،

⁶³ Something is omitted like فرمود، گفت.

⁶⁶ One long and one short syllable extra.

afterwards crossed and replaced with the numbers.

⁷⁰ دری.

⁷¹ Corrected as ذات.

⁶⁴ Probably to be inserted رسول.

⁶⁶ سلمان This name was first written clearly but

⁶⁷ Not finished.

⁷² نه.

⁶⁹ سلمان.

⁷³ Or ز.

⁶⁸ ابواب الجنة

- و جای دیگر هم مشار الیه میفرماید
- * شعر *
- سلمان فارسی که جهان آفرین بدوست ، باب علی که اول ازو ابتدا کنیم ،
 او زان سجود عزت روئی خدای کرد ، تا ما سجود عزت روئی خدا کنیم ،
 و حکیم نزاری دارد
- * شعر *
- خداوندا درین کشف همایون ، که آوردی ز سرّ غیب بیرون ،
 بیاطن از چنین کردی ظهوری ، بحجّت در دمیدی نفع صوری ،
 و مشار الیه در همین مذاجات دارد
- * بیت *
- بحقّ انبیا و 74 حجّت تو ، که روشن کرده راه 76 دعوت تو ،
 و نیز حکیم ثنائی در قصیده اسکندر دارد شرح رسیدن خود را بدعوت حجّت بیان کرده
- * بیت *
- [fol. IO] مسلمانان مشهر شد مرا زان شهره در عالم ،
 که او بود رهبر عالی بعالم باب مولانا ،
- Fol.
- و خواجه نصیر دارد
- * شعر *
- چو 76 صور اول 77 او حجّتش دمید آنکه ، بعلم زنده بود جمله را بمیراند ،
 چه باز صور قیامت بذات خود بدمد ، هر آنکه مرده چهل است زنده کرداند ،
- * بیت *
- و در قصیده دیگر واقع شده
- کسی که حجّت حق را نداند در جهان بیشک ، ندارد دیده بیضا یکی کورست بر عیمان ، 78
- * بیت *
- و خواجه قاسم تشری دارد
- بشناختم بمرد امام زمانه را ، آن بیذظیر 79 نام خدائی یکانه را ، 80
- آن مرد حجّت ست و اسم بی نظیر نام امام هم حجّت ست زیرا که اسم حقیقی امام که از او امام
 میتوان شناخت حجّت ست ، نه این اسمهای مجازی که در اکثر فصول و قصاید که در میان این فریقه 81 است
 همین معنی مستور ست که در رحمت و باب معرفت امام حجّت است بچشم و اسم امام ، و هر که از در درآمد
 بخانه رسید و هر کسی که نه نه ، و هر دو را معنی و ذات [fol. IOV.] یکی باید دانست ، این مضمون معلوم
 شد و مکرر گذشت که اگر نه یکی باشد (sic) و خواهند بود در آن صورت یکی خدا خواهد بود و دیگر خلق
 (و) از خلق خدای را (sic) نمیتوان شناخت ، و (فوق) میان این و باقی فریقه‌های نظریه در همین
 موضع 82 ست ، و قول اهل ظاهر هم گواه این معنی بآنکه خود خبر ندارند
- * بیت *
- پیر من و خدای من از تو بحق رسیده ام ، رهبر ره نمای من از تو بحق رسیده ام ،
 آنکه گفته اند
- * بیت *
- مردان خدا خدا نباشند ، لیکن ز خدا جدا نباشند ،

74 . انبیای

75 . را .

76 The same quotation is repeated on f. 16.

77 دعوت . F. 16

78 صمیا .

79 بیذظیر .

80 Sic. No metre.

81 Probably فرقه would be better

82 موعظ .

* بیت *

زان روی که چشم توست احول، معبود تو پیر توست اول،

و اگر کسی پرسد که در معنی یکی اند و در جسم یکی نیستند، جواب او درین امر دوست آنکه چون اگر شخص⁸⁵ ایشان در نبودنی که یکی دعوت با (sic) دیگر کردی عوام دران بشکست می افتادند و او را چون دعوت بسوی خود کردی صاحب غرض⁸⁶ میدانستند و (اگر) به ظاهر دعوت با (sic) دیگری میکنند بی غرض [fol. II] میدانند، و از آن غافلند که هر دو یکی اند، و چون هنوز در عالم کثرت اند و می بیزد (sic) چنانکه فصول مبارک میفرماید که دین بحقیقت مولانا ست و حجّتش، پس اگر نه ایشان در دین و دعوت یکی باشند از این معنی لازم آید (که) دین و حقیقت هم در باشد و داخل کثرت و هرگاه دین به کثرت رفت خواه دو خواه هفتاد و یک، جواب دیگر آنست که اگر شخص⁸⁷ ایشان در نباشد که یکی در سه کون ظهور کند و یکی همین حقیقت نذها را نگاه دارد، دین⁸⁸ [شریعت] اهل ترتب را که طالبان راه حق اند در دعوت او شکست پیدا شود، و [چون] بدین دلایل عقلی و شاهد نقلی ثابت شد که درین شش هزار سال شب دین بی حجّت شناخت امام حاصل نمیشود، و بعد ازین باید دانست که نشان معجز⁸⁹ او چیست و او را در همین اکوان حقیقت (چه) ظهوریست، سبب اول آنست، در اثبات نشان معجز او شروع می (sic) نمایم، و آن آنست [fol. IIV.] که بدانی (sic)، حجّت را نشانی و معجزی میباشد که هیچ موجودی از موجودات خلقی و امری دران معجز شریک نباشد و معجز بر دو قسم ست یکی (از) ⁹⁰ فعل و قدرت و دیگر (از) نلم و حجّت، و باز هر یک ازین مشابه و مانندی دارند (sic) یعنی بدین نشان می ماندند (sic) و لیکن نیستند (sic)، و معجز فعل و قدرت معجزیرا گویند که از جسم واقع میشود، و معجز علم و حجّت آنکه از روح واقع میشود، و (در) همه موجودات [در] فعل و قدرت از جسم واقع میشود و همه موجودات در جسم بار شریکند و قدرت زیاده ازان نمیتوان (sic) بود که مردی بر همه عالم مسلط شود و همه عالم را قتل کند و در آن حالت میتوان (sic) بود (که) شیری یا ماری او را بقتل نماید و نتوان گفت که شیر و مار که حیوانند از ایشان بهتر باشند، همچنانکه از حیوان واقع میتواند شد ⁹¹.... چون نبات در میوه داری و جمادات در ⁹² حواسگانی ⁹³ و آتش و باد و آب و خاک هیچ فردی از افراد ⁹⁴ این موجودات [که] علی حدّه ⁹⁵ (را در) عجائب و غرائب جسمی و فعلی ⁹⁶ بسر خود خامی نمی نباشند (sic) که دیگری [fol. I2] در آن بار شریک نباشد، و مشابه معجز فعلی (sic) چون سحر، طلسم و کرامات مشایخ و منجمان و رمّان و شانه بینان و مثال (آن) که آنها همه خبر از نهانی عالم خلایق میدهند شریک بسیار دارند، پس ثابت ⁹⁷ شد که معجز بی شریک و نشان بی مانند علم حقیقی اوست که در باب نفی باطل و اثبات ⁹⁸ حق که امام ست نماید چنانکه هیچ عاقل (و) منصف انکار او نتواند کرد و همین معجز که هیچ کس دست او ندارد [و] همین معجز ست که خاص بارست، و باز دلیل باین معنی که علم حجّت کلمه ⁹⁹ الحق ست (و) معجز او هم همان، نه فعل جسمانی، بسیار ست هم از علم

⁸⁵ شخصی . ⁸⁶ غرض . ⁸⁷ بدینی . ⁸⁸ Follows علمی which is crossed afterwards. ⁸⁹ Or معجز .
⁹⁰ Something is omitted here. ⁹¹ و or د . ⁹² حواس گانی . ⁹³ افرادی . ⁹⁴ حدّه .
⁹⁵ اصل . ⁹⁶ کلامه . ⁹⁷ صابت . ⁹⁸ اصل . ⁹⁹ کلامه .

ظاهر که شریعت که امر عامّ ست و هم از علم باطن (که) حقیقت که امر خاصّ ست، اما از ظاهر شریعت که آیت قرآن بسیار ست ازان جمله یکی، و ما علی الرسول الاّ البلاغ، یعنی از رسول که جبرئیل ست همین ادای رسالت که تعلیم اوست بر اثبات⁹⁸ وحدت خداوند حقّ میباید طلبید نه چیز دیگر و حدیث پیغمبر که، حرماً علی ... و الحقّ المنکوس ... [fol. I2v.] منہم و مطعمهم و مشربهم حتی یعرفون خالقهم و بارہم، یعنی بر ناشناخت (sic)⁹⁹ حلالهای شرعی همه حرامست و بر شناسنده حرامهای شرعی حلال، مثل شراب و مانند آن، اما شناسنده یک کس ست¹⁰⁰ یا کسیک در معنی یکی از¹⁰¹ باشد، و دلیل از باطن حقیقت که سخنان حجّتان و داعیان ست اولاً قول رئیس اجلّ که

Fol.

شراب را که بدنیا خوری⁹⁹ بامر کسی، ز روی مرتبه اورا شمر شراب ظهور،
و هر که بامر مرد حقّ خورد و بر (sic) دیگران دهد حلال میتواند شد پس برو چون حرام باشد، حکیم
نزاری دارد

تو امام وقت خود را نشناختی بتحقیق، بیقین بدانک بر تو ز و مال¹⁰⁰ حرامست،

پس هرگاه که فعل او منظور نتواند شد اورا بی معجز و نشان نتوان شناخت پس بعد قول چه چیز را

دلیل او توان کرد، در اکثر فصول این مضمون¹⁰¹ واقع شده ست که محقّ یعنی کلمه¹⁰² الحقّ [ست] به معجز
علمی [ست] میباید شناخت و در بعضی جاها¹⁰³ [fol. I3] واقع شده که قول¹⁰⁴ حقیقت یعنی این کلمه¹⁰² الحقّ

Fol.

که امام زمان ست از محقّ که حجّت ست میباید شنید و بعد ازان بحجّت او اقرار باید کرد و غرض¹⁰⁵

از شنیدن این کلمه¹⁰⁵ شنیدن معنی اوست که نفی (باطل) و اثبات امام ست، چنانکه در شریعت حق

لااله الاّ الله از محقّ شریعت که محمّد ست میباید شنید و معنی این در کلمه¹⁰⁶ شهادت که یکی در شریعت

ست و یکی در حقیقت، نفی باطل و اثبات حقّ ست اما [هر کدام] در (این) کون¹⁰⁷ تا کسی به حجّت

و برهان [یعنی] نفی باطل و اثبات (حق) که امام ست (اقرار؟) نکند مسلمان نمیگویند و به مجرد آنکه لفظ

کلمه¹⁰⁶ را بر زبان جاری سازد حکم بر اسلام او نمی نمایند و در شریعت حکم بر اسلام میشود، فاما همه وقت را

کلمه¹⁰² الحقّ را دلیل نمیتوان ساخت بلکه همان یکبار، و چون معجز و نشان او که کلمه¹⁰² الحقّ ست ثابت شد

بعد ازین باید دانست که چرا در همین کون حقیقت ظهور میکند و هر یک از آنست که تمام ترک شریعت گویند¹⁰⁷

سبب آنست که در سر هر دوره که همه احکام هزاره دران ایام مشخص میشود بعد از [fol. I3v.] حجّت سه مرد دیگر پیش

Fol.

نیستند که دران دوره میباشند یکی¹⁰⁸ پیغمبر و دیگر امام و دیگری حاکم شریعت، و پیغمبر را¹⁰⁸ ظهور در هر دو کون

میباشد زیرا که مرتبه حجّتی ندارد و امام در هر سه کون ظهور دارد، و حاکم شریعت در شریعت تنها، پس اگر حجّت

گرد شریعت گردد¹⁰⁹ متابعان او در دعوت حقیقت بشکّ می (sic) افتند و اگر خواهد که در شریعت هم ظهور کند

اشبات. 98 The more common would be ناشناس.

کلمه 102. مضمون 101. زن 100 Follows. خری 99. باو 98 Sic. Better. یکی ست 91. کلمه 106. عرض 105. کون 104. که 104 Follows. Something is apparently 107

wanting. Perhaps it will be better to read کون or اما در هر کدام از این کون.

107a Not clear. Perhaps it means که تمام ترک شریعت میکند و هر چه از آنست که ترک شریعت گویند.

108 Crossed: که مرتبه حجّتی ندارد. 108a Follows. و 109 Follows.

کذاه کار خواهد ¹¹⁰ بود بلکه از کذاه کار بدتر خواهد بود، چنانکه در سر دورۀ محمدی که مادر آن داخلم حجت همین سلمان بود که مقید شریعت نبود و قصداً و در حضور همه کس نامشروعاًت میکرد و بدان سبب بود که همه ضدان بر تشنیع میزدند و حضرت امیر احکام شریعت بجای می آورد و بعد از پیغمبر خود ببا بکر بیعت کرد اما سلمان را نداشت به بیعت چنانکه در محلیک عمر کریبان امیر را گرفت و به بیعت میبرد شخصی از ضدان در رسید و ردّ سلمان کرد و گفت چونست که شخصی را که تو در حق او آن همه را میگفتی ¹¹¹ و غلو میکردی حالا بدین ذلت ¹¹² به بیعت ابا بکر ¹¹³ میبردند تا سلمان در جواب او میگفت (sic) که اگر [fol. I4] به این همه میخواهد (sic) که آن این کند و این آن، و در آن حال اشارت بزمین و آسمان میکرد، تا حضرت امیر از روی قهر در وی نکاه کرد و گفت، نه هرچه بداند بگوید ¹¹⁴ چون سلمانرا هم کریبان گرفته با جمیع فارسیان به بیعت میبرد حضرت امیر در رسید و کریبان او را از دست عمر ¹¹⁵ خلاص کرد و نداشت که او را به بیعت برند، و سر آنکه خود بیعت میکرد آن بود که در زمان مصطفی شریعت او بهمه جا نرسیده بود بخواست که برسد تا تمام کفنده هم جنس اهل تضاد نبود (sic) که مدار بران دانستی پس آن شریعت تمام نمی شد تا خود هم متابعت آن تمام کفنده نمودی اهل تضاد هم نمودندی چنانکه شرح این گذشت که البته کون تضاد را هم وجودی میباشد زیرا که اگر ایشان باطلند که نباشند قدر ایشانرا هیچکس نداند، دیگر آنکه مدار و رونق اهل ترتب نمازد (و) اهل ترتب از طلب معرفت باز می (sic) مانند، چون ثابت شد (که) اهل تضاد را البته وجودی میباشد پس (اگر) شریعت مانع فساد و ظلم ایشان نشد هیچ یک را زنده نداشتی [fol. I4v.] و عالم بزی بویرانی نهایی و فایده اهل ترتب در این عالم باطل شدی چنانکه سید ناصر دارد * شعر ¹¹⁶

Fol. 147.

در ایشان ¹¹⁶ هست مشمت ^{116b} ناکس (و) خام، که عاقل دیو مردم خواندش ^{116c} نام،
 بفعل ابلیس صورت همچو ^{116d} آدم، بصد پایه ز اسپ و گاؤ خرکم ^{116e}،
 ز بیجان ¹¹⁷ دلی ¹¹⁸ بیدار شان ¹¹⁸ نه، بجز انکار خالصان کار شان نه ¹¹⁹،
 بلی هستند ¹¹⁹ این مشمت پریشان، مدا رانی ^{119b} جهان باشد ازیشان ^{119c}،

بدان سبب است که اهل تضاد را بستور سرکش مثل زده اند و شریعت بزنجیر و بند، یعنی همچنانکه ستور سرکش را به بند و زنجیر برآه می آرند ¹²⁰ همچنین اهل تضاد را هم بشریعت برآه در می آرند، پس ثابت شد که البته شریعت هم جهت صلاح میباشد، پس البته امام را هم دران کون ظهوری میباشد چنانکه در قطع فصلی واقع شده که مالک و رضوان که ممثل دوزخ و بهشت اند بسر خود وجودی هست، نه غلط است وجود هر دو باوست، یعنی بظهور او در کون هر یک، پس همچنانکه رضوان بهشت است و سبب رحمت

110 خواهد . 111 میگفت . 112 Here زلیل . 113 This name is written upside down.
 114 بداندند بگویند Perhaps better بگویند . 115 Also written upside down. 116 This is an extract from Rūshenāi-nāmah of Nāsir-i-Khusraw, see the edition of this poem by H. Ethé in Z.D.M.G., v. 34 (1880), pp. 453-4.
 116a So in Ethé's edition, here انسان . 116b E. مشمتی . 116c E. گویدش which seems to be better reading. Here خاندش . 116d So E. Here همچو . 116e E. follows a verse omitted here.
 117 E. بیجانی and variant نادانی Here بیخانی . 118 So E. 118a Here شانه . 118b Here شانه
 119a E. follows از . 119b E. and instead of از ایشان in the same verse he reads ایشان است و سبب رحمت . I prefer the reading as given here because it offers better sense. 119c E. the order of the verses is different. 120 (sic) آرن د .

Fol. 15] بفرمان اوست، همچنان مالک هم دوزخست و سبب عذاب بفرمان اوست، همچنانکه رضوانا به [fol. 15] عمین از نیکی ادعای¹²¹ ستر نیکان داشته اند که¹²² نیکی مردم ست همچنان مالک هم تنها از بدی¹²³ ادعای¹²¹ ستر¹²⁴ بدان داشته اند که بدی مردم ست، بهشت به نیکان نیکتر میشود (sic) و دوزخ با (sic) بدان بدتر، پس ثابت شد که باطل را هم بسر خود وجود¹²⁵ اضافی نمیتواند بود، در همه زمان در شخص، که یکی بهشت بود و یکی دوزخ، بهشت بجهت بهشتیان و دوزخ برای دوزخیان، تعیین نموده اند، امر خاص به بهشت فرموده اند و امر عام بدوزخ و خود بمذهب هر دو عمل می نماید تا هر دو را وجودی باشد و ازان دو هیچ کدام را متابعت دیگری نفرموده اند (تا) تابعان ایشان بشک نافتند و ترک مذهب ایشان (نه) گیرند و عالم ظاهر و باطن را بی رونق (نه) سازند، پس ثابت شد (که) البته حجّت را واجب ست که شریعت را تک کذد،

و چون تفریق و نشان او ثابت شد و بعد ازین در شناخت اهل ترتب شروع نمایم و آن آنست که بدانک اهل ترتب دو قسم اند قویان و ضعیفان، و قویان مردانی را گویند که بمعرفت حجّت عارف شده باشند [fol. 15v.] و مستجابان را دعوت بحجّت کذد و نشان ایشان اینست که همان دعوت حجّت را قبول کرده باشند و با ضعیفان ادا نمایند¹²⁶ و موافق احکام شریعت زیند، و ضعیفان مردانی را گویند که در قبول دعوت و تعلیم و بیان تسلیم تمام داشته باشند و ایشان موافق احکام عقلی شریعت زیند، و قویان داعیانند و مأذونان¹²⁷ و معلمان و مأذونان اصغر و ضعیفان مستجابانند تا در ادای اثبات امامت خواه قوی خواه ضعیف به درجه حجّت نرسند صاحب تائید نشوند، احکام خلقی شریعت چون شود، رز و شراب خوردن¹²⁸ و غیره از کردن¹²⁹ ساقط نشود، آری احکام خلقی شریعت چون شهادت و طهارت و نماز و روزه و زکوت و حج و جهاد، و هرگاه که بتأویل آن کار کذد از کردن ساقط میشود و آن هم در غیر تقیه،

دیگر باید دانست که چون مذهب¹³⁰ این فرقه دین حقیقی مولانا ست و حجّتش و بهای حقیقت که این دو میداند (sic) همه چیزست (sic) نه همین ده یک زیراک آن بهای شریعت بیش نیست و شریعت ست که بهمان ده یک به نمی ارزد، پس (از) اهل ترتب درین زمان شب (دین) حقیقت را کس خواهد¹³¹ داشت که همه چیز در بهای او (sic) تسلیم کذد و (اگر) یکم وجهت خود نگاه دارد حقیقت نخواهد داشت یعنی رضای حجّت و علم و معرفت او را حاصل نخواهد کرد¹³² و هر کس (که) علم و معرفت [fol. 16] حاصل نکند نجات نخواهد یافت چنانکه عزیزی دارد

* مصراع *

گر بموی باز مانی مرد این ره نیستی،

* شعر *

و خواجه نصیر دارد

چه صور دعوت او حجّتش دمید آنکه، بعلم زنده بود جمله را بمیراند،

چه باز صور قیامت بذات خود بدمد، هر آنکه مرده جهلست زنده کرداند^{132a}،

¹²¹ دهای .

¹²² کی .

¹²³ بدای .

¹²⁴ ستري .

¹²⁵ وجودی .

¹²⁶ نماید .

¹²⁷ اکبر probably omitted مازونان .

¹²⁸ خوردن .

¹²⁹ خوردن .

¹³⁰ مذهب .

¹³¹ خواهد .

¹³² Sic. Better شد ؟

^{132a} Cf. poetry on f. 10.

کسیک زنده شود از ندای دعوت او، به تخت مملکت سرمدیش بنشاند،
 کسی که مرده بماند بروز بعثت او¹³⁵، بآتش عدم جاودان بسوزاند،
 نشان زندگی او درین جهان ایذست، که دل ز هر چه بود غیر او بیفشاند،
 نشان مردکی آن دگر که این باشد، که روز درگه او ذره بگرداند،
 و کر ترا بوزد هر دو عالمت باشد، و کر نه ذات¹³⁴ ترا نیز از تو بستاند،

پس اگر ذره یا موی یا چیزی از بهای حقیقت که حجّت ست نکاه¹³⁶ دارد حقیقت نخواهد داشت
 چون از آن بماند¹³⁶ از همه بخواهد (sic) افتاد زیرا که همه اوست و همه بی او هیچ و اگر همه بدر تسلیم کند هیچ
 [جهت] با خود نکاه ندارد بر هر در عالم حاکم و پادشاه خواهد¹³⁷ بود،

چون اثبات¹³⁸ اهل ترتب بیان شد بعد از آن در اثبات¹³⁹ اهل تضاد شروع نمایم و آن آنست که اهل

تضاد در قسم اند یکی کافر و دیگر منافق و منافق [fol. 16v.] بدتر ست از کافر زیرا که کافر مردی را گویند
 که غایب و حاضر مساوی باشد نه در حضور قبول تعلیم معلّم این طایفه کند و غایبانه منکر شود تا بندگان خود را
 باقراری که در حضور معلّم کرده باشد از مکر او ایمن دانند در اثبات¹³⁹ آن آنچه از دست او آید در دشمنی
 و عداوت تقصیر نذماید و هرچه در ضمیر اوست پنهان ندارد و بندگان خود را از ایمن می دارند چنانکه
 عزیز می دارد

• بیت •

بسیار بود سک موافق، بهتر ز برادر منافق،

• مصراع •

و جای دارد

یا کافر صرف باش یا مؤمن پاک،

• مصراع •

و جای دیگر دارد

کافر باشی به که منافق باشی،

• بیت •

یا زنگی زنک باش یا مؤمن پاک، یا سخت چه سنک باش یا نرم چه موم،

ایذست صفت حال امام و اهل وحدت و اهل ترتب و اهل تضاد که بیان شد بعبارت فہم عام تا عام را

• شعر •

در یافتن آن آسان نماید و از فایده این بی نصیب نماند، و بمنه¹⁴⁰ وجوده

سک چه عالم کشت شد چالاک زهف، سک چه عارف کشت شد ز اصحاب کھف،

علم چون سک یافت و ارست از ضلال¹⁴¹، میکند در بیشها مید حلال،

• تم تمام شد •

135 او را
136 اسما

137 ذات
138 Follows

139 نیکاه

140 بافند
141 زلال

اصبات 188 ؟ خواهد 187

VI. TRANSLATION.

In the name of God, the Merciful, the Compassionate.¹

The book² on the recognition³ of the *Imām* who is the manifestation of the Divine Will; ⁴ the *Hujjat* (his) "Proof," who is the manifestation of Universal Reason; *dā'i*, the "preacher"; *ma'dhūn-i-akbar*, "those more informed" (about the religion); *ma'dhūn-i-aṣghar* "those less informed";⁵ and *mustajāb*, the *neophyte*,^{6a} "those whose prayer may be answered," who (all) are a manifestation of the Universal Soul;⁶ and the "people of opposition" (adversaries of the religion) who are a manifestation of Universal Body.⁷

(I. *The Manifestation of the Imam and his Hujjat*).⁸

Firstly⁹ I begin (to discuss) the recognition of the Imam. It is as follows. Know that (by the name of) Imam is called a man¹⁰ who sometimes can be known in his own person and sometimes with the help of his *Hujjat*. It is possible to recognise him (personally) only on the day of the "Sabbath of the Faith."¹¹ And it has to be

¹ This formula is not in agreement with the usual doctrine of the Ismailis about the Deity being attributeless, and is probably inserted by an ignorant copyist. The other book of the same collection. اسم الله العليّ، uses اسم الكتاب، which is not only used by the Western branch of this sect (cf. S. Guyard, "Fragments relatifs à la doctrine des Ismaélis," Not. et Extr. XXII, p. 193), but also by other kindred sects as Druzes (cf. de-Sacy, Exposé de la religion des druzes, 1838, v. I, p. 32), Nusayris (cf. R. Dussaud, Histoire et religion des Nosairis, 1910, pp. 51-52), Ali-Ilahis and even Hurufis (cf. E. Browne, "Some notes on the literature and doctrines of the Hurufi sect." J.R.A.S. 1898, p. 70) and Babis (cf. an interesting note by V. Rosen, Collections Scientifiques, etc., v. VI, p. 135).

² See above, Introduction, II, footnote 6.

³ In the vulgar language many similar forms are used instead of infinitive, such as *did*, *khariḍ*, *bar-gasht*, etc. All of them (as well as many Arabic *maṣḍars* used in Persian) have the sense not only of the name for a process of the action but also for the object of it; therefore *shinākht* means, besides, "definition", all that by which something is recognised.

⁴ عالم امر in Muhammadan theology means the world of spirits, which was not created of the materia but simply by an expression of the Divine Will (cf. S. Guyard, op. cit., p. 203, note 44).

⁵ Verb اذن besides its original sense "to order, allow" can mean "to allow in," in this sense as "into religious teaching." These expressions obviously mean "higher" and "lower" degrees of initiation. The term is used by the western Ismailis as well. Cf. S. Guyard, op. cit., p. 166, note 23, who refers also to de Sacy, Exposé, v. II, p. 389 and 395.

^{6a} So it appears in S. Guyard, op. cit., p. 102 and in the same way it is apparently spelt by the sectarians. The text gives everywhere مستجاب but Biyānu'l-Adyān (Schefer, Chrestomathie, I, 161), writes مستجيب.

⁶ It is to be remembered that نفس means not animus but anima and therefore can be better translated by "living powers."

⁷ Or materia. About the word تضاد cf. S. Guyard, op. cit., p. 201, note 20. This classification of the degrees of living beings is exactly the same as in another Ismaili treatise (No. 5 of the same collection), written about the same time (959 A.H.). It gives seven degrees in all, but if we exclude Imam and *Hujjat*, who are rather deities, and the adversaries who do not belong to the sect, it leaves only four available for a believer. They bear remarkable resemblance (if it is not simply accidental) to the Manichean degrees of episcopi (*dā'is*) electi, (*ma'dhūns*) and auditores (*mustajāb*).

⁸ I introduce these headings, which do not exist in the original text, in order to facilitate the handling of the book.

⁹ It does not mean "first chapter" but is simply an adverb.

¹⁰ It is a very impolite expression from the point of view of the educated Persians of to-day. The word however is used quite freely in India, etc. The Persian would say شخص.

¹¹ Similar millennial periods are especially popular with the Nusairis, cf. E. Salisbury, Kitābu'l-Bakūrat, etc. J.A.O.S., v. VIII, p. 276. Unfortunately the book of Dussaud, Histoire et religion des Nosairis, 1910, is not available to me at present and I give here references only in cases where they are preserved in my notes.

known that every "day of the Faith" is equal to one thousand years of this world (so that) a week of the Religion lasts seven thousand years. In these seven days the "day of the Faith" is only one, not more, and the other six are the "night of the Faith." This "day of the Religion" is called Saturday and on this day the Sun of the faith, the Imam, becomes manifested. This is the reason why it is said: 'All the commandments will pass, but that about Saturday will remain.'¹² [Fol. 2] The six days are called the "Night of the Faith" for the reason that at that time the law (*shari'at*) of the prophets is a veil of the Imam just as the night is the veil of the sun in this world. But as there is the moon which takes the place of the sun when it is hidden, so there is Hujjat, who takes the place of the Imam when he is not manifest, in order that his slaves, i.e. the "people of degrees"¹³ could recognise him with (the help of) the light of his "Proof's" teaching.

It is to be understood that in the six thousand years of the "night of the Faith" the Imam also becomes manifest occasionally. But these his manifestations are not those in which he appears in the whole of his glory.¹⁴ And the knowledge of him, in his real essence, cannot be attained. Just as on the contrary in the millennium of Saturday he can be recognised with his real nature because on that day his manifestation is complete.¹⁵ Therefore in these six thousand years he cannot be recognised.¹⁶ So the [Fol. 2v.] great Rais (chief)¹⁷ says (in his poetry):

The manifestation (of the Imam) as an ordinary man is a mystery. Do not depend on it in any way (?),

Because for a believer, who expects the Resurrection, there is no difference whether the Imam be apparent or hidden.¹⁸

But it would be absurd (to think) that he will leave the "people of degrees" without the possibility of recognising him; for the purpose of their acquiring this knowledge the world was created.¹⁹ If he should leave them so—which God forbid!—he would be ungenerous. Therefore inevitably a moon must exist in this night (of Faith) which would remain perpetually manifest in its real nature.

¹² Apparently an allusion to some book.

¹³ It is an artificial form (تَرْتِيبُ), I was told that the Pamir sectarians spell this usually as *tartib*, a much more common word. A still more logical term is used by Nusayris, اهل لمراتب. See E. Salisbury, op. cit., p. 250.

¹⁴ The author gives three kinds of manifestation اضائي، شكلی، معنوی. The first (معنوی) apparently means "in (full) nature (معني)". The last, اضائي is clearly explained (f. 5) as "illusory." The one called شكلی is the most difficult to translate adequately. In fact it means "in shape of an ordinary mortal man," as it is possible to gather from the context.

¹⁵ Apparently it means that the Imam has this "real" manifestation during the whole 'Saturday' millennium.

¹⁶ As it appears further this is impossible without the help of the Hujjat.

¹⁷ See above, *Introduct.*, footnote 17.

¹⁸ This poetry, like all the other quotations, is in hopeless condition and extremely difficult to translate. I would reproduce the first hemistich in prose as this *بيديج مجدد* (اورا) *ظهور شكلی (اعمال) عیب است*.

¹⁹ A sort of sectarian form of the usual beliefs in the cosmical significance of the mystical knowledge, analogous to the well-known sufi pious speculations about the *hadith* *ان عرف مخفيا وحديث ان عرف* etc.

²⁰ All the numerous quasi-orthodox expressions like the present, as well as *حضرت رسول*, *پیغمبر*, etc., can be considered as being simply *modus loquendi*, without reference to the beliefs of the author. It is usually the case in sectarian writings.

Any one who will not attain the knowledge during the time when the moon appears in its real essence, how should he acquire (this knowledge) at the time when the sun is manifest in a form which gives no light? Just as a poet says:--

If to-day no benefit is derived from a complete manifestation,
Of what use will be to-morrow a bodily manifestation.

In another place the poet says:--

The complete manifestation, in favour of which the propaganda is at work,
Will not be greater or smaller than what it actually shall be.

(II. *The Necessity of the Propaganda (da'wat) in the time when the Imam is hidden.*)

It must be known also that whenever during the six millennia of the "night of Faith" the Imām has a bodily incarnation (as an ordinary man) [*Fol.* 3] his Hujjat has no complete manifestation. So it was in the time of the Prince (of the believers—Ali) when Salmān did not reveal his teaching except to one man.²¹ But as soon as the Imam becomes hidden, he (Hujjat) must be completely manifested and it is impossible that both, the Imam's bodily incarnation as well as preaching in his favour, would disappear. It would cause the creations to fall into destruction.

The reason why the Imam occasionally withdraws the complete manifestation of the Hujjat and himself becomes incarnated as an ordinary man is that at that time the people are not capable (of accepting his doctrines), God forbid! Just as Hakīm Nizāri says in his poetry:--

The (time of the) complete manifestation (of the Imam) is veiled in mystery.
(But) do not withdraw thyself from those who desire (his arrival);
After this the gate of mercy (will be opened) in the heaven.²²
But if thou wilt be negligent do not blame us.²³

So it is proved that it is on account of his slaves' negligence²⁴ and sinfulness that he shuts occasionally the door of mercy and the gate of the knowledge of himself and leaves them to their fate.

If thou leave us to ourselves (in punishment for our bad behaviour),
(Then) explain (clearly) what thou wilt have (from us).²⁵

(III. *The Fourfold Knowledge about the Imam.*)

And again it must be known that (the way to) the knowledge of the Imam is fourfold. [*Fol.* 3v.] First, the knowledge of his body. It can be shared even by an animal. Secondly, the knowledge about his name. It can be obtained even

²¹ As the author will show later in this book this "one man" was Muhammad.

²² Literally "in the height," and as Paradise is located somewhere on that side, I think my translation will not be incorrect.

²³ The hopeless condition of the verses suggests that the author was citing them from his memory and the copyists have reduced them to a still worse plight.

²⁴ غفلت and سهو are practically the same and therefore I join them in one word.

²⁵ This hemistich can be translated more literally in this way:— (Then) do (with us) what thou wilt or what thou canst. This great difference in translation depends on the difficulty of reconstructing or guessing the context in which this detached verse stood originally.

by adversaries. Thirdly, the recognition of his Imāmat. In this the "people of degrees" can partake. Fourth, the knowledge of his (real) nature. It can be possessed by his Ḥujjat only.

(IV. *The Ḥujjat's and Dā'is' knowledge of the Imam*).

It is also to be understood that the "people of degrees", i.e. that dā'ī and those others inferior to him can always trace the person of Imam (in which he is incarnated, by the guidance of the two signs of which one is his inherited nomination²⁶ and the other his descent. But the chosen, i.e. the Ḥujjat, knows him since pre-eternal times by his miraculous knowledge and by innate disposition.²⁷ In several past incarnations²⁸ some dā'īs have not erred in recognising the Imam's person through being in possession of the true knowledge. The reason (of their correct recognition) was their following that principle.²⁹ But the other dā'īs, who were misguided, committed an error, the reason of which was that they took into consideration only the (Imam's) descent. Therefore they gave up Shāh Nizār with his (real rights for) Imamat³⁰ This was the reason (why it happened in this way).

Fol. 4.

In the two incarnations,³¹ in which he dropped both indications,³² he first caused to appear his Ḥujjat and appointed him, and after this [Fol. 4] he withdrew his two signs and disappeared, even in his personal form, from amongst the "people of degrees." Later on the higher degrees of the believers³³ traced the person of the Imam with the help of the indication and guidance of the Ḥujjat after an examination of the matter. But some people, not strong (in their belief), did not listen to these arguments of the Ḥujjat or (simply) were incapable of understanding them³⁴ by the way of following the opinion of the majority.³⁵

(V. *The Relation between the Imam and the Ḥujjat*).

It must be known also that the descendants of the Imam are of four kinds.

²⁶ In this way the sectarians understand the word *نص* as appears from their teachings. I translate it as "inherited" because it can be obtained only by the way of appointment from the father of the Imam, which in usual terms means simply bequeathment.

²⁷ The degree of the Hujjat apparently is not considered as being legal only when inherited as it is in the case of the Imam. The author does not touch this interesting question, but it seems that in principle this degree is obtainable by simple mortals (cf. Introduction, IV).

²⁸ It is a very common way in which sectarians express the idea of incarnation as being simply a "dress" for the Imam. The Ali-Ilahi use this word as well as *لباس* and especially *دون* a word of obscure etymology, supposed to be Turkish.

²⁹ This meaning of the word *شرط* is also very common in sectarian literature.

³⁰ A very ambiguous expression which can equally mean: "they choose Shāh Nizār for Imamat." All is caused by the author's confusion of the prepositions *بِ* and *لِ*. I prefer the second reading as being more in accordance with the historical events here alluded to.

³¹ See above footnote 28.

³² Another historical allusion, but unfortunately I cannot identify it with any degree of certainty. The history of the Ismaili Imams from the sectarian point of view is not known, and, I believe, hardly exists in their own treatises.

³³ "The stronger ones amongst the people of degrees," who are dā'īs and the two *ma'dhūns* (cf. fol. 15v.).

³⁴ Something is dropped.

³⁵ *نقلند* means imitation of the rites of the religion of the majority without examining their authenticity.

First, those who are descended from him as regards the body, just as Mast-'Ali.³⁹ Secondly, those who are descended from him in their spiritual nature—as Salmān. Thirdly, those who are descended from him as regards both their spiritual nature and the body, just as Imām Ḥasan, who is called *Imām-i-mustawda'*, i.e. "one to whom (the Imam) is entrusted."⁴⁰ And the last, those who are descended from him as regards their body, spiritual nature and the Divinity⁴¹, as our lord (mawlānā) Ḥusayn, who is called *Imām-i-mustaqirr*, i.e. permanent.⁴² When therefore it is explained that the Ḥujjat is a spiritual descendant of the Imam, in those days⁴³ when he has entrusted the rank of Ḥujjat to his bodily descendants, [Fol. 4v.] this rank was obtainable by everybody, not only the chosen. (The Imam) always had a (separate) law for the common people and another for the chosen, and so he has it (at the present time). The first of them is intended for the people⁴⁴ who know nothing about the secret teaching and, amongst them, for all the orthodox. The law for the chosen exists for the man who is following only the secret teachings and, with him, for all the sectarians, so that both the categories⁴⁵ will be benefited, as will be explained (further) in its own place.

Fol.

(VI. *The Manifestation of the Imam is essential to the existence of the World*).

It is also to be realised that the Imam must be necessarily manifested in all the three categories (of mankind), because he is in fact the "indispensably existent" and every thing besides him is but "possibly existent." By this name any thing is called which cannot exist by itself. Now, when all these "possibly existent" objects are present (it proves that) the Imam must be manifest in their generic class in both existences.⁴⁶ If it were not so, the worlds⁴⁷ could not exist.

⁴⁶ This obviously artificial name is very similar to those used by Persian derwishes and Ali-Ilahis. Both of them believe in various incarnations of their saints in different periods, but as these ideas are considered by the orthodox as heretical, they have invented a special system in which the same person has three different names: اسم شریعت or his ordinary name, اسم طریقت or a derwish surname, and اسم حقیقت which the derwishes receive at the high degree of initiation or, in the case of saints, the name of their "prototype", which he possessed when he was manifested in his real nature. Their pedigrees are filled with similar *Mast-'Alis*, *Sūkh-'Alis*, *Nūr-'Alis*, etc., but unfortunately no body remembers who is who in this ciphered multitude and their history is practically unreconstructable.

⁴⁷ I cannot remember if this and the next terms exist in the expositions of the western branch of the Ismailis. In *Haft-Bāb* it is explained that by this name is called the Imam, whose posterity are not Imams and therefore his Imam is entrusted to him temporarily.

⁴⁸ In the original text it was omitted but added afterwards, and it seems to be quite natural from the context to accept this addition.

³⁹ In "*Haft-Bāb*" it is explained as "having posterity."

⁴⁰ Literally, as in the text, "in these (=our) days," but the verb is in the form of the Past Tense, as also the verb in the next connected sentence. Therefore a mistake of درون for دران can be suggested, although it can be settled finally only when the author's allusion can be explained.

⁴¹ مردی obviously means a collective name.

⁴² کون is used by the author (as many other words, e.g. امر) in various senses. Here it obviously means the categories of ظاهر and باطن. A few lines later the same word is applied to the three religious sections of the existence, i.e. *shari'at*, *ma'ritat* and *haqiqat*.

⁴³ Again the same کون. It is very difficult to see what the author means, because these philosophic speculations were seemingly beyond the capacity of his theoretic thought.

⁴⁴ Again اکوان.

If some one should say that an object is an impossibility because the opposite to (its) existence will be non-existence of the equal (accidental) being, not (the non-existence) of the master of its essence, nor will its non-existence be counterpart of the presence of the "Indispensably-existent"; or if he should say (that) they exist but are the cause one of the other,—all this is nonsense.

Therefore [*Fol.* 5] it is clear that the Imam must be manifested in both worlds, of which one is created and corporeal and the other produced by the Divine Will and spiritual, as well as in all three forms of the last mentioned.⁴⁵

In the created and material world the posterity are always similar (to their progenitors), so that the son takes the place of his father. The same is the case in the spiritual world of the Divine Will. So the adversaries say on the ground of the principles of their shari'at, the "people of degrees" from their own teaching and the "people of unity," i.e. Hujjat, from the "Divine assistance."⁴⁶

At the same time it is necessary to note also that the manifestation (of the Imam) in (all) these categories is illusory, not complete. If it were otherwise (it would seem as if) the accidental beings could (have the power to) govern (the world).⁴⁷

The name "illusion"⁴⁸ is applied to something resembling any other, but being different from it in reality, just as a mirage which resembles the water, or a reflection in a mirror, which are distinct (from what they seem to be). "The real" is called something which is itself, as the water (which the mirage resembles) or the object (whose reflection is seen) in the mirror. And Raïs Hasan⁴⁹ says in a poem:—

Thou art living as a man with men, before the eyes of men in this world ;

In the form of a man thou art and with men thou remainest.

Thou comest amongst men not showing thy real face,

[*Fol.* 5v.] Because in thy pure and attributeless essence thou art void of every (form).⁵⁰

If (thou appearest) amongst the men, thou art a man, if amidst spirits—a spirit,

Thou grantest them their existence as well as governest them.

And the same Raïs says in (another) poem:—

The reason why thou hast received the illusory attributes.

And why they became incalculable for the world.⁵¹

⁴⁵ The same *كون* which is opposed to *عالم*

⁴⁶ *تأيد* The same term appears on f. 15v. of this treatise. In other books in which I can trace it at present it occurs in 'Immu'l-Kitāb, in the form of *علم تأيدي*. The original meaning of this word is "strengthening." As it is applied to the form of the knowledge possessed by the Hujjat, who does not receive any teaching from the Imām and knows all himself, I prefer to translate it in this way in the sense of "Divine assistance by the influence of the Imām's essence." This term is also known to Western Ismailism and appears several times in S. Guyard's "Fragments relatifs à la doctrine des Ismaélis," p. 13 (text), also pp. 148 and 160-161 (note). He refers also to de Sacy's "Exposé," v. II, p. 85.

⁴⁷ It is an obscure sentence. At first it offers a clear translation by reading *حکم ممکنات دیشتی* (with *idāfah*). This gives the meaning: "If he were to be manifested in his real essence, he would govern the accidental beings. But so it is in fact, as the sectarians affirm. Therefore the stress is on the form in which he appears and the obvious intention of the author must be to say that the Imam cannot manifest himself in all his glory in this accidental form because it would seem that one of these forms governs the others.

⁴⁸ The plural form is probably a mistake.

⁴⁹ See above, introduction, footnote 17.

⁵⁰ The usual and essential doctrine of the sectarians. Cf. introduction IV, footnote 31.

⁵¹ *این درگاه* hardly means anything else.

Is that every religion, whether it be true or false, bad or good,
 Invented its own way (of worship) and calls thee by a different name.
 Of all these names and attributes, which appeared,
 It is as if a garden rose up with young waving trees.⁶²
 Thou art partaking in all these, only from thee
 Comes the existence of all these, inherent in the beings.
 But in the eyes of the truth, in thy real essence thou art
 Really void of all the attributes and all the names.

And Khawāja Naṣīr⁶³ says :—

O thou in whose existence is a possibility of being for the world,
 O thou in whose protection is mankind's safety !
 As a person thou art the manifestation of the Divine Light,
 And in the view of reason thou art the source of the different kinds of creations of the world.

Thou comest appearing to the eyes of all creatures,
 But remainest hidden even from the universal Reason in thy mysterious power.
 All three worlds are with thee and thou hast been with all of them,
 Both (the material and spiritual) worlds come from thee but thou art far from all of them.

[*Fol. 6*] (Therefore) it is to be understood, that only the manifestation of the Imam in these worlds is their real cause, not anything else.

(VII. *Definition of the Degree of the Ḥujjat*).

Having explained what is known by the name of the Imam, I will proceed to discuss the definition of (the degree of) the Ḥujjat. Know that by this name a person is called whose real essence is the same as that of the Imam from all eternity. He becomes manifested in this world for the sake of the "people of degrees" in order by having instructed them in his teaching to make them recognise the Imam, because the Imam himself is free from (the necessity of) adopting (the teaching) or transmitting it (to anybody).⁶⁴ The Ḥujjat, however, free from (the necessity of) receiving (any body's) instruction, is not free from the duty (of delivering his teaching). And the *dā'ī* as well as the three⁶⁵ degrees after him are not free (from both duties). The *neophyte*⁶⁶ is not allowed to teach⁶⁷ and needs only to accept the instruction.

⁶² I take باغ *bagh* as a definitive compound, "the garden of young trees." The word تکدن *tekden* is not common, but *نکن* in combination with verbs, especially خوردن *khordan* in sense of "to start," "to move," etc., is much used.

⁶³ Cf. introduction, II, footnote 18.

⁶⁴ The author often uses here the word *د* without any further definition, but it is clear from the context that means only the duty of teaching.

⁶⁵ Sic. Very often there is a rank called معلم *mu'allim*, "the teacher," but it is not clear whether it is a separate degree or whether one of the *ma'dhūns* is bearing this title. With reference to the term حد *ḥad* and حدود *ḥudūd* cf. S. Guyard, op. cit., p. 20 and 118.

⁶⁶ This rendering of مستجاب *mu'stajib* although not quite adequate is sufficient to explain the essential side of his position amongst the other degrees.

⁶⁷ The author uses the word امر *amr* in five different meanings: (1) امر (عالم) *amr (ʿālam)* the Divine Will (*fol. 1v.*); (2) the rank

Therefore it is now clear that the Ḥujjat has a necessity to deliver his teaching and others need either accept it and transmit or only adopt it. And if he do not appear and teach, the "people of degrees" will fail in attaining salvation and perfection (in) the next life and therefore [Fol. 6v.] there will be no use in the creation of the world.

(VIII. *The Logical Proof of the Necessity of the Ḥujjat*).

There are numerous indications, in logical arguments as well as in tradition, showing that without the help of the Ḥujjat it is impossible to recognise the Imam.

The logical proof is as follows. In every thing existent its perfect quality cannot pass from the state of potency into action without an impulse from outside. If it could be otherwise, the result necessarily would be that all the (material) bodies, in which the ability of movement is considered as their most perfect state, could come into activity spontaneously, without being compelled by something else, which "stays behind them," i.e. in some of them the vegetable spirit, and in the others the animal or human spirit. If this is the case with the body, which belongs to the world of semblance, in the spirit, which is the archetype (of the body), without (the help of) the Ḥujjat no spiritual movement can exist, because it is the progress from the vices towards (moral) perfection and transmitting⁶³ (the teaching) to those able (to accept it).

(IX. *The Traditional Proofs of the Necessity of the Ḥujjat*).

The proof of tradition (can be obtained) first from the orthodox teachings of shari'at⁶⁴, which are called by their followers "the word of God and of the Prophet," and also from the teachings of the "worshippers of the Truth,"⁶⁵ who are opposed to the orthodox, as Ḥakim Sana'i, (Jalālu'd-Dīn) Rūmī "the revealer," Shaykh 'Aṭṭār and others. And even from the words of the Bāṭinis, by whose mouths God is speaking. [Fol. 7]. They (all) refute their own statements (by contradictions), but cannot understand this even if these contradictions become patent.⁶⁶ There are also teachings of the mystery of the (eternal) Truth, revealed by the Imam, in the time of his perfect incarnation, or by his Ḥujjat who is always completely manifested.

Whenever in the common⁶² teaching of shari'at the Qoran, the Lord Gabriel, Mikael, Israfil and Azrail are spoken of, their real meaning and archetype, as can be explained, is the Ḥujjat, because in interpretation, "ta'wil," the meaning of the "angel" is the "people of unity," i.e. the Ḥujjat, nobody else. And wherever *dā'ī*

or position (امر حاجتی fol 4); (3) commandment or teaching (امر خاص و امر عام ff. 4v., 12, 15); (4) here in the sense of the "active religious life," "preaching," and (5) question (f. 10v). It is a good example of the author's terminology.

⁶³ again without a direct object. I keep it in the same sense as in the preceding chapter.

⁶⁴ Literally outer teaching of shari'at (not interpreted by ta'wil).

⁶⁵ By the name *Ahl-i-haqq* many sects call themselves, just as is the case with the Persian Ali-Ilahi.

⁶⁶ It means apparently that the Batinis can be in such deplorable condition if left without guidance of the Ḥujjat.

⁶² See footnote 59.

is mentioned, it means the prophet, as in the Qoran there is a verse (let His word be exalted!)⁶³— “. . . calling towards God, by His order, as a burning candle.”⁶⁴ And as regards (his statement) that he (Muhammad) was receiving revelation from Gabriel, i.e. that he was a *dā'i*, he received instruction from Salmān and the words which he uttered prove this: “If Abū-Dharr could know what is in the mind of Salmān truly he would call him an unbeliever”⁶⁵, which means that should Abū-Dharr be aware of what is in Salman's heart he would kill him. When our Lord (Sayyid-nā)⁶⁶ was asked about the meaning of this tradition of the Prophet [*Fol.* 7v.], he said in reply that if Salman were to say to Abū-Dharr that his, Salman's, position is superior to that of the Prophet and that Mawlānā 'Ali is the creator and the architect of the world, the former would look upon these words as a heresy and slay Salman.

Fol.

There are (words) of the Prince of the believers (Ali): “Salman is with us (as one) of (our own) family, a sun from the Light of God, a part of us (and) from us. The heart of a true believer is the Light of God, but no believer is as powerful as Salman although a believer is eternal in the two worlds.”⁶⁷

Rūmī, the revealer, says about *Khiḍr* and Moses, that the latter was learning perfection from the former. And in the beginning, when Moses had not received from him a (revealed) instruction, he could not realise the mysterious meaning of *Khiḍr*'s actions. So Rūmī says in his *mathnawī*:—

That boy whose throat *Khiḍr* has cut,
The common people will not understand his mystery.
Even from Moses, with all his wisdom and wit,
It remained hidden. Thou, o wingless, do not try to fly!⁶⁸

Hakīm Nizārī says (alluding to this story):—

If it had been an easy thing to penetrate to that source (of mystery),
How could Moses turn back from *Khiḍr* in confusion?

The Paradise of Adam, the Ark of Noah, the vision [*Fol.* 8] of Abraham, Jesus and Mary, the mount Sinai of Moses, Gabriel of Muṣṭafā—all these are (forms of) the *Hujjat*. All the orthodox believe in this (tradition), but they do not know about its interpretation (*ta'wīl*). Just as Amīr Sayyid 'Alī-i-Wā'iz,⁶⁹ one of the orthodox, in a poem composed in praise of Ali, says that once (the Prophet) was sitting and Gabriel was by his side. At this time the Prince (of the believers, Ali) entered the house and Gabriel paid respect to him. The Prophet asked: “Why hast

Fol 8

⁶³ As I pointed out above (footnote 20), the author is so accustomed to using these pious-expressions in every day life that they slip involuntarily into his writing. Or is it the fault of the copyist?

⁶⁴ The Qoran, XXXIII, 45.

⁶⁵ However strange it may be this *hadīth* is mentioned even by a moderate shi'ite writer of the IV c. A.H., Abū 'Amr Muḥammad b. 'Umar b. 'Abdī'l-'Azīz Kāshī in his book *معرفة اخبار الرجال* (Lith. Bby, 1317), p. 12, with an *isnād* reaching to Ja'far Ṣādiq: *ان لو علم ابو ذر ما في قلب سلمان لقتله*. In the present text the place is badly mutilated and I reconstructed it in accordance with the author mentioned here.

⁶⁶ Cf. above the Introduction, II, and the footnote 15.

⁶⁷ It is obviously a combination of various traditional holy utterances of the Imams and the Prophet. The first is very common (cf. op. cit., pp. 8, 10), the second part I could not trace.

⁶⁸ The well-known story in *Mathnawī* of Jalālud-Dīn Rūmī.

⁶⁹ 'Alī bin Husayn Wa'iz Kāshifī, cf. introduction, II, and footnote 10.

thou such veneration for my little boy?" To this Gabriel replied: "He was my teacher in the beginning of my existence." Then the Prophet asked: "How much time passed since thy creation?" Gabriel replied:—

"Although I do not know the (exact) number of my years,
I know a star, an ornament of the Divine Throne.
It is a star which only once in every thirty thousand years
Rises over the greatest and the highest Throne (of God).
Since the time when I came into existence by His might,
'That star thirty thousand times appeared to me."

Fol. 8v. It is said also that although Gabriel has the form of a bird,⁷⁰ as the other angels, on that day however he appeared [Fol. 8v.] to the Prophet in the form of a man, and as a man was sitting by the side of Muṣṭafā. In fact the Imam who is the "origin" and Gabriel, who follows him, as well as Muṣṭafā, who follows Gabriel, all of them always have the appearance of a man; and later, when Muṣṭafā accepted the teaching of the Ḥujjat, their real essence became (also) one. Not only can Muṣṭafā, the "strong one" amongst the "people of degrees," join them, but the other degrees which are inferior to him can become joined with them as soon as they obtain the same knowledge.

Fol. 9. Amidst the traditions current amongst the orthodox there is one in which it is related that somebody asked 'Āisha if it is true that the Prophet says that on a certain night⁷¹ he went to heaven and saw those things (of which he told). 'Āisha said in reply: "I saw only that he went out from the house and came back so soon that water was still flowing from the jug which he struck with the skirt of his cloth when going out. And I do not know anything as regards what he says that Gabriel brings messages to him. I know only that occasionally the "barefooted" Salman comes and tells something secretly and [Fol. 9] after a short time the Prophet begins to say that Gabriel descended and told him from the mouth of God so and so."

In short, all the tradition of the orthodox gives evidence that Gabriel is (in reality) Salman, but they cannot understand this. And what the "people of Truth" say is as well absolute evidence that the Imam has said: "Salman is from me and I am from Salman." In another place he said: "Salman is one of the gates of Paradise," because the door of Paradise is a man, and therefore the whole place of it must be a man. In another place he says: "Salman is the door of Paradise" but (he does) not (say) the "soul⁷² of Paradise." In some other place⁷³ he says

⁷⁰ This is not merely a trace of the local folklore of the country where the author lives. This idea is apparently of great antiquity and is widespread in the East. Exactly the same is the idea of the Yezidis (cf. *Le découverte récente des deux livres sacrés des Yézidis*, p. Anastase Marie, the *Anthropos*, v. XXV (1911), p. 37 and Isya Joseph, *Yezidi texts*, the *American Journal of Semitic Languages and Literatures*, v. 25 (1908-9), p. 123), if the sacred books of this sect, discovered lately, are genuine.

⁷¹ An allusion to the night of *Mir'āj*. The story is well known and usually is brought by the orthodox theologians as an argument in favour of the exactly opposite statement, i.e. that the Prophet really travelled in that short time.

⁷² Or "place" (جای) which is similar in writing) in accordance with above *کاو*.

⁷³ From all these جای دیگر میفرماید it is very probable that the author refers to a certain book, which supplied him with this information.

“I am with my friends everywhere they would seek for me, in hills, on the plain, in the desert,” etc.⁷⁴ And everybody to whom he revealed his essence, i.e. the knowledge of him, is not in need of being physically connected with the Imam.⁷⁵ This (was revealed in the time of) the Great Resurrection.⁷⁶ In another place he says: “Be obedient to me and I will make thee like myself,” i.e. [*Fol. 9v.*] “obey me and thou wilt be similar to myself as Salman.”

Rais Hasan says:—

Thou art one whose “Door” in this world is the Hujjat,⁷⁷

(It can be said) by a hundred thousand mouths that he is similar to and of the same origin as thee.

(About) his position, which is similar to that of the “two bows’ length,”⁷⁸

Wisdom tells in Kenoma (Emptiness) and Pleroma (Fulness).⁷⁹

And the same author in another place says:—

Salman Farsi, who is the creator of the world,⁸⁰

Is the “door” (to the knowledge) of Ali. Let us begin (this poem) with mention of his name.

He prostrated himself in veneration of the face of God for the reason

That we also would do prostration for the worship of the face of God.⁸¹

Hakim Nizari says:—

O Lord, in the great revelation,

In which thou hast unveiled the hidden mystery,

If thou hast manifested in secret⁸²

It is because thou hast caused the trumpets (of the Resurrection) to be blown by thy Hujjat.

The same poet in these “*munājāt*”⁸³ says:—

By the truth of the prophets and thy Hujjat,

Who made ready the way to thy teaching (*da'wat*).

Hakim Thanai says in a poem (composed in praise of) Iskandar⁸⁴ regarding the circumstances of his joining the teaching of the Hujjat: [*Fol. 10*]

The true belief became glorious in the world in my eyes because it was told me

That the exalted guide (to it) is he, the “gate of Maulana.”

⁷⁴ In Persia *هامون* is called a swamp (as in Seistan).

⁷⁵ Cf. introduction, IV, footnote 41.

⁷⁶ It would be interesting to discover whether it means the same *قيامة القيا* referred to by E. Browne, “A lit. Hist. of Persia,” v. II, p. 454.

⁷⁷ The verse is very bad as regards its prosody.

⁷⁸ The popular metaphor borrowed from the Qoran.

⁷⁹ Is not the word *خرد* here a *takhalluṣ* of the poet? About *سلا*, *سلا* cf. S. Guyard, op. cit., p. 166.

⁸⁰ Cf. introduction, IV.

⁸¹ The verses are in a hopeless condition.

⁸² Something is wrong with this verse, probably with *چو*, instead of which *چون* perhaps would be better.

⁸³ The “praying song,” which usually deals with praise to the Prophet, etc.

⁸⁴ Cf. introduction, II, and footnote 12.

Khwāja Naṣ r says :—

When his Ḥujjat will blow the first of his trumpets,
He will kill all those who are still living in possession of knowledge.
And when He in his own person will blow the trumpet of the Resurrection
He will make alive all who died in ignorance.⁸⁶

In another poem it is said :—

Whoever does not know without doubt the Ḥujjat of the Truth in this world,
He has no eye which can see, he is the most blind of all the blind.

Khwāja Qāsim from Tushtar ⁸⁸ says :—

I have obtained the knowledge of the Imam of my time, with the help of a man,⁸⁷
Who is himself the incomparable name of the Single God.

That man is the Ḥujjat and the “incomparable name,” which is the name of the Imam, is the Ḥujjat as well, because (only) he is the real name of the Imam and only from him is it possible to acquire a knowledge of the Imam, and not from those fictitious names. The teaching concealed in the majority of the books ⁸⁸ and poems current amongst this sect, is that the “door of the mercy” and the “gate of the knowledge” of the Imam is the Ḥujjat, leading to the person and the name of the Imam and (as in ordinary life) whoever comes through the door enters the house and who does not do so cannot come into it.

Fol. 10v.

The nature and the real essence of both [Fol. 10v.] are the same. This doctrine was explained several times. And if it were not so and they both were not the same, in this case one of them would be God, and the other a creature. But God cannot be recognised from the creature. This is the difference in the teaching of the present sect and intuitive systems.⁸⁹ The doctrines of the orthodox say the same, although they cannot understand these indications.

O my pīr, my God, with thy help I knew the Truth,
O my guide and leader, with thy assistance I found the Truth.

And it is said :—

The men of God are not God himself,
But they are not distinct from God.⁹⁰

(And another verse) :—

For the reason that thy eyes are weak,
Thy first object of worship must be the pīr.

⁸⁶ The rules of prosody are almost ignored.

⁸⁸ Called by the Persians *Shustar*.
the grammatical point of view.

⁸⁹ Cf. Introduction, II, footnote 6.

⁹⁰ The word *نظير* probably is used in a sense similar to *ظالم* and opposed to *بالعدل* and means (I suppose) simply “superficial.” The word *بإني* is a pleonasm, common in colloquial language.

⁹¹ It is not quite clear if the author cites these verses as an evidence from the sectarian side or as illustrations of the orthodox doctrines he speaks about. Anyhow these three quotations are unmistakably sectarian, not only confined to the Ismailis but also used by Ali-Ilahis, etc. The second quotation is very common amongst the derwishes

(X. *The Reason why the Imam and his Hujjat are the same in their essence but separate in their bodily appearance.*)

If some one should ask why they are the same as regards their nature but exist separately in the bodily form---he may be answered in two ways.

(The first) explanation is this. If their persons were not different so that one of them might preach in favour of the other, a suspicion might arise amongst the common people and they might think that he is doing this for a mean purpose if he were to call them to join his own cause. But as long as he preaches apparently in favour of the other, the mob does not consider him [Fol. 11] as doing this in his own favour, being ignorant of the fact that both of them are one. They live in the world of multitude⁹¹ and find a proof of the Truth of the religion of our Lord and his Hujjat in what is said in the "blessed books."⁹² At the same time if the Imam and his Hujjat were not the same in their religion and preaching, the result necessarily would be that this their religion and the Truth are different, manifold. And as soon as the (true) religion becomes manifold it makes no difference whether there be two (sects) or seventy-one.⁹³

Fol.

The second reply is as follows: If their persons were not different, so that one could manifest himself in all the three worlds and the other observe the Truth only, a doubt might appear in the religion of the "people of degrees," who are the seekers after the way to the Truth, about the real character of his preaching.

By these logical proofs and the evidence of tradition it is explained why in the six thousand years of the "night of the religion" the knowledge of Imam cannot be acquired without the help of his Hujjat.

(XI. *The Hujjat's Miraculous Knowledge.*)

Now it is necessary to know what is the sign of his miracle⁹⁴ and why he is manifested in the forms⁹⁵ of Truth (only). The first reason is as follows. I will begin to explain the sign of his miracle.⁹⁶ [Fol. 11v.] The Hujjat necessarily must possess a sign or a miracle which could not be performed as well by any created or spiritual being. The miracles (in general) are usually of two kinds. One is that performed by the action of physical power and the other by (miraculous) knowledge and argument. Each of these kinds can be imitated, i.e. (an action may be done which is) similar to it but is not the same in reality.

Fol.

The miracle which depends on an action of the physical power is called that which happens in the material world, while the miracle of knowledge and persuasion

in Persia, who say *على را خدا نمیدانیم، لیکن از خدا جدا نمیدانیم*. All three citations are much used in the Upper Oxus regions where pir-worship is common, cf. Biddulph, *Tribes of the Hindoo-koosh*, 1880, pp. 119-125.

⁹¹ Opposed to *عالم وحدت*.

⁹² Apparently sectarian.

⁹³ An allusion to the usual Muhammadan idea of the seventy-two religions of the world, of which only one is the true and the remainder are false.

⁹⁴ Again the *اکنون*, which here can be rendered more literally by "existences."

⁹⁶ May be: "the sign and miracle" (by which his Hujjatship can be proved).

appears in the mental sphere.⁹⁶ In all beings action and power belong to their material side which they as well as the Hujjat possess. There could be no greater power than if a man were to subdue to himself the whole world and slay all mankind. And he may abide in such condition (of greatness), but a lion or a snake may kill him although nobody can say that a lion or a snake is better than that man, they being only animals. And as (a physical miracle) can come from an animal, (it can happen also from the other categories of the material world),⁹⁷ as from a plant in (the power) of producing fruits, from minerals in affecting the senses,⁹⁸ from fire, wind, water, earth, (in short) no wonderful and strange peculiarity of the material qualities or action can be possessed by any single individual object in the world which cannot [*Fol. 12*] be shared by the others.

Fol. 12.

The imitation of the miracle of knowledge⁹⁹ can also be shared by many (living beings). Such are sorcery, incantation, the miracles of the saints,¹⁰⁰ astrologers, fortune-tellers, "comb-seers,"¹⁰¹ etc., who (also) reveal the secrets of the created world. Therefore it is clear that the miracle inimitable and the sign the like of which nobody can produce is the Hujjat's true knowledge which he possesses for the negation of the wrong and the establishment of the Truth, which is (the teaching about) the Imam. And no one who is reasonable and just can deny it.

This is the miracle which nobody else can perform and this wonderful power belongs only to the Hujjat.¹⁰² There are also many indications proving that the knowledge of the Hujjat is the "word of the Truth,"^{102a} and that his miracle is the same, not a physical action. These indications can be found in the teaching of the orthodox, which is the "commandment to the common", as well as in the "secret wisdom," or the teaching of the Truth, which is the "commandment to the chosen."

There are many verses of the Qoran in the "open" teachings of the orthodox (proving this statement). One of them says: "On the prophet depends only preaching,"¹⁰³ which means that it is possible to demand from the prophet, i.e. Gabriel, only this delivery of his message, which is instruction in the explanation of the doctrine about the unity of the True Lord, and nothing else.

⁹⁶ I do not translate روح by "spirit" here to avoid confusion with امر. The word روح means "soul" in the sense of consciousness and therefore "mentality" would be the nearest in meaning.

⁹⁷ Something is omitted in the text.

⁹⁸ It is a very peculiar word being Arabic with a Persian suffix. It may be simply a fantasy of the scribe who could not recognise another word used originally.

⁹⁹ It is an obvious lapsus calami and therefore I read علمي.

¹⁰⁰ It is remarkable that the author classes the miraculous deeds of saints with sorcery, etc. This may be connected with some special principles of his religion.

¹⁰¹ My inquiries about this sort of fortune-tellers in Persia and Bukhara were resultless. There is a peculiar way of fortune telling by looking on the blade of a knife, which is common in the district of Juwayn, north of Sabzewar in Khorasan. This profession is hereditary and special knives are used.

¹⁰² It is remarkable that this proof of the Hujjat's supernatural mission, etc., is word for word that used by the orthodox in favour of Muhammad's claims for being recognised as the final Prophet, etc. Nearly one thousand years of independent existence of this religious community could not help them to invent anything more ingenious.

^{102a} An allusion apparently to some sacred formula, but it may be, in accordance with the philosophic tendencies something like a poor and half forgotten recollection of the doctrine about the "Logos" etc.

¹⁰³ The Qoran, V, 99.

There is also a tradition of the Prophet saying: "We made prohibited to but the right is reverted [*Fol. 12v.*] their food and drink until they know their Creator and Lord."¹⁰⁴ It means that to those who did not acquire the knowledge (of the Imam) even the things are prohibited which are allowed by the shari'at, but to the "knower" even that which is prohibited by the orthodox doctrines is permitted, as (drinking) wine, etc. But this "knower" is only one, or those who are with him as regards the teaching.

The proofs from the secret doctrines of the Truth are the utterances of the Hujjats¹⁰⁵ and dā'is. First the saying of the Great Rais:—

The wine which thou drinkest in this world by any body's order,
Consider it in its degree as the wine of the manifestation.¹⁰⁶

If any drinks it by the order of the "man of Truth" and gives it to others it may be lawful. Therefore how can it be prohibited! Ḥakīm Nizāri says:—

Thou hast not recognised the Imam of thy Time and hast not tried to find him.
Then know clearly that gold and property are unlawful to thee.

Now, if it is impossible to see his actions (and) he cannot be recognised without (the evidence of) a miracle and sign, then what can be an indication of him except his words? In the majority of books it is stated in this way: the "revealer," i.e. the "word of the Truth," must be considered as a "miracle of knowledge." In some other places [*Fol. 13*] it is said that it is necessary to hear from the "revealer," i.e. the Hujjat, the "True Word" which is the "word of the Truth,"¹⁰⁷ which is the Imam.¹⁰⁸ After this it is necessary to accept his Hujjat. And the purpose of listening to this "word" is to learn its meaning, which is the negation of the false and affirmation of the (truth of the) Imam. In the same way in the shari'at the truth of the formula "There is no deity except Allah," has to be heard from the revealer of the orthodox doctrines, i.e. Muhammad. The meaning of these two formulas of the "evidence" (*shahādat*), of which one is in the shari'at and the other in ḥaqīqat, is refutation of the false and affirmation of the Truth. But in this religion¹⁰⁹ nobody can be recognised as a true believer until he proves by (proper) arguments and indications (his) negation of the false and acknowledgment of the Truth, i.e. the Imam. Nobody will consider him a true believer from the mere fact of his having pronounced the formula (of the confession) although in the shari'at it is so. And so "the word of the Truth" cannot be taken as the evidence except on that single occasion.¹¹⁰

¹⁰⁴ A very mutilated place (probably in the original copy from which the present is made).

¹⁰⁵ Existing at the same time, or several incarnations of the one?

¹⁰⁶ The Nuṣayris freely use wine in their forms of worship. Is it not an allusion to the similar use of wine for the religious symbolism?

¹⁰⁷ There are several "pre-eternal," etc., formulas written on the throne of God, etc., in the sectarian beliefs. A considerable number of them are personified in Ummu'l-Kitāb. About *كلمة الحق* cf. S. Guyard, op. cit. pp. 50, 167, 178.

¹⁰⁸ May it mean, "that which is told about the Imam"?

¹⁰⁹ Again *قول*. The place is obviously very mutilated.

¹¹⁰ Obviously, from the context, in case of the Hujjat.

(XII. *The Reason why the Hujjat can be manifested in the "Truth" only.*)

Now, when the miracle and sign of the Hujjat, which are "the word of the Truth," are explained, one must know why he becomes manifested in the haqiqat (the eternal Truth) only, and why, as every body says, he makes¹¹¹ things which point out that he absolutely does not observe the prescriptions of the shari'at. The reason is that in the beginning of every millennial period, when all the institutions governing in this epoch are formed [*Fol.* 13v.], there are, besides the Hujjat, only three persons (taking part in establishing the doctrines),¹¹² not more. They are, the prophet,¹¹³ the Imam and the orthodox ruler.¹¹⁴ The prophet has to appear in the two forms of the religion,¹¹⁵ because he does not possess the degree of the Hujjat. The Imam must be manifested in the three worlds¹¹⁶ and the ruler of the orthodox only in the shari'at.

Therefore if the Hujjat should obey¹¹⁷ the orthodox laws, doubts as to his propaganda in favour of the Truth would arise amongst his followers. And if he should like to be manifested in the orthodox world (as well as amongst the believers of the hidden Truth) he would be a sinner, perhaps worse than a sinner. This is why in the beginning of the period of Muhammad in which we are living, the Hujjat was Salman, who by no means followed the prescriptions of the shari'at, but intentionally and in the presence of every body was doing unlawful things. This is why all the adversaries blamed him.

But the Prince (of the believers—Ali) observed the commandments of the shari'at and after the death of the Prophet took the oath of allegiance to Abū-Bakr although he did not allow Salman to do the same. When 'Omar having grasped the collar of Ali was dragging him to swear allegiance, some one of the adversaries came forth and began to abuse Salman, saying: 'How comes it that the person, about whom thou tellest all these (stories) and to whom thou ascribest such extraordinary qualities, is now dragged in such humility to take an oath of allegiance to Abū-Bakr?' Salman in reply said: "If he liked [*Fol.* 14] he could make this that, and that this," pointing at the same time to the earth and the sky. But the Prince, having looked upon him angrily, said: 'One must not say everything he knows.' But when ('Omar) grasped the collar of Salman and dragged him with all

¹¹¹ A very mutilated place.

¹¹² It would be interesting to know whether all the three always accompany the Imam. This idea of the reincarnated "companions" is essential to the doctrines of the Ali-Ilahi and the Nusayris.

¹¹³ i.e. Gabriel (cf. fol. 12).

¹¹⁴ He must be in the time of Ali no one other than Muhammad. It is however doubtful because he was at same time a da'i (cf. fol. 7). If it is not so this "ruler" must be sought outside of the Muhammadan community of that time, provided the author was sufficiently versed in history when making this statement.

¹¹⁵ Again the confusion with the word *كون* which suggests that the author in his religious zeal simply identifies the teachings, etc. with the "worlds," i.e. the earthly, heavenly and infernal, as is clear from the context.

¹¹⁶ It is clear that here *كون* means the same as *عالم*.

¹¹⁷ A popular expression (which does not mean "to come around, to avoid"). It means that shari'at is not taken as a "centre," round which the Hujjat is moving.

the Persians¹¹⁸ to take the oath, the Prince came and freed him from the hands of 'Omar and did not permit this.

The secret why he himself swore was that in the time of Muṣṭafā his religion (*sharī'at*) had not yet reached everywhere and (Ali) wished that it should spread so that the "completer"¹¹⁹ should not remain in the same condition as the adversaries, this he thought to be the most important.¹²⁰ The orthodox religion (*sharī'at*) could not be complete however unless he were himself to follow that "completer" (because otherwise) the adversaries would not follow him. But as was already explained, the adversaries have to exist, because, if being wrong they should not exist, nobody would know about their real position. Therefore the "people of degrees" would remain without their goal¹²¹ and glory, and would cease to seek for the (true) knowledge. If therefore it is clear that the adversaries have to exist as well, then without *sharī'at* which prevents them from their cruelty and tyranny they would not leave a single man alive [*Fol.* 14*v.*], the world would be devastated and there would be no advantage for the "people of degrees." So Sayyid Nāṣir(-i-Khusraw) says:—

Pol. I.

Amongst them there is a handful of the wretched and villains,
Whom a clever man calls the "devilish people."
They are Satan in their deeds although in the shape of men,
Being a hundred degrees lower than a horse, cow or ass.
Their hearts are not awake because they have no soul,
They have nothing to do except to criticise the chosen.
Yes, they exist, this handful of the perverse,
They are the cause of the humility of the world.¹²²

This is why the adversaries are (usually) compared to an obstinate mule and the *sharī'at* to a chain and rope. As an obstinate animal is led along the road with the help of the rope and chain so the adversaries can be led by the (proper) way with the help of the *sharī'at*.

So it is clear that the *sharī'at* is conducive also to the (common) benefit and therefore undoubtedly the Imam must manifest himself in it as well. In a portion of a book¹²³ it is said that Mālik¹²⁴ and Riḍwān, the archetypes of Hell and

¹¹⁸ I did not make special inquiries in the books dealing with the early days of Islam but I never met with any statement to the effect that there were many Persians in Medina at that time.

¹¹⁹ This is probably a sort of technical expression (تمام كندو — completing). I have not met with it in other books of the same collection. Here it means obviously Muhammad and may be a rendering of the orthodox expression خاتم الانبیا or something like this. Cf. S. Guyard, op. cit., p. 151 where التمام means Muhammad son of Ismail. Here it is impossible.

¹²⁰ The author uses the word مدار, centre, etc., in an uncommon sense.

¹²¹ This is again the same مدار.

¹²² As shown in the footnote to this place in the text it is a quotation from Nāṣir-i-Khusraw's Rūshnāi-Nāmāh (Ed. by H. Ethé in ZDMG, v. 34 (1880), pp. 453-4). The cited words are applied in the poem to uneducated and morally low people in general.

¹²³ The word قطعه in Persian books usually has quite a technical sense as a part of a poem, or a ghazal in which the first hemistichs are not rhyming. Therefore it can mean: "in a poem of a book." But then it would be necessary to expect در قطعه در فصلی. It may be that the second در is simply omitted. If left as it is it suggests the interpretation of a "fragment of a book."

¹²⁴ The use of this name for the evil spirit in this text is very remarkable. Satan rarely appears in the other

Paradise, are self-existent. No, this is wrong. They both are existent by him (the Imam), i.e. by his manifestation in the essence¹²⁶ of each. As Riḍwān is Paradise and in his hands are the ways of mercy, so Mālik is Hell and he has in his hands the ways of punishment. As, for this reason, the people make Riḍwān [Fol. 15] (in their belief) to take upon himself the protection of the good, which is (simply the idea of the) kindness of men, so Mālik only for the reason of wickedness, which (in fact) is the wickedness of men, is believed to protect the wicked. As Paradise is better for the good, so Hell is worse for the bad.

It is clear now that even the false cannot have an illusory existence by itself. There are always two principles¹²⁶, Paradise and Hell. The first is destined for the holy, and the second for the wicked. For the first the teaching of the chosen is commanded, and for the second the teaching of the common people. But he (the Imam) is acting himself in accordance with the principles of both in order that they may exist,¹²⁷ although he did not command one of them to follow the teaching of the other, because their followers may fall in doubt and abandon their religion, leaving therefore the orthodox and the sectarian religion¹²⁸ without their glory. So it is proved undoubtedly that the Ḥujjat necessarily must abandon following the teaching of the shari'at.

(XIII. Definition of the Classes of the Believers.)

Having given a definition and the signs of the Ḥujjat I will proceed to the description of the "people of degrees." They are divided into two categories—the strong and the weak. The former are those who acquired the knowledge of the Ḥujjat [Fol. 15v.] and perform their preaching in his favour amongst the *neophytes*. Their sign consists in the fact that having accepted the teaching of the Ḥujjat, they transmit it to the weak, living in accordance with the rules of the shari'at.¹²⁹

Those called "the weak" are the people who resign themselves entirely in accepting the teaching, instruction and interpretation (of religion, given to them by the "strong"). They must live in accordance with the reasonable prescriptions of

sectarian books of the same collection except the so frequently mentioned here "Old Testament" of the Ismailis, viz. Ummu' l-Kitāb, where he plays a very prominent rôle, different from the usual Muhammadan beliefs and more like those of the Manicheans about the Demon of the Darkness (Rex Tenebrarum). His usual names are 'Azāzil, Ahriman and Ḥārith Marraī; the last one, not very common, appears to be his "official" name in accordance with Muhammadan tradition. An-Nawawi in his "Tahḍību'l-asmā" (ed. Wüstenfeld "A Biographical Dict. of illustrious men," Göttingen, 1842-7. v. I. (text), p. 137-138) gives his "biography" under the name of Iblis Abu Murra. The names Mālek or Mālek Tāūs and 'Azāzil are common to Yezidis and Ali-Ilahis of Western Persia, who worship this spirit. In some texts of the Yezidis Tāūs-Mālek is called *مَلَكَة عَزَائِيل* (cf. "Yezidi texts" by Isya Joseph, American Journal of Semitic Languages and Literatures. v. 25, p. 123). This name appears also in the books of the western Ismailis. Cf. E. Salisbury, Translations, etc. J. A. O. S. v. II, p. 317, where Malik is called "the impersonation of the complete ignorance."

¹²⁶ Again this difficult word *كون* "being, world,"

¹²⁶ Literally "persons."

¹²⁷ It would be extremely interesting for the study of the sectarian psychology to know whether the Imam is manifested in the persons of Riḍwān and Mālik or in a subordinate personage in these worlds.

¹²⁸ Literally "the worlds of the open and the hidden," but I am translating in accordance with the context.

¹²⁹ Apparently in their interpreted form.

the shari'at.¹³⁰ The strong are the dā'is, "those (more) informed," the teachers,¹³¹ "those less informed," and the weak are the *neophytes*. Whichever he may be, strong or weak, a believer cannot attain to the Divine guidance (*ta'id*)¹³² until he acquires the degree of the Ḥujjat¹³³ in the performance of the acknowledgment of the Imāmat.

What are the "reasonable" prescriptions of the shari'at? Will not the prohibition of eating grapes and drinking wine, etc., be removed? Yes, the ritual¹³⁴ prescriptions, as reciting the formulas of the confession, ablutions, fasting, prayers, tithe, pilgrimage and religious war, may be cancelled if the believer is acting in accordance with the interpretation (*ta'wil*) of these commandments, but only when there is no necessity for the *taqiyya*.¹³⁵

(XIV. *The Question of the Tithe.*)

It is to be understood also that the religion of this sect is the true teaching of the Lord (Mawlānā) and His Ḥujjat and therefore the (material) value¹³⁶ of the Truth which they both know (must be) every thing (one possesses), not only the one-tenth (of the income)¹³⁷ prescribed by shari'at. This one-tenth is the price of shari'at which is not worth more. Therefore in these times of the "night of the Faith" the Truth can be obtained only by those of the "people of degrees," who will sacrifice every thing they possess for the sake of Truth. But whoever will keep for himself even a trifle, shall not acquire the Truth because he will not obtain the consent of the Ḥujjat and his wisdom and knowledge, and none of those who do not [Fol. 16] possess these will acquire salvation. A poet says:—

If thou wilt remain in possession even of a trifle (value of property) thou art not the man
of the "way."

Khawāja Naṣir says:—

When his Ḥujjat shall blow the trumpet of the preaching, he will
Kill all who are living (still) in possession of the knowledge
But when he shall blow the trumpet of Resurrection in his own essence,
He will make alive all who died in ignorance.¹³⁸

Fol.

¹³⁰ These "reasonable" commandments are discussed later on.

¹³¹ Cf. above, footnote 55.

¹³² Cf. above fol. 5, footnote 46.

¹³³ Cf. above, fol. 4.

¹³⁴ The word *خالقي* used by the author instead of *dimi* may have the sense of (*khalqi*), "pertaining to the creatures," or (*khulqi*), "moral." Therefore I give a translation in accordance with the context because neither of these meanings is good.

¹³⁵ "The precaution," or rather precautionary religious mimicry, which the followers of the persecuted sects practice quite legally, observing outwardly all the prescriptions of the religion of the persecutors: See I. Goldzieher, ZDMG. 1906, pp. 213-226.

¹³⁶ The idea of the market value of all knowledge and especially religious, is one of the most deeply rooted features of oriental mentality. Amongst the derwishes of Persia very often the "mysteries" of their revelations have quite fixed pecuniary value and the spiritual progress of a disciple depends largely on the cash he pays to his "preceptor."

¹³⁷ It is not without significance that the author, omitting all other religious prescriptions, deals only with this. It is not impossible that the restatement of the high ideals in this respect was one of the chief reasons for the composition of the present book (cf. fol. 16v.) to remind the believers of the importance of this material question in the worship.

¹³⁸ Cf. these two verses on f. 10.

To those who will be alive by the sound of his teaching,
 He will give a place on the throne of his eternal ¹⁸⁹ kingdom.
 But those who remain dead on the day of His mission
 He will burn in the fire of the eternal non-existence.
 The sign of life in Him in this world is this :
 That man should free His heart from whatever is not He.
 The sign of death in Him is opposite to this,
 And He will destroy that man's place to atoms.
 If He breathe to thee, both worlds will come into thy possession,
 But if not, He will take from thee even thy essence.

Therefore if any one will keep for himself from the "price of Truth (i.e. Hujjat)" anything however small it may be, he will not attain the true teaching. Failing in this he will fail in every thing, because all the things are in Him and without Him nothing. And if he will hand to Him all he possesses, keeping nothing for himself, he will become a king and lord of both worlds.

(XV. *The Adversaries.*)

After having given the definition of the "people of degrees," I will proceed to the description of the adversaries. They are divided into two classes: the unbelievers and the hypocrites (dissemblers). The hypocrites [*Fol. 16v.*] are worse than unbelievers, because the last-mentioned are called the men who are preserving the same attitude in the presence as well as the absence (of the believers), and do not make an appearance of accepting the instruction of the teacher of this sect, denying it however in secret. And the believers will keep themselves safe from their intrigues being warned by the statements which they (the unbelievers) make in the presence of the instructor. They will not fail in practising all sort of hostile actions in their power, but at the same time they will not keep their real intentions secret so that the believers can take precautions. A poet says:—

A faithful dog is much better than a brother who is a dissembler.

In another poem it is said :—

Be either purely an unbeliever or a faithful believer.

In another place it is said :—

Rather be a (complete) unbeliever, than a dissembler.

Another verse :—

Be either a Negro from Zanzibar, or a pure believer,
 Be either quite hard as a stone or as absolutely soft as wax.

¹⁸⁹ The word *سومده* is of very strange etymology and the meaning "eternal" or "divine" is apparently not an exact translation. It occurs in the *Qoran*, XXVIII, 71 and 72, and it is very interesting that in an early Persian *Tafsir*, (of which a copy apparently of VII c. A.H. is preserved in the library of the As. Soc. of Bengal, A a 7) the passage *جهد الله عليكم النهار سومده* is rendered by *خدايي تعالى روز را بر شما سومده كرداند*. What does *سومده* mean here

This is the exposition of the (real) state of the Imam, the "people of unity," the "people of degrees" and the adversaries, explained in a language understood by every body in order that the common people may more easily learn about it and not remain without their share in its benefit.

By the glory of His essence!¹⁴⁰

A dog which is trained, becomes alert and swift,
And when it acquires a (mystic) knowledge shares the company of the Seven Ephesians.¹⁴¹
The dog who has attained to knowledge, abandons all unlawful actions
And hunts in the groves only lawful game.

It is finished.

VII. INDICES.

A. Table of the Contents of the Text.¹

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II.	The necessity of the propaganda (da'wat) in the time when the Imam is hidden	2v.-3.
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VII.	Definition of the degree of the Ḥujjat	6-6v.
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IX.	The traditional proofs of the necessity of the Ḥujjat	6v.-10v.
X.	The reason why the Imam and his Ḥujjat are the same in their essence but separate in their bodily appearance	10v.-11.
XI.	The Ḥujjat's miraculous knowledge	11-13.
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XIV.	The question of the Tithe	15v.-16.
XV.	The adversaries	16-16v.

¹⁴⁰ It may be a particularly sectarian formula of blessing at the conclusion of a work.

¹⁴¹ The story of the Seven Sleepers of Ephesus mentioned in the XVIII sura of the Qoran, is very popular amongst the sectarians. The dog (called *الرقيم*) which is believed to have accompanied them, is admitted to Paradise (as in *Umū'l-Kitāb*), by common belief, and is included in the number of animals which are settled there such as *Burāq* of Muhammad, *Duldul* of Ali, *Humā*, etc. This belief is extremely popular amongst Ali-Ilahis. The *Nuṣayris* consider this dog as an incarnation of Ali *علي ابن ابي طالب* (cf. E. Salisbury, op. cit., p. 303).

¹ I have to remind the reader that this dissection of the text as well as the headings are entirely mine and are intended to facilitate reference only

B. *Index of Persons.*

Folios.		Folios.	
9v.	سلمان فارسي	8	ابراهيم
6v.	حكيم سنائي	14v.	ابليس
7, 7v.	سيدنا	13v.	ابو بكر
8v.	عائشه	7, 7v.	بوذر
7	عزرائل	14v.	آدم
6v.	شيخ عطار	7	اسرافيل
9v.	علي (امام) v. حضرت امير، مولانا، مولانا علي	9v.	اسكندر (قصيده —)
8	امير سيد علي واعظ	v. حضرت امير v. علي	امير
13v., 14	عمر	امير سيد علي واعظ v. علي	امير سيد علي واعظ v. علي
8	عيسى	با بكر v. ابو بكر	با بكر v. ابو بكر
10	خواجه قاسم تشري	7, 8v., 12, 13v.	بيغمبر (v. مصطفى)
7v.	كليم الله v. موسى	9v.	حكيم ثنائي
14v., 15	مالک	7, 8, 8v., 9, 12	جبرئيل
13	محمد (v. بيغمبر، مصطفى)	4	امام حسن
8	مريم	حسن (رئيس) v. رئيس	حسن (رئيس) v. رئيس
4	مست علي	4	مولانا حسين
8, 8v., 14	مصطفى (v. بيغمبر، محمد)	3, 7v., 8, 13v., 14	حضرت امير (v. علي)
7v., 8	موسى	8	حضرت علي (v. علي، مولانا)
	مولانا (v. علي، حضرت امير)	7v.	خضر
10, 11, 15v.	مولانا علي	بوذر v. ابوذر	بوذر v. ابوذر
	مولانا حسين v. حسين	رسول v. بيغمبر، مصطفى	رسول v. بيغمبر، مصطفى
7v.	مولانا علي (v. مولانا، حضرت امير، علي)	14v.	رضوان
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14v.	سيد ناصر (خسرو)	5v.	رئيس
3v.	شاه نزار	2v., 12v.	رئيس اجل
3, 7v., 9v., 12v.	حكيم نزاري	5, 9v.	رئيس حسن
5v., 10, 16	خواجه نصير	3(c), 4(c), 7, 7v., 8(c), 9, 9v.,	سلمان
7v.	نوح	13v., 14 ¹	

¹ (c) means "ciphered," i.e. written in such a way that the numeric value of the letters is substituted for the characters (according to *abjad*).

C. *Index of Poetical Quotations.*

Folios.		Folios.	
14v.	سید ناصر خسرو	9v.	حکیم ثنائی (قصیدہ اسکندر)
3, 7v., 9v. bis. 12v.	حکیم نزاری	7v.	رومی (جلال الدین) (مثنوی)
5v., 10, 16	خواجہ نصیر	5v.	رئیس
2v., 3, 10, 10v. ter.	Anonymous. ¹	2v., 12v.	رئیس اجل
16v. ter.		5, 9v. bis.	رئیس حسن
2v., 16, 16v.	(عزیز داری) ,,	8	امیر سید علی واعظ
		10	قاسم تشریحی

D. *Index of Termini Technici, etc.*

1v., 3v., 5, 14, 14v., 16, 16v.	اهل تضاد	15v.	احکام شریعت
6v.	حق	15v.	خلقوی شریعت
9	حقیقت	15v.	عقلی
8, 9, 10v.	ظاهر	6	آخرت
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9, 14v., 15	بهشت	6, 8v., 9, 10, 12, 12v., 13, 13v.,	
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15v., 16	بعالی حقیقت	4	مستقر
10v.	پیر	4	مستودع
2	پیغمبران	3v. (c), 3v., 15v.	امامت
7v. 8, 15v.	تاریخ	1v. 5, 6, 6v.	امیر
5, 15v.	تائید	4	حجتی
5, 6, 7, 7v., 12, 15v., 16v.	تعلیم	4v., 12, 15	خاص
4	تقلید	4v., 12, 15	عام
15v.	تقیہ	9v.	انبیا
14 (bis)	تمام کفندہ	6v.	اهل باطن
3v.	جامہ (در جامہ)	2, 2v., 3v., 5, 6, 8v., 11, 14,	ترتیب
		14v., 15, 15v., 16, 16v.	

¹ Apparently in the majority of cases of so-called "popular" poetry.

Folios.		Folios.	
15v.	زکات	Iv.	جسم کل
8v.	سخن نهانی	Iv.	جمعه دین
12	شانہ بینان	9	جفتہ
Iv., 2, 2v., II	شب دین	13v.	حاکم شریعت
2, 5, 6v., 7, II, I2, I3, I3v.	شریعت	I5v.	حج
I4, I4v., I5, I5v.		2	حجاب امام
Iv., 2	شذبه دین	Iv., 2, 3, 3v., 4, 5, 6, 6v., 7, 8,	حجّت
I5v.	شهادت	8v., 9v., IO, II, IIv., I2v., I3v,	
4	صورت شکلی	I5, I5v, I6.	
I3v.	غدان	3v., 6, 8v.	حدّ، حدرد
I6v.	طائفه (این —)	3v., I2, I2v., I3	حقّ
I5v.	طهارت	2, (4), 4v., 7, I2, I3, I5v., I6	حقیقت
4v.	ظاهر مطلق	6v., 9, IOv.	خدا
4v., 6v., 8, 8v.	ظاہریان	6v., I2	خداوند
II, I2v., I3, I4v.	ظهور	2v.	خوامان ترتب
5	» اضافی	Iv.	خورشید دین
5	» حقیقی	Iv., 3v., 6, 7, I2v., I5v.	داعی، داعیان
2v., 3	» شکلی	9	در بهشت
2, 2v., 3, 7, 7v.	» معنوی	2v., 3, 8v., 9v., IOv., II, I3v., I5v.,	دعوت
6, 8v., I5	عارف	I3, I3v.	دوره
5	عالم امری	I3v.	دوره محمدی
I5	» باطن	I4v., I5	درزخ
I5	» ظاهر	I5v.	ده یک
Iv., 5v.	عقل کل	I5v.	دین حقیقی مولانا
12	علم باطن	I2	رسالت (= تعلیم)
I5v.	علم معرفت	6v., 7, 8, 8v., I2	رسول
I4	فارسیان	I2	رمالان
7, 8	فرشته	6v	روح متعلم
IO, I5v.	فرقه (این —)	Iv.	روز دین
IOv.	فریقه های (sic) نظریه	I5v.	روزه

Folios.		Folios.	
4v.	متصرف وجود	Iv.	فصل
I3	محقق شریعت (محمد)	I4v.	فصلی (قطعه —)
I2v.	» (یعنی کلمة الحق)	IO, I2v.	فصول (اکثر —)
I2v.	مرد حق	II	فصول مبارک
8	مرغ (جبرئیل بصورت —)	9v.	قالب قوسین
Iv., 6, I5v.	مستجاب (مستجاب)	7, I2	قرآن
I2	مشائخ	9	قیامت بزرگ
3v.	معجز علمی	I6, I6v.	کافر
6, 8v., 9, IO, I4, I5, I5v.	معرفت	7v.	کشتی نوح
I5v., I6v.	معلم، معلمان	I2, I2v., I	کلمة الحق
4v.	ممکن الوجود	6	کمال آخرت
I2	منجمان	8	کوه طور موسی
I6	مناقق	Iv., I5v.	مأذون اصغر
I5v.	نجات	Iv.	» اکبر
Iv.	نفس کل	I5v.	مأذونان
I5v.	نماز	6v.	ما ورا
4v.	واجب الوجود		

II. NOTES ON THE ISMAILIS IN PERSIA.

I. GEOGRAPHICAL DISTRIBUTION.

The present state of Ismailism in Asia excited remarkably little interest in the students of the East in Europe although they never spared effort in studying the scattered and scarce materials regarding this sect which they could find in historical literature.¹ Therefore it would not be an exaggeration to say that we know much more about the state of this sect as it was seven centuries ago than as it is now, though still represented by numerous followers in Syria, Persia, Central Asia, North Africa and especially India.² But European scholars and travellers are not greatly to be blamed, for the study of this sect is extremely difficult for a foreigner. The long period of persecutions, lasting over one thousand years, has made the concealment of everything about themselves amount to almost a mania in the sectarian character. Very often this obstinate show of mystery is quite useless and even harmful for the Ismailis, because as a rule their non-sectarian neighbours know extremely well every single individual amongst their friends who belongs to the sect. The mystery observed with such strictness gives a chance to their enemies to misrepresent and misinterpret many things about them and to give currency to the wildest stories invented to their discredit. The so-called "educated" sectarians usually are still worse. If asked they will either deny all knowledge of doctrines or spin lies until when caught in patent contradictions they simply confess that they do not like to say anything.

These circumstances may disappoint even a very keen student, and sometimes, when other conditions make the case still more complicated (as it was on account of the War when I tried to make my research amongst them), it becomes completely desperate. But I can say with certainty that these difficulties are not invincible if the student has at his disposal leisure and especially money, which is an excellent means of softening hard hearts and making the mysteries more transparent.

It would be impossible to define even approximately the number of the Ismailis in Persia. They are extremely dispersed, and especially if living in small isolated communities are entirely or in great measure unrecognisable. In any case, however, they are not very numerous and are rapidly becoming assimilated to ordinary

¹ As I have already mentioned (Part I, Introduction, footnote 1), some active interest in the sectarians was shown only by some Russian officials in Turkestan, who tried to collect their still existing literature and contributed occasionally on these matters to the Russian periodicals.

² In the case of India, where the Ismaili population is perhaps the most ancient and interesting, practically no attempt was made to study them. Even in such extremely valuable publications as the Census reports of India the Ismailis are never specified, appearing as 'Musalmans,' while the very minor Hindoo sects are dealt with at length. A specimen of this is to be found in the recently issued 'Glossary of the Tribes and Castes of the Punjab and N.W. Provinces,' v. I, 1919, by H. Rose. This extremely important publication which gives much invaluable information about many little known forms of worship dedicates to Ismailism only *one* page (514-515) in which nothing new is said.

Shi'ites. As in the olden days their religion is more attractive to the peasants and nomads than to the inhabitants of the cities.

The districts in which they are most numerous are those of Kerman, Sirjan, and the vicinity of Jabal Bariz, where they are usually known under the name of Khorasanis. They speak Persian (with some peculiarities common in this part of the country) and claim descent from the provinces of Herat and Nishapur. They mix, especially in the case of better families, with the local non-sectarian population, but we shall probably not be far wrong if we suppose that they originally belonged to the same Jamshidi tribes, some of whom can be still found near Nishapur, having migrated from their original seat in Afghanistan. Almost all Khorasanis are still nomads, although not rarely some families try to become settled. They are divided into several tribes, numerically different, but not so in the style of life. The most important are:—

- | | |
|-----------------------|--------------------------------------|
| 1. <i>Bāwardī.</i> | 8. <i>Ya'qūbī.</i> |
| 2. <i>Harījī.</i> | 9. <i>Shikārī.</i> |
| 3. <i>Mīrzāda.</i> | 10. <i>Tāherī.</i> |
| 4. <i>Mīrshāhī.</i> | 11. <i>Ma'sūmdehī.</i> |
| 5. <i>Jalālī.</i> | 12. <i>Siyāhkūhī.</i> |
| 6. <i>Surkh-buzī.</i> | 13. <i>Chilmālikī.</i> |
| 7. <i>Jamshīdī.</i> | 14. <i>Siyāhī, etc.</i> ³ |

As regards their relation to their faith, they represent all transitory phases between strict allegiance to their original belief (as far as it can be carried by ignorant nomads) and, on the other side, open renegacy. The more reliable sectarians are considered *Bāwardī* and *Siyāhkūhī* (so I was told). But others are partly Shi'ites, and more than half the Jamshidis, e.g., are Shi'a. Generally speaking they are very ignorant and poor people, taking but little interest in religious matters, entirely absorbed in their hard struggle against the dryness of the desert and arid hills, on which they graze their flocks, and the extortions of the Persian officials.

The Khorasanis who can be met with in the province of Sultanabad, north of Ispahan, seem to be of similar origin. They are also nomads and live amongst Luri tribes and Turkish-speaking villagers, very scattered and by no means numerous.

The place where the remnants of probably the most ancient Ismaili population are still living in Persia may be the districts of Qain and Birjand. This corner of Iran, situated off the trading roads, was till quite recently the scene of a very patriarchal and old-fashioned life.⁴ Still more was this the case in the middle ages, and no wonder that the Ismaili castles which appeared here as early as in XIc.

³ I have had no chance so far of visiting this part of Persia and therefore cannot give here the exact location of the various tribes. My information about them was received in Khorasan from a sectarian belonging to the *Bāwardī* clan.

⁴ The War, which caused the continual presence of foreign troops, changed many things in this part of Persia and on my last visit after a comparatively short period of seven years, (1913-1920) I found that many old habits had disappeared completely.

A.D.⁶ could flourish practically unmolested till the troops of Hulagu Khan in the second half of XIIIc. destroyed many of them.⁶ The Ismailis of Quhistan were not much inferior to those of Alamut in their literary activities, as appears from the fact that Naşiru'd-Din Tūsi was appreciated first in this province and the celebrated poet Nizāri descended from there.⁷

At the present time the sectarians live in many villages north-west from Birjand, although in strictest disguise. They are more open only in Sedeh, a village on the Meshed-Sistan road, half way between Qain and Birjand, where their headman, the tax-collector, lives.⁸ In all these villages they are so similar to their Shi'ite fellow-countrymen that even an observant traveller will not notice anything particular about them.

In the districts of Gunabad, Turbat, Jam and Meshed the sectarians must be very rare if they exist at all. So also is the case with Meshed city. But quite close to this centre of Shi'itic fanaticism, within some 30 miles, they are comparatively numerous in the district of Nishapur. This circumstance is rather more remarkable than appears at first sight if we consider not only the vicinity of the "holy city," but especially the extraordinarily mixed population of that ancient province. Turks,⁹ Kurds, Baluchis, etc., predominate, the Persians being by no means in the majority. Life was very disturbed in this corner of Persia, which suffered more severely from all the invasions and calamities which befell the country, and therefore it is extremely difficult to say in what degree the sectarians here may be called the descendants of the ancient heretics.

The population which belongs to this religion in the Nishapur district is of two kinds. The first lives on the plain or among the front hills of the range separating the Nishapur valley from that of Meshed. Their villages are quite close to the city, for example, Firdaus, Ali Kuri,¹⁰ etc. In Kushk, further eastwards, they live partly settled, as 'half-nomads.' All of them believe quite firmly that they came from the neighbourhood of Herat during the last Perso-Afghan war.¹¹ They call themselves of Baluchi origin, but speak Persian. The reason why they have

⁵ W. Barthold, "Historico-geographical Review of Iran" (in Russian), 1903, p. 94.

⁶ "Tarikh-i Guzida," p. 526-7 (text). There is still a very conspicuous ruin near Qain, on the top of a hill (I visited it personally in September, 1920). It can hardly be taken for anything else than an Ismaili castle, because it is useless if regarded as a fortification for the protecting of the city (which in olden days could not be situated in the near neighbourhood by reason of the absence of water). I could not find any inscription, but the whole structure and the bricks are obviously very old. A similar castle lay west of Birjand (south-east from Khusp) on a hill over a precipice.

⁷ Cf. part I, Introduction, footnote 9.

⁸ At the present time he is a certain Murad-Mirzā, a clever and practical man, by no means popular amongst the sectarians.

⁹ They are very numerous especially in the village of Khafr where they speak various dialects, still unstudied, which sometimes differ from Azarbayjani and Turkomani. Some other tribes live in Kūh i-Jaghatāi, north of Sabzawār.

¹⁰ It is situated quite close (5 miles distant) to the city, just behind the 'Imamzada' near which the grave of 'Umar Khayyam is believed to be. Ali Kuri is on the Meshed-Tehran road, near the post-station Kalāta-i Wazir. Both have mixed population, not numerous.

¹¹ They assert that they offered their help to the Persian army and therefore could not remain after its withdrawal. I do not know how far this is true. It may be however the same form of migration as that of the Berberis (Hazara).

settled here in so overcrowded a locality is explained in a very complicated way which originally simply means that they were invited by the owners of the land to replace the old population of the villages they occupy at present.¹²

The other group consists of the apparently old settlements in the gorges of the chief range. The most important of them is Dizbād(-i-Bālā), a large village where the tax-collector lives. There are also several other villages in which, as in Qāsim-ābād, the sectarians live with Shi'ites. It is difficult to say how old their population is. They speak quite bazar-like Persian, with fewer peculiarities than that of Dāna, Mūsha and other villages on the plain. I was shown a "mazār" of a supposed Ismaili saint, dating back some 300 years, and some heaps of ruins on the adjacent hills, but these do not give any indication as to the antiquity of the present population.¹³

It seems that many remnants of this sect may be found in the Caspian provinces, Gilan and Mazanderan, a place rich in sects and survivals of the olden days. Unfortunately these provinces are but little explored although they would be extremely interesting for a student of anthropology, folklore and linguistics. The Ismailis played here a political rôle till quite recently.¹⁴

Many indications point to the existence of this sect in some places of Afghanistan,¹⁵ besides their well-known seat in Badakhshan and the country on the Upper Oxus and the Indus.¹⁶

II. THE SOCIAL POSITION AND THE STATE OF RELIGION.

It is unnecessary to recall the fact that the ignorant and poor sectarian population, not only the nomadic, but also the settled, is subjected to all the misfortunes of the common Shi'ite peasantry in Persia. With the last they live usually on the best of terms, as far as I could see in the Birjand and Nishapur districts. Their Shi'ite friends, as has been mentioned above, know accurately every single man amongst them who belongs to the sect, but the Persian villagers are exceptionally peaceful, and religious disputes are the last thing they care about. The sectarians are

¹² It is quite a common thing in Persia for a landlord (or rather "water-lord") if a new 'kaniz' is opened to bring some families of peasants to inhabit the village and to work the land. Sometimes it results in an extraordinary mixture of population. If the villagers find better conditions or are not satisfied with their master, they arrange some further move. This is one of the reasons why there are so few places in Persia where the village population can be believed to be of really old origin.

¹³ Compared with the peasants of Juwayn and some parts of Sabzawār district, situated close to this region, the inhabitants of Dizbād, etc., in appearance and language seem to be of mixed and modern origin.

¹⁴ Cf. H. Rabino, "Rulers of Gilan," J. R. A. S. 1920, pp. 277-296 (especially pp. 293-294).

¹⁵ Probably amongst the nomads in Northern Afghanistan (may be Jemshidis and Timuris who migrated to Nishapur and Kerman). Cf. for sectarians in Farah, Shea and Troyer's "Dabistan," v. II, p. 450 (footnote). Also Biddulph, "Tribes of the Hindookoosh," p. 119, for the sectarians near Balkh (Muftadis).

¹⁶ J. Biddulph, "Tribes of the Hindookoosh," 1880, p. 110-125, gives the districts, where the entire population consists of the sectarians (mawlais)—Hunza, Panyal, Zebak, Shughnan, Raushan, Munjan, Darwaz and Kulab, or are partly inhabited by them, Ludkho Valley, Chitral, Khokand, Karategin and Badakhshan. Since the time he wrote his book a little more has become known about their distribution in those regions and it appears that in Zebak, Munjan and Darwaz the sectarians are not numerous, in Kulab there are very few and almost none in Karategin and Khokand.

absolutely similar to the ordinary peasants in their style of life. They share all their good and bad sides of mental and moral development. They have preserved as few old habits and practices, superstitions, etc., as the Shi'ites. Opium smoking is quite common amongst the richer of them. The sectarians rarely take to the trading profession, but more readily enlist in the Persian army and police (in order to secure by their position more safety and protection for themselves).

As in the case of all the peasants of Persia they are divided into two unequal groups, those who own their land (or rather water) and those who work on somebody else's land. In the latter case they very often work on the numerous estates belonging to the Agha Khan in Persia.

Their relation to the local authorities are very complex. Many of them, especially the peasants of Agha Khan, are under the protection of the British Government, and as pure Persians, they never lose an opportunity of assuring British Consuls of their great loyalty to the Sarkar. But this does not prevent them from repeating all these things with the same sincerity to the Persian authorities who naturally cannot be much pleased with their exterritorial tendencies. When charged with duplicity they invariably protest that the British protection is sought only by some of their leaders for purely selfish reasons and that they do not represent the opinion of the community, etc., etc. The independent land-owning sectarians try their best to dissociate themselves from Agha-Khanis in public in order to avoid their share of the authorities' dislike.

In the poor and hard life of a Persian peasant the question of money is the most serious. This has three chief forms—paying taxes, bribes to the recruiting agents, and the pay, lawful and unlawful, to the 'mujtahids,' i.e. the mullas, who are judges and lawyers at the same time, whose sanction is sometimes required especially in the frequent water-disputes. It is necessary to remember that the rules of "Idāra-i-māliyya," or the financial department, regarding taxation are as difficult to be defined as the laws governing an artist's inspiration. And the actual collectors are occasionally so enthusiastic in their work that they go beyond the official prescription. The recruiting is by no means less interesting to the governors of the various districts in their most unselfish endeavours to raise a mighty Persian army. These expeditions are undertaken very often and the sectarians, as not enjoying full rights, are especially carefully examined. But all this is nothing compared with the mercilessness of the 'mujtahids' who take revenge on their victims for the financial damages caused by the occasional disregard of their courts on the part of the well-protected Agha-Khanis.

The last mentioned are in much better condition (although far from being perfect) from the mere fact that they usually have as a leader a more or less educated man, whose position as a collector of the incomes for his master always has a magic effect in increasing his own wealth and therefore secures to him more respect and consideration on the part of the authorities. He cannot be dealt with as easily as an ignorant peasant. Sometimes, if he is a mulla as well and does not enjoy a very bad reputation, the local non-Ismaili peasants prefer to bring their cases

to him for settlement, especially those in which they are not claiming help against the sectarians. The motive is always the same—it is cheaper, and besides an Ismaili headman of this kind, as a local inhabitant, knows much better the state of things on the spot than a mulla who lives often in a distant city. It is needless to say that the mujtahids are well aware of this interference (possibly unintentional) with their rights which causes a reduction in their fees. And this is one of the chief reasons why they sometimes assume a very hostile attitude and, under a decent pretext, are always ready to start persecution.

A typical case of this sort took place in the district of Nishapur some twelve years ago. As these cases rarely reach the ordinary European traveller and at the same time give a very interesting illustration of the conditions of country life, I think it would not be useless to give here a short description of it. I had a chance to collate the reports of both sides and therefore I do not think it is far from the truth in its essential parts.

A mulla, Muḥammad Bāqir by name, usually resided in his village (Ḥārithābād) near Qadamgāh, on the Meshed-Tehran road, close to the places inhabited by the sectarians. He had sufficient reason to dislike them as systematically avoiding his court and diverting a large number of his non-sectarian clients. His fanaticism grew up with the arrival of the so-called 'Persian revolution' which, like revolutions in all times and countries, afforded a good chance to the enterprising people, and a pretext for looting some wealthy Ismailis was shortly found. Having collected locally a sufficient mob he marched to Dizbād, Qāsimābād, etc., where the four wealthiest sectarians were taken prisoners and brought to Nishapur. Here by a committee of several mullas the prisoners were sentenced to death on the charge of heresy and, as a matter of course, their property was declared confiscated. Two of the four prisoners were actually executed on the chief square of Nishapur, but the other two managed to settle about the gratification with their guards and fled.¹⁷ The energetic intervention of the British Consul General at Meshed stopped the further development of this 'sacred war,' (*jihād*), and the chief initiator, Mulla Muḥammad Bāqir, was arrested and sent to Tehran. He was released afterwards, and at the present time lives at Ḥārithābād, near Qadamgāh, enjoying the reputation of a saint (although having no clients).

As I was told, there exists nothing like an educated class amongst the Ismailis in Persia. It seems that their tradition died out here, anyhow in the eastern part of the country. The scattered individuals who possess a little education receive it usually in the Shi'a madrasas, especially in those of Meshed. Therefore though surpassing their coreligionists in learning they know about their own religion practically as little as the common people. All the sectarians whom I asked entirely agree that there are no representatives of the higher degrees of initiation in Persia. The reason of this state of things can hardly be ascribed entirely to the persecutions which usually produce exactly the contrary effect on the secret communities. The

¹⁷ I saw one of these two rescued sectarians at Dizbad in July, 1918. He was not more literate than his fellow-villagers.

chief trait, as it appears to a foreign and occasional observer, is a sort of special indifference towards religious questions. I never heard about the existence of persons enjoying spiritual authority amongst them, for instance pirs, who are still common in the regions on the Upper Oxus.¹⁸

The assimilation with the ordinary Shi'ites is very rapid. The common people, accustomed to live in 'taqiyya' and practising the external rites of Shi'ism, seem to be particularly and quite sincerely fond of so-called 'rūza-khwānī' or recitals of the miraculous stories about 'Ali and his descendants, with occasional theatrical representations of the most pathetic scenes. These forms of worship, chiefly attended by women and children, exercise an enormous influence on the masses, rooting deeply in their minds from their earliest years the most extravagant ideas about the Imams. All this makes a gradual transition to orthodox Shi'ism quite easy, and there are very numerous sectarians who can be called Ismailis only because they have not declared officially the change of their religion.

The literature seems to be lost almost completely. I was told many times by the sectarians (and this is a very probable explanation of the fact), that the books are usually kept, if possessed, in secret places. The sudden death of the owner, etc., causes the book to be lost for ever to the community.

Although the sectarians, who usually talk very freely about the most intimate life of their community, become very uncommunicative as soon as any question about even the most unimportant details of their religion is asked, there is little doubt that their beliefs are similar to those held by the Ismailis in the Upper Oxus regions. The books which I showed to them (the text published here and the Ummu'l-Kitab) the sectarians recognised as their own, "not counterfeit,"¹⁹ although they confessed that they had never before seen these writings. Judging from many small facts and personal impressions I would think that their statement was correct.

The scanty fragments of their writings which I am offering in the next section may be regarded as sufficient argument in favour of this opinion. They give the same doctrines about Ali, Salman, periods of incarnation, etc., and their pedigree of the Imams is apparently the same as that of Haft-Bāb. In the notes to these small texts I shall try to give, as far as I am able, explanations of the allusions. Here I will mention only what I could learn about their relation to the Agha Khan who is nothing but the incarnate God Himself. This question is indeed of great interest to a student of religions.

As I was told by travellers in the regions of the Upper Oxus the sectarians living in that part of Asia very strictly observe the two chief material forms in which this worship is expressed, i.e. payment of one-tenth of their income (*dah-yak*), and, in the case of well-to-do people, performance of the pilgrimage to the Deity.

¹⁸ Although J. Biddulph, *op. cit.*, p. 121, speaks about proselytes in that country, the sectarians unanimously assert that their propaganda, *da'wat*, is suspended. They never explain the reason, but it seems quite likely that the cause consists in the religious doctrines, possibly those connected with the ideas of the millennial periods in which the Imam appears either secretly or in others in full glory

¹⁹ قلب نیست as they used to say.

In Persia it seems to be quite different. The Persians are by no means fascinated by their Indian coreligionists, whose modes of worship they call a form of "idolatry." Their high religious hierarchs are unfavourably compared with the Persian authorities. Instances of pilgrimage are very rare,²⁰ not only by reason of poverty but also on other grounds. With regard to *dah-yak* its payment cannot be put on one side as long as the normal relations are preserved. Therefore in this connection the sectarians must express their opinion in a more categorical way. The general tone is that of deep doubt, which indeed is very depressing for a strict sectarian. The Western tendencies of the present Agha Khan cannot be understood, still less approved by an ignorant peasantry living under the same conditions and with the same religious ideas as those of a thousand years ago. On the other hand the general talk is that the Imam has no male offspring, which fact, according to the most ancient and deeply rooted principles, proves that he is not a true Imam.²¹ Moreover, his Ḥujjat, as I was told, died when only 6 months old. It is necessary to recall the more than a thousand years old expectations, the very great sacrifices, etc., which the community had to endure, to realise the depth of their disappointment. No wonder therefore that a great many sectarians, especially those not bound to Agha Khan, holding with him the relation of a peasant to his landlord, plainly and frankly deny all his rights to Imamatus. But as the world cannot exist without an Imam, they are quite sure that there is one, who will very shortly appear to all, a mighty warrior, "who never will take off his riding boots (*chakma*) and whose first game will be the wild ass (*gūr-khar*)."²² It is unnecessary to say that these sectarians give nothing as *dah-yak*.

Agha Khan's peasants, certainly, cannot express so boldly their disapproval, but it does not in any way mean that their opinion is contrary to that of the independent villagers. Besides it is always necessary to keep in view the fact that the practical Persian mind seems to be little disposed to live on self-sacrifice. The great poverty of the majority of the sectarians, to whom ten per cent forms a very essential part of their income, powerfully militates against their entertaining any such extravagant ideas.

With regard to the other external rites of their own religion when they practise it in its pure form without need of concealment, I may mention that they do not recognise as necessary the fast of Ramazan, do not perform namaz, and also have some holidays of their own about which I could not obtain any precise information.²²

²⁰ It is interesting that even in my very limited experience of the sectarians I never saw or heard about one of them who after having performed the pilgrimage returned a more ardent follower of the religion. But at the same time I have seen several cases where previously zealous believers on their returning from India became reuegades.

²¹ Even Shahrastani (ed. Cureton, p. 129) mentions this doctrine *والامام لا يكون الا ويكون له خلف وعقب* "the Imam is not a (true) Imam unless he has an heir (to his Imamatus) and posterity."

²² The book in the collection of I. Zarubin, dealing with these questions is *Wajh-i-Din* (No. 2), apparently quite a genuine production of the famous Naṣir-i-Khusraw. It is mentioned in a work which is almost contemporary with Naṣir-i-Khusraw (written in 485 A.H.) namely the *Kitāb bayānu'l-adyān*, by Abū'l-Ma'ālī (ed. C. Schefer, *Chrestomathie Persane*, v. I, p. 161 of the text). I can find no trace of the *Wajh-i-Din* anywhere else. H. Ethé (*Grundriss d. Iran*.

III. SPECIMENS OF THE RELIGIOUS WRITINGS OF THE PERSIAN ISMAILIS.

As I have already mentioned I failed in all my endeavours to find a specimen of any considerable size of the sectarian literature. The only result of my search was a little piece of dirty, worn paper, a quarter of a foolscap leaf, on which was written: (1) a list of the successive Imams; (2) a list of the Hujjats, and (3) the beginning of a versified exposition of the principal sectarian doctrines. These three little texts, as I was told, must be learnt by heart by every sectarian, but unfortunately the man who showed me this document,²³ has entirely forgotten the end of the poem, which, as he says, he lost a long time ago and since has had no chance of rewriting it. All he could remember besides this were some disconnected verses from several Shi'ite poems popular in Persia, which are quite useless for reproduction here.

The text is written in a hurried and coarse hand, apparently that of a man who does not very often use the qalam, with many errors against the rules of orthography chiefly under the influence of the vulgar way of pronounciation of the names. The paper yellow with grease, with badly frayed edges, is Russian, and this can be considered as a proof that it was written in Persia. The possessor says he has kept it with him over 15 years.

It is necessary to recall that memoranda of this kind are usually prepared for the believers by their spiritual guides, and therefore the literary defects of the present specimen can represent the actual state of education not only amongst the ordinary sectarians, but even the best of them, who pretend to be their preceptors.

A. Lists of the Imams and their Hujjats.

The prominent position occupied by the doctrine of incarnation in the system of Ismailism as it appears in the present phase of its development might suggest the existence of some interest amongst the believers in the history of their Imams. So far however nothing is known of works of this kind. Even if they exist at all they are by no means common.²⁴ The sectarians in Persia, from whom I tried to find out some oral tradition about the past history of their sect, knew practically nothing except a few facts regarding the last two or three Agha Khans.²⁵ The remainder of the present pedigree seemed to be for them inerey a list of names not connected with any concrete recollections. Of course it may be attributed

Phil., v. II, p. 28c) regards it as lost. It would be very interesting to publish it not only as one of the earliest Ismaili treatises but also as a very early specimen of the Persian prose.

²³ It will be better not to mention here the name of the man or the place where it happened, because in case this paper by any means should happen to reach the sectarians of that district, or even the non-sectarian friends of the personage in question, he may be put to trouble, being charged either with heresy or, by his coreligionists, with divulging the mystery.

²⁴ In the collection of the Asiatic Museum at Petrograd, so often referred to in the first part of this paper, only one book, *Haft Bâb*, touches on a few historical events. Dealing with purely dogmatic matters however it does not much concern itself with the history and gives very little new material.

²⁵ This surname, which belongs originally to Hasan 'Ali Shâh Maḥallâfî, is now used as a technical term for the head of the Ismaili community by sectarians as well as by ordinary people.

entirely to their general ignorance, and it is quite likely that the initiates of the higher degrees, 'the chosen ones,' know a great deal more about these matters.

Whatever the case may be the sacred tradition, safeguarded by the strict commandments of the religion from intentional violation, cannot be disregarded entirely. And there are many arguments in favour of its trustworthiness. Whenever it deals with the periods at which the Imams came into touch with the general history, their names and order are given in complete agreement with the reports of the non-sectarian annals. Even in the dark period of about six hundred years since the fall of Alamut until quite recently, about a century ago, when the Imams reappear in Persia in the reign of Fath-'Ali-Shāh,²⁶ some accidental allusions to the history of the Caspian provinces²⁷ give additional evidence in favour of the tradition.

It is quite obvious however that even the great veneration felt for the memory of the incarnations of the olden days could not prevent quite involuntary mutilation of the individual names in the writings of the uneducated, and even confusion of the order. Therefore before undertaking any serious attempt to study it from the historical point of view it would be necessary to collate carefully as many copies as possible of different dates and collected in various countries where the Ismailis are living.²⁸

Moreover even in this correct form the present tradition cannot be treated as representing the opinions held by the sect on this subject in all the periods of history. The changes in political circumstances, and especially dogmatic development, might involve some alterations in the pedigree. These are the reasons, besides the scarcity of reliable information as to the history of the sect, which necessitate postponing the detailed analysis until better times.

There is another reason for this. The views as to the early history and the origin of Ismailism prevailing at present in European literature cannot be considered as finally established and may suggest the necessity of some revision.²⁹ Even the slightest examination of the original historical works, partly already studied, shows that many things can be looked upon in a different way. To discuss all these matters in full detail would involve the writing of a quite independent

²⁶ Cf. below, notes on the incarnations Nos. 44 and 45.

²⁷ Cf. below, note on the incarnation No. 31.

²⁸ Unfortunately the similar pedigree given in *Haft-Bāb* and continued up to 1321 A.H. (by the copyist, who finished his work in this year, as stated in the colophon), is not available to me at present. It contains 19 names after Rukuu'd-Din Khūrshāb and therefore agrees quite well with that published herewith.

²⁹ I am very far from having any intention of belittling in any way the great services rendered to oriental research by the eminent scholars of the older generation. Their studies will always remain a standard of scholarly work and to them only are we indebted for the possibility of any further progress in our knowledge of these matters. Since their time the methods of historical research and criticism of the sources of information have undergone their natural development. And it appears more and more that not very much weight can often be attached to the statements of the Muhammadan writers even in their reports formulated in the most persuasive tone. The style of their exposition of events makes it very difficult not to be influenced by the extremely individualistic mode of treatment of the historical facts, with which only princes and prominent persons are concerned, and to pay due attention to the substratum of the historic evolution, the life of masses. The last method of research was adopted already by van-Vloten, Wellhausen and is at present followed by Prof. W. Barthold in Russia and p. H. Lammens in France. But so far it has been applied only to a limited extent, and the proper study of the early religious life of Islam and of sects, such as the Ismailis and of other Shi'ite movements in connection with them, promises to be a question of enormous importance, able to undermine many theories which seem to be quite firmly established at present.

pamphlet. Therefore it must suffice to review here only the most important questions with which a correct understanding of the present pedigree is closely connected. First of all it would be best to see what is actually known about the origin of Ismailism.

1. The early historians give practically no information with regard either to the origin of Ismailism as such, or its early doctrines and political aspirations before the time of Mahdi and the rise of the Fatimide caliphate.³⁰

2. Practically nothing reliable is known about the religion of the Carmathians (al-Qarāmiṭah), the alleged predecessors of the Ismailis, and the real character of their connection with the Fatimides.³¹ The rare reports of the authors of the later period show that the Carmathian beliefs at least were not always the same as those of Ismailism.³²

3. Nothing authentic is known about the origin of the Fatimide Khalifs, who pretended to be descendants of Ismail, nor as to the real nature of the opinion of the believers on their worship as Imams. A remarkable, and seemingly quite unique fact may be observed in this connection. Nearly every historian touching on the Ismaili question, gives not only a new version of the genealogy of this dynasty, but even almost invariably mentions *several* variants of it, bringing up the line of their descent not only through different (and obviously rival) branches of Ismail's posterity,³³ but even ascribing their origin to the *non-Ismaili* Imams, whose parties were at the later period the worst enemies of the sect.³⁴

4. About Ismail himself almost nothing is known³⁵ except that he died in his father's life time.³⁶ The tradition by which his nomination as an Imam was revoked

³⁰ Tabari, Ibn Miskawayh, Kindi and various minor authors do not take much interest in religious matters and therefore, probably, do not pay much attention to the rising Shi'ite movement. The writers of the later period, when the Fatimides have already achieved their great successes in the political struggle, cannot be regarded as unprejudiced by the ideas which developed among the sect at that later time.

³¹ Cf. E. Browne, "A lit. Hist. of Persia," v. I, p. 404.

³² Ibn al-Athir, who takes a keen interest in the early exploits of the Carmathians (probably as a result of his studies of the Fatimide Khalifat), gives some important detailed accounts of their tenets. In one of them (v. VII. 278) it is quite clear that the sect described is a Kaysauite one, because the Imam appears to be Aḥmad b. Muḥammad ibn Ḥanafīyya, who has not the slightest relation with Ismailism.

³³ Tabari, III, 2218, gives various pedigrees of the Carmathian chiefs (he does not mention 'Abdu'l-lah ibn Maymūn al Qaddāh at all). Of the earlier books these different variants are given by Ibn al-Athir, v. VIII, p. 18, Ibn Taghribirdi, v. II, pp. 447-8, and in an important Shi'ite book, 'Umdatu'l-ṭālib fi ansābi āli Abi-Ṭālib, by Aḥmad b. 'Alī, surnamed Ibn-'Inbā (regarding him see C. Brockelmann, Gesch. d. A. Lit. II, 199), p. 222 sq. of the old undated Lucknow (لکھنؤ) sic lithography. It would be interesting to examine the pedigree given by Naṣīru'd-Dīn Ṭūsī in the preface to his "Taqwīm" (?), mentioned by the same author (p. 225), and in a modern Sufico-shi'ite encyclopaedia 'Arā'iqu'l-Ḥaqā'iq, by Ma'sūm 'Alī Shirāzi (Lith. Tehr. 1318), v. II, p. 104, who thinks that the great doctor of Islam could know something of these matters as he had a long connection with the Ismailis.

³⁴ Ibn al-Athir (v. VIII, p. 28) and Ibn-Taghribirdi (v. II, p. 447-8), who probably followed the former, give a version by which the Fatimides descended from the brother of Ismail, the seventh Imam of the "twelve-Imamite" Shi'ites, Mūsā Kāzīm. The later author (Ibn Taghribirdi, *ibid.*, p. 448) even mentions another variant, in which Mahdi descends from 'Alī Zaynu'l-'Abidin.

³⁵ It is remarkable how little interest this Shi'ite saint excited in the believers. In spite of a long and careful search I could not discover any traces even of legends about him, which are so numerous about other Imams, usually regarding their "martyrdom."

³⁶ The only author, as far as I know, who gives the date of this event, 133 A.H., is that of 'Umdatu'l-ṭālib, p. 223. It is, of course, impossible to state whether it is correct or not.

by his father³⁷ obviously comes from a party hostile to Ismailism and on the whole is very doubtful.³⁸

5. That Ismail left posterity, perhaps even very numerous, may be regarded as a historical fact.³⁹

6. With regard to the rights to Imamatus claimed by the Fatimides exclusively for themselves on account of their pretended direct descent from the *elder* line of the house of Ali (denied, however, by their enemies who denounced even officially the correctness of this genealogy),⁴⁰ it can be pointed that: (1) the whole theory does not agree with the absolutely unquestionable fact that this principle is seriously violated by Husayn's being the *younger* son of Ali, and (2) that there were in the early Shi'ism no commonly accepted and established views as to the exclusive rights of any particular branch of the Alides to be the Imams.⁴¹

³⁷ An additional explanation of this revocation may be suggested. Tabari, III, 154 and 2509, mentioning Ismail always gives him the epithet *الإعرج* i.e. "lame," may be lame from birth. The same appears in 'Umdat-ŧ-ŧalib (p. 222). If this can be proved from any other earlier and reliable source, the allusion acquires considerable importance. It is a well-known fact that one of the most essential and primitive beliefs in the worship of the deified chiefs pontiffs, etc., is that they must not be sick (in the earlier phases of the religion they can be killed in such case) and in particular they must have no bodily defects. The early Shi'ite extremist ideas about the Imams were not rarely inclined to their deification. In such archetypal organism, on the existence of which depends the life of the whole world, nothing may be wrong otherwise great calamities may befall the universe. These ideas, in a moderate form, are still alive in Muhammadan countries and it would not be quite wrong to keep in memory this possibility. In the atmosphere of rivalry and intrigue which was not uncommon among the pious Alides, this pretext, quite possibly without its clear formulation, could be used against Ismail. The worship of this saint appears in a much later period when the real tradition regarding him was quite forgotten and he had become a mere name.

³⁸ The whole tradition consists of only two facts, usually reproduced: (1) that Ismail was given to drinking wine, and this was the reason why his father revoked his nomination, and (2) that after his death, the funeral was stopped several times by the order of his father and the body was shown to the public so that there would be no doubt about the fact of Ismail's having died. (The details of this event are quite vividly described in this story, cf. 'Umdat-ŧ-ŧalib, p. 223 sq. and *ŧarā'iq-ŧ-Ḥaqā'iq*, v. II, p. 104). If the first anecdote be admitted to be true, the second probably deserves no credit. To confirm these suspicions it may be mentioned that another story is usually added in similar accounts about the intrigues of Ismail's son, Muhammad, against his uncle Mūsā Kāzim in the reign of Harūn ar-Rashid, which caused the imprisonment and subsequently the death of that Shi'ite saint. Tabari, III, 2501, gives no detail and does not mention Muhammad's name in this connection, but the Shi'ite tradition, a very important fact, ascribes it to him clearly, cf. 'Umdat-ŧ-ŧalib, p. 222, *قبض الرشيد على موسى الكاظم وحبسه وكان سبب هلاكه*. There can be no doubt therefore that a tradition of this kind is not likely to be preserved by the Ismailis or their friends. And if we remember the hatred and hostility which Ismailism always provoked not only amongst the Sunnis but Shi'ites as well, it will be quite clear that these stories have very little historical value.

³⁹ Tabari mentions Muhammad b. Isma'il at least a dozen of times as a *ŧāwi*. 'Umdat-ŧ-ŧalib (pp. 222 sq.) mentions also another son of Ismail—Ali. Muhammad had two sons: Ismail II (p. 223) and Ja'far surnamed ash-Shā'ir "poet." Both of them had a numerous posterity, mostly settled in Syria and Egypt. The author refers to an early Shi'ite writer, Abū Naṣr Saḥl b. Dāūd Bukhārī (not mentioned by Tūsi however), in whose opinion *أولاد اسمعيل* *ابن محمود بن اسمعيل لاشك في نسبهم* (i.e. Ismail II, p. 224). Aḥmad surnamed 'Abū'sh-Shalā'la' descended from Ja'far, the "poet." On the whole it seems to be very probable that these pedigrees were really genuine.

⁴⁰ Cf. E. G. Browne, "A. lit. H. of Persia," v. I, p. 398, and 'Umdat-ŧ-ŧalib, p. 224.

⁴¹ It seems that the question about any particular Alide's rights was quite immaterial and was no cause of concern to his followers so long as his general genealogy was correct. The descendants of Ḥasan, who according to Ismaili opinion could not attain the position of Imam, and especially those of the third son of Ali, Muhammad ibn Ḥanafiyya, were worshipped as much as, if not more than the Husaynites. Still more typical of these ideas is the fact that these doctrine under some special historical circumstances, were transferred to the enemies of the Alides, and there was a by no means small group of the sectarians who expected the arrival of the Sufyanite, the Imam from the house of Ummayya (cf. W. Barthold, "The Caliph and the Sultan" in "Mir Islama," v. I (1912), p. 210-211, who refers to the interesting report of Mas'ūdi, *Bibl. Geogr. Arab.*, VIII, 335 sq. and I. Goldzieher, *Muham. Studien*, v. II, p. 119 sq.). The same question of the Sufyanite is dealt with to a degree by van Vloten in his "Recherches sur la domination Arabe, le chiitisme

Thus, as we have seen, very little trustworthy information appears to be available at present about the origin and the early history of Ismailism. We must not however lose hope that more light will be shed upon these interesting problems. When further original works dealing with the early period of Muhammadanism are properly edited, the method of following only a few historians, who give an account of this sect, will be replaced by a synthetic coordination of all the scattered notices in various annals and reports, dealing with events connected in any way with that movement. The context will give us much of what we have so little at present, the possibility of an unprejudiced research into the real facts as they were.

It is remarkable how little Ismailism was studied in connection with the kindred Shi'itic sects, with which even nowadays, in spite of a millennium of evolution, it has so much in common.⁴² There cannot be much doubt that in its earlier period, when all these sects were in the process of formation and could not possess many inveterate prejudices hardened by a long tradition, the divergencies were but few. In vain a student looks for characteristic details of these sects in the books of old authors who preserved for us their precious descriptions. All the movements seem to have been variations of one very powerful idea which absorbed all the minds—Messianism. And the difference consisted only in preferring one or the other branch of Alides whose offspring would appear in the supernatural capacity of a Messiah, or, more rarely, consisted only in the degree of intensity of the Shi'itic feelings,—i.e. deification of the Imam.⁴³

The little which transpires regarding the life of the masses of the population in the vast empire of the Abbasides in the beginning of their rule by no means supports

et les croyances messianiques sous le khalifat des Omayyades, in Verh. d. Koninklijke Acad. van Wetenschappen Afdeeling letterkunde," D. I. No. 3 (1894), p. 61, and his later article on Mahdi in ZDMG, 1898, p. 213 sq.) Very typical detail of the psychology of these messianic beliefs can be noticed in the fact, mentioned by van-Vloten (Recherches, *ibid.*) that several Mahdis (e.g. Qaḥṭānī in southern Arabia) had an epithet *Maṣūir* "the Victorious" Quite probably if an aspirant be not victorious, he is not Mahdi and, it may be, vice versa. It would not be perhaps out of place to mention here that the sects of the worshippers of the Sufyanite proved to be as lasting as the Shi'ite teachings and even at present there are still remnants of this sect living in the strictest disguise in Badakhshan (so called Marwānī) and perhaps also near Hamadān in Persia. (The Yezīdis, about whom so much was written recently probably also have something in common with these sects). Some interesting illustrations of these Messianic conceptions can be found in Prof. D. S. Margoliouth's "Mahdis and Mahdism" in the Proceedings of the British Academy, v. VII.

⁴² Cf. E. G. Browne, *op. cit.*, v. I, pp. 394 and 407, where the opinions on this subject of S. de Sacy and Stau. Guyard are cited.

⁴³ Shi'ism, which was already a powerful movement, as proved by the risings of Mukhtar in Kufa, as early as the end of the first century A.H., was still growing, politically as well as dogmatically, a long time after Ismailism was firmly established. The sect, which proved to be the most vital, the so-called *Ithnā-'ashariyya*, just started at that time (the end of the third century A.H.). To what is generally known about the sects of this period, an interesting account may be added of the heresiarchs who deified 'Alī Hādī (d. 254 A.H.), the eleventh Imam of the Shi'ites, and some of his relations. The author, Muḥammad b. 'Abdī'l-'Azīz al-Kāshī (Tūsi's List No. 668), who was living apparently in the second half of the IV century A.H., was very close to all these events as is proved by the attention he pays to them (usually the Shi'ite writers avoid touching these questions as they might cast some shadow on their own beliefs). In his book *Ma'rifat al-akhbār al-'ijāl* (Print. Bombay, 1317, pp. 321-329) he gives quite a number of these persons: 'Alī b. Haskah Qāsim Yaḥqīnī, Ibn Bābā Qumī, Muḥammad b. Nuṣayr Numayrī (the Prophet of the present Nuṣayris), Fāris b. Hālim Qazwīnī, Abū 'Abdī'l-lah Kāndī, Mūsā as-Sawwāq, Muḥammad b. Mūsā ash-Sharqī and many others, who were preaching their doctrines in all parts of the Muhammadan world at the time when Ismailism was rising in Northern Africa.

the usual views on the origin and the enormously rapid expansion of Ismailism, attributing them entirely to the diabolical malice and the quite supernatural abilities of some individuals, especially of 'Abdu'l-lah b. Maymūn al-Qaddāh.⁴⁴ Eliminating all these miraculous and satanical elements, we can seek for an explanation which would be more in conformity with the historical perspective. And it can be reconstructed with an amount of verisimilitude.

There will be nothing improbable in an admission that a little Shi'ite sect in Syria, one of a great number, quite insignificant and unpromising at home, could acquire by various means some accidental success amongst the credulous Berbers of Northern Africa. A successful revolt and further victories under the banner of Mahdi could change the whole configuration of the Shi'ite world. It was saturated with Messianic expectations, the most ardent and impatient, as the beliefs of all neophytes usually are.⁴⁵ What could be more persuasive, more obvious for their psychology, than the Divine proof of the truth and righteousness of this particular line of the Alides, manifested in their victories which in the talk of bazars could assume the most marvelous forms. And even if there were some scepticism, the brilliant feat of the conquest of Egypt could dissipate all the doubts.⁴⁵

Here lies apparently the key to the mystery of the enormous success attained by the new Messiah. All the early Muhammadan authors agree in emphasising the energy with which the propaganda in his favour was carried on. If it was extremely widespread and the emissaries were lurking practically everywhere sowing the seeds of fanaticism and sedition, it was only because it could find an adequate response in the masses of the population. It remains only to imagine what wild lies these unscrupulous and parasitic folk (as all the propagandists of the secret teachings invariably are) would spin for their unsophisticated hearers about the miracles of their supernatural patron acting in the fairy-lands of Maghrib, fortunately several thousands of miles distant from the spot. As I have mentioned above, the general impression from the authorities is that the idea of an exclusive right to be a Messiah possessed by only one definite line of the Alides was not prevailing at that early time. Especially for the people living far away from Baghdad and Mekka, where the aristocratic Alides nested, it was materially of no difference who was the Imam, so long as there was no doubt as to his parentage. Therefore it is also not improbable that the change was not difficult, and besides, quite possibly, the Mahdi could be represented as the direct offspring of the particular line worshipped locally.

If there is any truth in this conjectural explanation we can readily understand

⁴⁴ The rôle of this personage quite probably was very prominent. But it is extremely difficult to separate in all the reports about him the truth from the usual legendary exaggerations which so richly gather around popular heroes. Quite possibly even the earliest writers, as the author of the 'Fihrist,' could record only the common talk for a biography of such personage, and only added to confusion by their pious scepticism, trying to represent him as wicked as possible.

⁴⁵ To what is said above, in the footnote 41, it may be added that the Messiah was expected as early as one hundred years after Muhammad's death (therefore the year 100 A.H. was taken as the date of Abū-Muslim's birth). These beliefs were so universal and so firm, that they found their way to China and were recorded in the Chinese official historical works, as shown by E. Chavannes in his 'Documents sur les Tou-Kiue (Turcs) occidentaux,' p. 205. (I quote from W. Barthold's pamphlet in 'Mir Islama' v. I, p. 431).

⁴⁶ Cf. the end of the footnote 41.

not only the enormous success and the rapidity of expansion of Ismailism but also two other facts which have been overlooked so far, i.e. the above-mentioned unique manifoldness of the pedigrees of the Fatimides, probably representing the local versions of it, and, on the other hand the divergencies⁴¹ in the beliefs, of which clear traces not only are still existent but are manifest in the whole history of Ismailism, especially accentuated by its two chief branches, the eastern and the western.

Even the dominant religions rarely possess no local or national peculiarities in the various parts of the vast areas which they occupy. Still less can we expect this from a secret creed and believe that Ismailism was thoroughly uniform even in its chief principles, as the doctrines about the Imam, his Hujjat, etc. There is no doubt however that sectarian rulers and leaders, for purely political reasons, hardly could encourage the vagaries of the more extravagant of their followers, at least openly. There are many instances in their history that it was really so, and this is why it is so extremely difficult to trace the evolution of these ideas.⁴² But it may seem that they existed in their more or less present forms long before the great reformer Hasan 'a lā-dhikrihi's-salām. The madness of al-Hākīm could scarcely have taken its actual form, unparalleled in the history of other dynasties, if it had not found sufficient support in the religious ideas of his time.

Still less definite information can be gathered about the cultus of the Hujjat.⁴³ The myth of Salman which obviously lies under it, seemed to be too heretical to the Muhammadan writers to reproduce it. The only genuine text of western Ismailism which is available at present,⁴⁴ gives practically nothing in this connection. On the other hand, the writings of the eastern Ismailis, and especially the documents dating from the same period as those of the western in question,⁴⁵ lay particular stress on

⁴¹ Even a small collection of genuine treatises of the sect, like that to which belongs the text published in the first part of the present pamphlet, bears clear traces of these divergencies. They hardly can be ascribed only to various degrees of frankness with which the same doctrines were expounded for the more initiated or the beginners, or to development in course of time. The most enigmatic treatise is 'Immu'l-Kitab, which at first seems not even to belong to the Ismaili system at all, in spite of the great veneration which it receives now amongst the followers of this sect.

⁴² The nature and the spirit of these ideas, as well as of the whole Ismaili system, were very often taken by many scholars as being typically Persian. I am afraid it does not seem very convincing to me. The whole system of degrees of initiation, mysteries in everything, the worship of a dynasty of incarnated Gods, even the divine-natured priest—Hujjat, etc., all this has little to do with the plainness of Zoroastrianism, which is rather poor in fantasy and invention. But we are at once at home with the Ismaili doctrines as soon as we are again in Syria and Egypt with all their dynasties of incarnated deities, the mysteries of their complex cultus, etc. Lydia, Phrygia, Babylonia, and especially Phoenicia and Egypt were the ancient seat of all these beliefs which in some parts of these countries were existent still as late as the tenth century A.D. No wonder that Ismailism springs up in Syria, and acquires its decisive success in Northern Africa, where the almost savage tribes of Berbers could easily preserve in the slow tempo of their life much of what they inherited from the Egyptian as well as Phoenician colonial civilisations. It seems that the stress on the 'Persianism' of this creed is due to a large extent to the alleged Persian descent of its reputed founder, Abdu'l-lah b. Maymūn al-Qaddāh. But we must remember that the pious Muhammadan writers almost invariably credit all the heresiarchs of note with such a foreign origin. Even if they were not foreigners, they *must* have been Zindiqs or Jews. On the other hand, although Shi'ism undoubtedly was very popular amongst the Iranian peoples, it is also a fact that the best minds of Persia took a leading part in building up the strict orthodox sunnism, and even now the Sunnite Iranians greatly outnumber their Shi'ite brethren.

⁴³ I give their names together to make the correspondence more evident.

⁴⁴ Already referred to many times: S. Guyard, *Fragments relatifs à la doctrine des Ismaélis*, 1874. These texts were written in the IX and X c. A.H.

⁴⁵ As the text published above, *Huṭ-Ḥab*, and another anonymous text (No. 5), all dating from the X c. A.H.

the doctrine. The non-sectarian writers, whose reports about the nature of the Ismaili beliefs are available and who usually give very few details, as yet attach to the principle of the Hujjat little importance.⁵² It may be concluded therefore with a certain degree of reliability that this prominent idea acquired its dominant place, at least in official recognition, not earlier than the time of the rupture between the two branches of Ismailism. It is not improbable that it happened at the beginning of that new period when Hasan 'alā dhikri-hi's-salām started reforming the religious doctrines of the sect.⁵³ He may even have promoted this teaching so far as it has gone for some private reasons.⁵⁴ And in the dark period of the history of the sect the messianic ideas may likewise have directed some further development of the conception of the "Divine Proof."

These reasons by no means promise an easy possibility of identifying the historical personages who appeared in this great position. In accordance with the sectarian beliefs⁵⁵ the Hujjat need not necessarily be a relation of the Imam, for any body can appear in this capacity.⁵⁶ Therefore only a detailed history of the Imams can help to trace which of their companions correspond to the persons mentioned in the list. Besides, there is no guarantee that the names given here are not conventional, intended to conceal the true tradition from all except the initiated.⁵⁷ In any case it is possible to expect some historical value in this list only with regard to its later part. So far it seems quite obvious that the Hujjats of the earlier period, before Hasan 'alā dhikri-hi's-salām, were fixed *post factum*⁵⁸ and most probably chosen from the popular sectarian heroes of each period.⁵⁹ On the whole the Hujjat question may possess absorbing interest as being apparently connected with the development of the myth and cultus of Salman and various early Shi'ite saints⁶⁰ of Persian origin, which are closely connected with the most important sides of the true nature of early Muhammadanism and the struggle of the local national ideas against Islam.

⁵² In these expositions only the western teachings are usually given, and their terminology and even essential doctrines are quite different. The various religious degrees are not defined properly, such as Asās, Naṭīq, Imām, Bāb, Hujjat, etc. Quite possibly the real doctrines were kept in secret, and, possibly as well, there were various currents, representing the local separate tradition or, may be, the results of small reforms.

⁵³ He is usually represented as a learned man, who also composed books himself. Cf. *روضه الصفا* v. IV. *حبيب لسير* v. III, p. 67 (of the lith. ed.), *رسائل در قام آورد* and *معلومات خود را در حيط عبارت و تعبير آورد*.

⁵⁴ It is quite possible that this Hujjat with his "Miraculous Knowledge" had to be employed to dissipate the doubts of his followers with regard to his pedigree. Probably this is alluded to in the text published in the first part, f. 30., where it is said that "the Imam disappeared, but was recognised afterwards by his Hujjat."

⁵⁵ Cf. the first part, Introduction, IV, and footnotes 42 and 43.

⁵⁶ As Salman Farsi, their archetype, who descended from the Imam only in *معنى*.

⁵⁷ I have mentioned already (Part I, Introduction, the end) that this sort of cipher is quite common in the practice of other sects. It suits very well the Hujjat who is incarnated only in his "truth," where he may have a name different from that known to unbelievers.

⁵⁸ As was the case, e.g., with the incarnations of the Imam in the pre-Muhammadan epochs of the ancient prophets.

⁵⁹ There are many early personages like Abu Dharr, Kumayl, etc., who were practically deified by many sects, and a good example is *Ummu'l-Kitāb*, where they are real Demiurges, assisting Salmān. It is quite possible that amongst these Hujjats many might be relations of the Imam, if only the tradition about them could be traced.

⁶⁰ There are several well known saints of this type as *ابو خالد کابلي*, *قاسم بن عوف شيباني*, etc., who appear even in the early works. They are obviously apocryphal.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ ،

جناب سرکار پیر صلی اللہ علیہ و سلم صاحب

حق مولانا علی

پیر سرکار خداوند عالی

پیر برحق محمد مصطفیٰ

I حق مولانا علی

حسن	” ” ”	حسین ¹	” ” 2
قاسم شاہ	” ” ”	زین العابدین	” ” 3
جعفر شاہ	” ” ”	محمد باقر	” ” 4
زین العابدین	” ” ”	جعفر صادق	” ” 5
امیر احمد	” ” ”	شاہ اسمعیل	” ” 6
صید کو نور ⁷	” ” ”	محمد (بن) شاہ اسمعیل	” ” 7
اندر امام لہدین ⁸	” ” ”	شاہ و فی احمد	” ” 8
محمد منصور	” ” ”	شاہ تقی محمد	” ” 9
غائب الدین ⁹	” ” ”	شاہ رضی عبد اللہ	” ” 10
عبد المجید	” ” ”	شاہ مہدی (ابو) محمد	” ” 11
مستنصر باللہ	” ” ”	شاہ قائم ⁶	” ” 12
احمد ہادی	” ” ”	شاہ منصور	” ” 13
ہاشم شاہ	” ” ”	شاہ معز	” ” 14
محمد شاہ	” ” ”	شاہ عزیز	” ” 15
محمود شاہ	” ” ”	شاہ حاکم ابو علی	” ” 16
محب الدین شاہ	” ” ”	شاہ ظاہر علی ⁶	” ” 17
خالق الدین شاہ	” ” ”	مستنصر باللہ	” ” 18
عبد المؤمن	” ” ”	شاہ نزار	” ” 19
اعلام الدین	” ” ”	شاہ ہادی	” ” 20
صالح الدین ⁷	” ” ”	شاہ مقتدی	” ” 21
شمال الدین ⁹	” ” ”	شاہ قاہر	” ” 22
نصیر الدین احمد	” ” ”	(حسن علی) ذکرة السلام ⁹	” ” 23
شہاب الدین ¹¹	” ” ”	علاء (الدین) محمد ¹⁰	” ” 24
صدر الدین	” ” ”	جلال الدین	” ” 25
حسن کبیر الدین	” ” ”	علاء الدین محمد	” ” 26

¹ The words حق مولانا are omitted. ² Sic. ³ ? صید (زید) و رکن الدین. ⁴ ? امام الدین. ⁵ ? قالب الدین. ⁶ Or قالب الدین.

⁷ In the text قاسم. ⁸ In the text زاهر. ⁹ In the text twice. Is it simply a mistake? ¹⁰ Not clear.

¹¹ In the text لا محمد. ¹² In the text ذکر با سلام. ¹³ Sic.

پیر برحق	تاج الدین	حق مولانا رکن الدین	27
» » »	فتح اللہ جوانمردی ¹²	شمس الدین	28
» » »	حیدر علی	قاسم	29
» » »	علاء الدین محمد	اسلام	30
» » »	قاسم شاہ	محمد	31
» » »	نصر محمد	مستنصر باللہ	32
» » »	اغا بابا ہاشم شاہ	عبد السلام	33
» » »	محمد زمان	غریب میرزا	34
» » »	آغا غریب	نور الدین	35
» » »	محراب بیگ	مراد میرزا	36
» » »	علی اکبر بیگ	ذو الفقار علی	37
» » »	علی اصغر بیگ	نور الدھر علی	38
» » »	میرزا محمد باقر الحاجب	خلیل اللہ	39
» » »	بیہی سرکار ¹⁴	نزار ¹³	40
» » »	شاہ حسن علی	سید علی	41
» » »	میرزا حسن علی	حسن علی	42
» » »	شاہ قاسم علی	ابو الحسن علی شاہ	43
» » »	شاہ ابو الحسن علی	خلیل اللہ	44
» » »	علی شاہ	شاہنشاہ حسن علی	45
» » »	شاہ بدین ¹⁶ شاہ کہ شاہ خلیل اللہ باشد	آقا علی شاہ	46
» » »	سید ابو الحسن شاہ	سلطان محمد شاہ	47

پیر برحق سرکار مطلق سرکار خدارندگار
 آغلی سلطان محمد شاہ جامعہ¹⁶ خاصہ مراد
 مطلب جمع مؤمنان مشرق عالم تا مغرب عالم
 از یمین عالم تا یسار عالم بخیر خوشی بر آورده
 فرماید بحق جملہ نامہای مبارک بحق عزیزان
 درکالہ¹⁷ کہ از کذا ما و نقصان¹⁸ در کدر، بتاریخ
 شہر مبارک رمضان¹⁹ ۲۳²⁰ یوم²¹

¹² نقلہ جوانمردی. ¹³ نزار. ¹⁴ بی بی سرکار. ¹⁵ شہاب الدین. ¹⁶ Sic? Not clear, as the whole of this colophon, written on a corner of the leaf, is very greasy and worn.

¹⁷ Sic? ¹⁸ نصیان. ¹⁹ رمضان. ²⁰ Sic?

²¹ The end is torn off, but this paper cannot have been written less than 15-20 years ago judging from its appearance, as well as from the statement of its owner

TRANSLATION.

In the name of God, the Merciful, the Compassionate.¹

(The Imams).

(The Hujjats).

The true God, Our Lord 'Alī (manifested in):	The Lord, the Preceptor, ² the exalted God. ³
1. The true God, our lord 'Alī (born 29 B.H., died 40 A.H.).	The true guide Muḥammad Muṣṭafā (d. 11 A.H.)
2. Ḥusayn (d. 61 A.H.).	Ḥasan (d. 49–50 A.H.).
3. Zaynu'l-'Ābidīn ('Alī) (d. 94 A.H.).	Qāsim-Shāh. ⁴
4. Muḥammad Bāqir (d. 113–114 A.H.).	Ja'far-Shāh.
5. Ja'far-Ṣādiq (d. 148 A.H.).	Zaynu'l-'Ābidīn.
6. Isma'īl (d. 133 A.H. ?).	Amīr Aḥmad.
7. Muḥammad.	Ṣayd-i-kūnūr (?).
8. Wafī Aḥmad.	Andar-Imān-li-Dīn (?).
9. Taqī Muḥammad.	Muḥammad Manṣūr.
10. Raḍī (Riḍā ?) 'Abdu'l-lah.	Ghā'ibu'd-Dīn.
11. Al-Mahdī (Abū-Muḥammad 'Ubaydu'l-lah) (276–322 A.H.).	'Abdu'l-Majid.
12. Al-Qāim (-bi-amri'l-lahi, Aḥmad) (d. 334 A.H.).	Mustanṣir-bi'llahi.
13. Al-Manṣūr(-bi-quwwati'l-lahi, Isma'īl) (d. 341 A.H.).	'Aḥmad Hādī.
14. Al-Mu'izz(-li-dīni'l-lahi, Abū-Tamīm) (d. 365 A.H.).	Hāshim-Shāh.
15. Al-'Azīz (-bi'l-lahi, Abū Manṣūr, Nizār) ⁵ (d. 380 A.H.).	Muḥammad-Shāh.
16. Al-Hākīm (-bi-amri'l-lahi, Abū 'Alī Manṣūr) (d. 411 A.H.).	Mahmūd Shāh.
17. Az-Zāhir(-bi'l-lahi, ⁶ Abū'l-Ḥasan 'Alī) (d. 427 A.H.).	Muḥibbu'd-Dīn-Shāh.
18. Al-Mustanṣir-bi'l-lahi (Abū Tamīm Ma'add) (d. 487 A.H.).	Khāliqu'd-Dīn-Shāh.
19. (Al-Muṣṭafā-li-Dīni'l-lahi) ⁷ Nizār (d. shortly after 487 A.H.).	'Abdu'l-Mu'min.
20. Shāh-Hādī (Mahdī).	I'lāmu'd-Dīn.

¹ About this invocation see Part I, Translation, footnote 1.

² I give in concise form the honorific titles which are almost untranslatable.

³ 'Khudāwand' seems to have here its present-day meaning.

⁴ I omit the honorific title Shāh in the list of the Imams as superfluous, but in the list of the Hujjats it is better to preserve it because it may be connected with some special doctrines.

⁵ So in 'Umdatul-tālib (see about it further).

⁶ So in the text of the Ta'rikh-i-Guzīda, p. 513. In the abridged translation (v. II, p. 124) it is given (on the authority of Ibn-al-Athīr) az-Zāhir-li-i-zāzi-Dīni'l-lahi.

⁷ So in 'Umdatul-tālib.

(The Imams.)	(The Hujjats).
21. Shāh-Muqtadī.	Şālihu'd-Dīn.
22. Shāh-Qāhir (-bi-quwwati'l-lahi, Ḥasan).	Shimālu'd-Dīn.
23. (Ḥasan 'alā) dhikri-hi's-salām (557-561 A.H.).	Naşīru'd-Dīn Aḥmad.
24. (Khudāwand) * 'Alāu'd-Dīn * Muḥammad (d. 607 A.H.).	Shihābdīn. ¹⁰
25. (Khudāwand) Jalālu'd-Dīn (Ḥasan) (d. 618 A.H.).	Şadru'd-Dīn.
26. (Khudāwand) 'Alāu'd-Dīn Muḥammad (d. 653 A.H.).	Ḥasan Kabīru'd-Dīn.
27. (Khudāwand) Ruknu'd-Dīn (Khūrshāh) (d. shortly after 654 A.D.).	Tāju'd-Dīn.
28. Shamsu'd-Dīn.	Fatḥu'l-lah Jawānmardī.
29. Qāsim.	Ḥaydar-'Alī.
30. Islām.	'Alāu'd-Dīn Muḥammad.
31. Muḥammad.	Qāsim-Shāh.
32. Mustansir bi 'l-lahi.	Naşr-Muḥammad.
33. 'Abdu's-Salām.	Āghā Bābā Ḥashim Shāh.
34. Gharib-Mirzā.	Muḥammad-Zamān.
35. Nūru'd-Dīn.	Āghā Gharib.
36. Murād Mirzā.	Mihrāb-Beg.
37. Dhū'l-Fiqār 'Alī	'Alī-Akbar-Beg.
38. Nūru'd-Dahr-'Alī.	'Alī-Aşghar-Beg.
39. Khalīlu'l-lah.	Mirzā Muḥammad Bāqir al-Ḥājjib.
40. Nizār.	Bībī Sarkār.
41. Sayyid 'Alī.	Shāh Ḥasan 'Alī.
42. Ḥasan 'Alī.	Mirzā Ḥasan 'Alī.
43. Abū'l-Ḥasan 'Alī Shāh.	Shāh Qāsim 'Alī.
44. Khalīlu'l-lah (d. 1233 A.H. = 1818 A.D.).	Shāh Abū'l-Ḥasan 'Alī.
45. Shāhinshāh Ḥasan 'Alī (d. 1298 A.H. = 1881 A.D.).	'Alī-Shāh.
46. Aghā 'Alī Shāh.	Shāh-ba-Dīn (= Shihābu'd-Dīn ?) Shāh, who is Shāh Khalīlu'l-lah.
47. Sulṭān Muḥammad Shāh (still living).	Sayyid Abū'l-Ḥasan Shāh.

The true guide, the absolute lord, the Divine Master, Sulṭān Muḥammad Shāh, the choicest incarnation,¹¹ let Him grant what is desired and sought by all the

* It was probably the official title of these rulers, and even appears as a title of the present Agha Khan in the colophon.

⁹ E. G. Browne, "Lit. Hist of Persia," v. II, p. 454, gives نور الدين. In Ta'rikh-i-Guzida the title is not mentioned.

¹⁰ I preserve this way of spelling intentionally, because there may be a chance of discovering whether this incarnation of the Hujjat has anything to do with the persons mentioned very often under this name in the tradition of Ahi Balas.

¹¹ Literally "the choicest dress" (in which the Deity appears).

believers of the world from the East to the West and from the South to the North having accomplished it in the best way.¹² For the sake of these blessed names and for the sake of the great attendants of the throne forgive us our sins and errors. (Finished) on the 23rd of the month of Ramaḍān. . . .

Notes on the list of the Imams and Hujjats.

1. The Hujjat in the time of Ali is believed to have been Salmān Fārsī.¹ Therefore the name of Muhammad is introduced here for some special reasons, probably from fear of persecution.

1-5. The dates are given as in S. Lane-Poole, *Muhammadan Dynasties*, § 27.

2. The reason why Hasan appears as a Hujjat and not an Imam is probably due to the sectarian opinion that an Imam, whose posterity were not Imams as well, is not genuine. It is very difficult indeed to find when exactly the pedigree received the present form, as has been discussed at length above.

3. It has been already mentioned that any attempt to identify the Hujjats cannot be regarded as having any chance of success, because there is no principle to follow in such research.

7-11. As is shown above nothing can be done at present to elucidate this dark period. The historical works so far available, which mention this tradition, belong to a comparatively later period. Of Western authors Ibn Taghribirdī² gives it in somewhat different order: Mahdī b. (3) Taqī Husayn b. (2) Wafī Aḥmad b. (1) Raḍī 'Abdu'l-lah b. Muḥammad b. Isma'il. But it appears almost word for word as in our list in *Ta'rikh-i Guzida*: Mahdī b. (3) Raḍī 'Abdu'l-lah b. (2) Taqī Qāsim³ b. (1) Wafī Aḥmad b. Muḥammad b. Isma'il. The most interesting is that the author refers to a still earlier work *'Uyūnu'l-tawārikh* by Abū Tālib 'Alī b. Najīb Baghdādī.⁴ This may to a certain degree be regarded as an argument in favour of the admission that the pedigree in the earlier part was not altered after the time of the Imams of Alamūt, and may possibly be the survival of the version officially adopted by the Fatimides.⁵

The other versions, as I have pointed out, vary extremely as to their names, the number of generations, etc. Very often they are prejudiced by some local or temporary fashion, reflected in the writings of particular authors. It is interesting that even S. Lane-Poole could not avoid this and therefore tries to bring the pedigree

¹² The text is very bad and the translation is therefore only approximate.

¹ Cf. part I, introduction, IV, and f. 9 of the text. Also see verse 6 of the poem, found together with the present pedigree, and printed further below.

² Abū'l-Maḥāsīn ibn Taghribirdī, *An-nujūmu'z-zahira*, ed. Juynboll. Leyd. 1857, v. II, pp. 447-8. The author brought his history up to 857 A.H. (Brock. II, 42).

³ Ed. E. G. Browne, 1910 (Gibb M.S.), text, p. 510.

⁴ The majority of persons who were called Muhammad are given in the biographical works, etc., as surnamed Abū'l-Qāsim, the *kunya* of the Prophet. Therefore, if it is a mistake for Abū'l-Qāsim, this version is exactly the same as the traditional.

⁵ *Ta'rikh-i-Guzida*, text, p. 510. I could not trace this book or its author anywhere.

⁶ As far as I know, the historians do not give it anywhere.

given by Ibn al-Athir⁷ into agreement with the doctrine of the periods of 'seven' Imams, even at the sacrifice of Ismail himself.⁸

11-18. The dates are given as in S. Lane-Poole's *Muhammadian Dynasties*, § 27.

19-23. This is another dark period in the succession of the Imams. I could not find any information about the real reasons of Nizār's nomination being revoked by his father or the date when this event happened. The year 471 A.H. in which, according to *Ta'rikh-i-Guzida*, Ḥasan Ṣabbāḥ was busy with propaganda in favour of Nizār (and not his father Mustanṣir, who was still alive) might be regarded as the date before which the revocation took place. But the whole context does not admit of giving much credence to this information.

Nizār died after 487 A.H., in which year his brother Musta'ali, who succeeded as khalif his father, Mustanṣir, imprisoned him after having captured him at Alexandria (probably on the occasion of an attempt to escape from Egypt).⁹ If this happened very soon after his brother became a khalif, more than 70 years elapsed till 557 A.H., when Ḥasan of Alamūt declared himself as his descendant. For this period Qazwinī gives two names: (1) Hādī and (2) Qāhir,¹⁰ but Ḥabibu's-Siyar mentions three generations: (1) Hādī, (2) Mahdī¹¹ and (3) Qāhir.¹² These details, although very suspicious,¹³ prove, that the tradition in the time of the Imams of Alamūt was practically the same as nowadays. The historic value of these reports is as doubtful as all that we know about Ḥasan. Even if our information is based on genuine sectarian annals, it can not be regarded as reliable because these documents may have been forged in so doubtful times. At the same time we have no means of judging how far these annals even in this form were reproduced by the Muhammadan writers, and what was taken from the other sources. The version that Ḥasan was a lineal descendant of Kiyā Buzurg Ummid naturally cannot be of sectarian origin, even should it be true. The story of a mysterious child given to Ḥasan Ṣabbāḥ by Nizār,¹⁴ living at the doors of Alamūt in such disguise that nobody knew him, etc., is too miraculous even for the oriental mind, and in its present form it hardly would appear in the sectarian books. There is another consideration which makes the matter still more complex. It is commonly represented that Ḥasan Ṣabbāḥ took Nizār as the Imam and discontinued all relations with the Western branch of Ismailism. It is one of the most essential beliefs of the sect that the world cannot remain without an Imam. Even if

⁷ Ed. Tornberg, VIII, p. 18. I think it was taken from this author, because I have not seen this version anywhere else.

⁸ As the author writes in the pedigree "Ismail or Muhammad," There was possibly a branch of (early) Ismailis, who regarded Muhammad as the last of the Imams, etc., in connection with the messianic beliefs, but it seems quite clear that the identity of Ismail and his son is a conjecture of Muhammadan historians, because it is in obvious contradiction to the elementary Ismaili doctrines.

⁹ *Ta'rikh-i-Guzida*, text, p. 515.

¹⁰ *Ibid.*, p. 522.

¹¹ Perhaps a mistake for مهتدی as a variant of the present مهتدی.

¹² Ḥabibu's-Siyar, III, p. 77 (of the lith. ed.).

¹³ The average duration of an Imamatus is 30 years in this pedigree. But in this place it is only 23, although the first of the three "hidden" Imams came (as the story says) to Alamūt as a young boy (kūdak).

¹⁴ *Ta'rikh-i-Guzida* (p. 522) says that Ḥasan Ṣabbāḥ brought him from Egypt with him, but Rouḍatū's-Ṣafā and, after it, Ḥabibu's-Siyar, give another version by which this kūdak was brought to Alamūt by an emissary of Nizār ابو الحسن ممدی. The details of the story make it suspicious.

he is hidden it is the duty of the Hujjat and the dā'is to show him to the believers. From the point of view of the sectarian religious psychology it is incredible that for seventy years this question could remain unsettled. Therefore it is necessary to admit that either there were some genuine Imams, or, what seems more probable, they were still the same Fatimide khalifs (undoubtedly for a long time still in the remote corners of the Ismaili world), recognised only nominally (and rejected afterwards after the reform of Hasan). The most disappointing time arrived for the true believers when after the death of Āmir (524 A.H.)¹⁵ the next khalif, Hafiz, was not his son, nor even the son of an Imam at all. Whatever might be the reasons, the pretexts and the real circumstances accompanying Hasan's declaration of himself as an Imam, it was probably done not without difficulty, as is proved by the extraordinary measures taken to effect it. It was probably the most grotesque act in the whole course of history, when a man in an extremely solemn assembly, in front of many thousands of people, personally declared himself to be the incarnated spirit of another man, who died five hundred years ago, and, at the same time, of God himself.¹⁶

23-27. Dates are given as in Ta'rikh-i-Guzida.

31. It might be of great interest to find out whether this Imam is the same person as Khudāwand Muhammad, the descendant of the rulers of Alamūt, who appears in about 776-791 A.H. as a religious head of the Ismailis of the Caspian provinces.¹⁷ It is quite possible that the descendants of this dynasty who are mentioned as having stayed at Sultaniya up to the end of the IX c. A.H. were the next Imams in this succession.

32-38. The strange title Āghā. (usually applied to the eunuchs) in the names of Hujjats 33 and 35, is difficult to be explained, but the title 'Beg' in three successive generations may show that the Imams resided in the country where Turkish influence was felt sufficiently strong (may be in North-western Persia). In the time of one of these incarnations (37 or 38), by approximate calculation, the first millennium after Muhammad was to come to an end, and a new one to begin with the manifestation of the Imam in his full glory. Who he was in this list it is impossible to say. But it is not impossible also that the expectation was postponed.

39. Very strange is the title "Ḥājib" of this Hujjat which means 'a chamberlain' and was used at the courts of kings in the earlier times.

¹⁵ He had no male offspring, and was killed by an Ismaili of the Eastern sect. Cf. Cl. Huart, *Histoire des Arabes*, v. I (1912), p. 349.

¹⁶ The description of this event, which took place on 17th Ramaḍān 559 A.H., is given in Ta'rikh-i-Guzida, Rouḍatu's-Ṣafā, Habibu's-Siyar, etc. (E. G. Browne, op. cit., p. II, p. 454). The term *Qiyāmat* or *Qiyāmat-i-buzurg* is probably an allusion to the *Qiyāmat*, resurrection, of 'Ali, incarnated in the Imams. The fact which was so strange to the above-mentioned Muhammadan writers, that 17th of Ramaḍān, the day when 'Ali was killed, was declared as a festival, may find some explanation in the early beliefs that not 'Ali, but the Devil in his form was killed (see Shahrastani, ed. Cureton, p. 132), and that 'Ali never died but remains on the moon (as the Nusayris think), or on the clouds (several early sects). *Haft-Bāb* gives a description of the same event, but there is practically no difference from those usually given except in honorific titles, etc., generously distributed amongst all the prominent sectarian personages.

¹⁷ H. Rabino, *Rulers of Gilan*, J.R.A.S., 1920, p. 244.

40. Still more strange is the appearance of a woman as a Hujjat, but there is no mistake in the list and the sectarians confirm it quite clearly.

44. According to the sectarian tradition, confirmed by history, he was killed in Yazd. Fath 'Ali Shāh in whose reign it happened (1818), tried however to win the favour of the family and married one of his daughters to the son of Khalilu'l-lah.¹⁸

45. He came to India in 1840, after many adventures, as the sectarians relate, through Afghanistan and the regions on the Upper Oxus.¹⁹

47. The Hujjat of the present Agha Khan, Sayyid Abū'l-Hasan died while still a child of six months. Therefore, as the sectarians say, the duty of Hujjat passed also to Agha Khan (which seems to be not quite in agreement with the sectarian doctrines).

B. *The Poem of Incarnations.*

This poem of Riqāt (or Ruqāt),¹ probably a purely sectarian poet, whom I could not trace anywhere, was intended apparently as a concise exposition of the chief principles of the Ismaili doctrine for the lower degrees of the initiated. Unfortunately it breaks off at the fifteenth verse and it would be extremely interesting to find the end of it. Versified expositions of this sort for everything, religious rules as well as grammar, vocabularies, etc., are still extremely popular in Persia as also all over eastern countries, and we may reasonably expect that other specimens of the same kind are extant.

The language has nothing particular in it and seems to be quite modern. The only antiquated word, *burnā* (v. 5)² was remembered by the author and introduced here for the sake of the rhyme only. The text, as I have already stated, is in very bad condition.

There is a very interesting question, still quite dark to me, which arises inevitably every time quotations from the Qoran are used in the sectarian writings. Some of the Ismaili books which I have seen attribute to it no great importance, as does the author of the "Book on recognition of the Imam," who somewhat sceptically³ admits it to be the 'word of God,' citing it as an evidence rather on the side of his adversaries. But in other books as *Ummu'l-kitāb*, which is considered as ancient and very venerated, every page is filled with Qoranic citations treated with the greatest respect. My insistent inquiries amongst the sectarians were invariably replied to in a most evasive way and it seemed that the Ismailis were afraid to touch this question. Whatever the truth may be, the author of this poem seems to attach to

¹⁸ H. Yule, "The Book of Ser Marco Polo," v. I, p. 146.

¹⁹ Op. cit., v. I, pp. 146-147. Cf. also a short notice on his brother and the next Imam in *Ṭarā'iqu'l-Ḥaqā'iq*, part III, p. 189. He appears to have personally told the author of that book that he studied a certain time in Kāzīmayn (shrine near Baghdad). This statement seems to be quite strange.

¹ So the sectarians spell his name. The etymology of this word however is extremely doubtful, and I would prefer reading *Rufāt*, which means 'trifle, something broken, useless', and therefore could be easily chosen by a believer for the *takhalluṣ* of a religious poet as a sign of his great humility and confession of sinfulness. (There is a village called *Riqāt* about 12-15 miles from Birjand in a side valley, in a south-western direction).

² A proof that this word is not used now and understood by the uneducated is a gloss on the margin جوان.

³ Cf. text, f. 6v.

it great importance and gives some good specimens of the application of *ta'wil*, the doctrine of allegoric interpretation so essential to the Ismaili system.

The principles discussed in this part of the poem give nothing new, of course, but are important evidence for the definition of the position held by the sectarian beliefs in Persia towards those of the East or West. Many principles, and especially their details, show a close connection between this branch and the doctrines current in the regions of the Upper Oxus. They may be summarised as follows:—

1. Ali is the real God as possessing all the attributes of Deity.
2. He was incarnated not only in the time of Muhammad, but in every one of the millennial periods which have elapsed since the creation of the material world.
3. Gabriel, who revealed the religion from God, was in fact Salman Farsi.

قصیده ذریه^۱ من کلام زکات علیه الرحمة

۱	علي بود نبود اين دهر پيدا،	ز قدرت کرد عرش و فرش برپا،
2	علي هم لا يزال ولا يمكن است،	بود پنمان ز ناييفا و اعما،
3	علي اسرار سر لو كشف بود،	بود در ظاهر و باطن هویدا،
4	علي را قادر و قدرت نما دان،	ندارد هم کفی باشد چه یکتا،
5	علي هم ساتر و ستار باشد،	علي بخشد کفاه پيرو بُرنا،
6	علي استاد جبرئيل ^۲ سلمان،	گشوده ^۳ شوکت ^۴ آن شاه والا،
7	علي در سورة ^۵ سابع ^۶ و ثاني ^۷ ،	الف لام و هم او باشد خلقنا، ^۸
8	علي فرستاد تورات و انجيل ^۹ ،	علي وصفش عيان شد ^{۱۰} در محفها، ^{۱۱}
9	برو تو ذریه ^{۱۱} بر خوان ز فرقان،	بشو بعضها من بعض جویا،
10	علي را ذریه ^{۱۲} يکت يکت بگويم،	اگر يکت لحظه کوش خود کفی وا،
11	علي در عهد آدم شيفت بودی، ^{۱۳}	ولي از چشم ناقابل مخفنا،
12	علي در جامه ^{۱۴} ساه آمده نيز،	مفائق کی بداند سر معنا،
13	علي مولا ملک سلام بودی، ^{۱۵}	ز بودش هست اين عالم چه بری،
14	علي در جامه ^{۱۶} سلطان بر آمد،	بدا: اين جامها ر (ا چون) هلاهما، ^{۱۷}
15	علي خود بود هارون ولايت،	که داده يد ^{۱۸} بيضا را بموسی،

۱ در رتبه ۱. ۲ Follows است against the metre. ۳ Follows ز. ۴ شوکت followed by something illegible.
 ۵ سبع. ۶ الثاني. ۷ تلنا. ۸ The number of syllables and their prosodic value is correct, but the order is wrong.
 ۹ است. ۱۰ صهفا. ۱۱ ذریه. ۱۲ ذریه و.
 ۱۳ بود. ۱۴ بود. ۱۵ Sic, against the metre. ۱۶ دید و.

TRANSLATION.

The poem of the incarnations¹ by Riqāt, the Mercy of God be upon him!

1. Ali was existent before this world appeared, he made to stand the heaven and the earth by his mightiness.
2. Ali is eternal, omnipresent,² (but) hidden from the blind or short-sighted.
3. Ali was the secret of the mystery (about which it was said): 'O that it would be revealed!³ He is manifested in the world of the open and the hidden.
4. Ali is the powerful, manifesting his might, know it. He has no rival⁴ and is the One.
5. Ali forgives men, forgives them always. He remits the sins of the old and young.
6. Ali is the preceptor and Gabriel is Salman, who revealed (the mystery) of that great king's glory.
7. Ali is Alif and Lam in the second and seventh chapters⁵ of the Qoran, and about him it is said 'we created' (man, etc.)⁶
8. Ali has sent the Gospel and the Bible, and his praise is openly expressed in the book of Abraham.⁷
9. Go, recite from the Qoran the chapter of the 'Descendants,'⁸ and seek those who descended 'one from the other.'⁹
10. I will tell thee the incarnations of Ali one by one, if thou wilt open thy ears for a moment.
11. Ali was Seth in the epoch of Adam,¹⁰ but it is concealed from the eyes of those incapable of understanding this.
12. Ali came also 'dressed'¹¹ as Shem¹²—how can a dissembler acquire the mystery of this doctrine.¹²

¹ This title is given to this poem owing to the incarnations of Ali discussed in the verses 11-15 of this poem (and probably further in the complete text). The word *dhurriyyah* is mentioned many times in the Qoran in the sense of "the posterity, descendants." The author gives to it another sense, in accordance with the *ta'wil* of the *Sura* III, 30 'And God has preferred to the worlds Adam, and Noah, and the families of Abraham and 'Amrān who descended one from the other.' Something like this is stated in XIX, 59, where the same personages are mentioned.

² These expressions are very common in the Qoran and it is difficult to say which particular place is alluded to. They never appear together in the same verse.

³ This expression, although it seems to be quite Qoranic does not appear in that book.

⁴ Allusion to the Qoran, CXII, 4.

⁵ These are again the so much admired mysterious letters in the beginning of some chapters of the Qoran. The suras second and seventh begin with them. This is the reason of my correction of the text, although I quite realise that the Muhammadans very rarely quote the suras by their number, but by name. ⁶ The Qoran, XCVIII, 2.

⁷ In the Qoran the word *صحف* is still used in the sense of a book generally (ib. LXXXVII, 19 where *صحف إبراهيم* and *صحف موسى* are mentioned). I translate it in accordance with the later practice when the word *صحف* became used almost exclusively in the sense of Abraham's legendary book.

⁸ See above, footnote 1.

⁹ Part of the same verse, III, 30.

¹⁰ Haft-Bāb gives *ملك شولم يعنى شيت*. The western tradition is the same. cf. E. G. Browne, *Lit. Hist. of Persia*, v. I, 409.

¹¹ A typical sectarian expression. Especially Ali-ilahis are fond of it, saying that God can descend in any form just as a man can dress himself as Kurd, or Persian, or Ferengi.

¹² So in the western branch, E. G. Browne, loc. cit. Haft-Bāb gives a strange name *ملك يزداق*.

13. Ali was Mawlānā Maliku's-Salām,¹³ he by whose existence this world stays.
 14. Ali came in the form of Suiṭān.¹⁴ Ali these forms (which he took as a man puts on his clothing) regard to be like moons.
 15. Ali was himself the holy Aaron,¹⁵ who has given 'the whitened hand' to Moses.¹⁶

¹³ So in Haft-Bāb. In the western branch Ishmael, (E. G. Browne, loc. cit.).

¹⁴ In Haft-Bāb and the western belief there is no intermediary epoch between that of Abraham and Moses. The name of Sultān is therefore extremely mysterious. (This name by many sectarians of Persia, chiefly Ali-ilahi, is applied to the King of Evil).

¹⁵ So in the western branch (E. G. Browne, *ibid*). Haft-Bāb instead of Aaron gives Iskandar Dhū'l-Qarnayn, i.e. Alexander the Macedonian (perhaps because his worship is still very popular in the countries on the Upper Oxus where there are occasionally found the families of chiefs descending 'directly' from the great warrior).

¹⁶ The common version of the biblical story about Moses' miracles in the presence of Pharaoh.

APPENDIX.

After this paper had been completed I received from Persia yet another list of the Ismaili Imams. This new version agrees generally with that given above, except in a few points, and contains 48 names instead of 47. The discrepancy is found in the names of the Imams mentioned in the list above under serial numbers as follows :—

- (a) 25. In the new list حسن is added.
 (b) 27. Added خورشاه .
 (c) 35. Reads بوذر علي instead.
 (d) 38. Reads نورالدين instead.
 (e) Between 42 and 43 قاسم علي is given.

W. I.

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THE PRAKRIT DHĀTV-ĀDĒŚAS
ACCORDING TO THE WESTERN AND THE EASTERN SCHOOLS OF
PRAKRIT GRAMMARIANS.

BY

SIR GEORGE ABRAHAM GRIERSON, K.C.I.E., PH.D., D.LITT., LL.D., *Vāgīśa*,
Honorary Fellow of the Asiatic Society of Bengal and of the Royal Danish Academy of Sciences ;
Fellow of the British Academy ; Correspondant Étranger de l'Institut de France ; Honorary
Member of the Nāgārī Pracārīnī Sabhā, the American Oriental Society, Société Finno-
Ougrienne, the International Phonetic Association, the Bihar and Orissa Research
Society, and the Modern Language Association ; Foreign Associate Member
of the Société Asiatique de Paris ; Corresponding Member of the
Königliche Gesellschaft der Wissenschaften zu Göttingen ;
Vice-President of the Royal Asiatic Society.



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THE PRAKRIT DHĀTV-ĀDĒŚAS.

The Prakrit Grammarians discuss at considerable length what they call *Dhātv-ādēśas*. As a grammatical term, *ādēśa* means 'substitute,' and a *Dhātv-ādēśa* is the Prakrit verbal root which is to be, or may be, substituted for a Sanskrit verbal root. Thus, according to Hēmacandra, iv, 60, the Prakrit root *hō-* is one of the *ādēśas* for the Sanskrit root *bhū-*, so that one of the Prakrit equivalents of *bhavati* is *hōi*.

Prakrit verbal roots may be looked upon as falling into four classes, viz. :—

1. Those which are identical with the corresponding Sanskrit roots, such a root is *cal-*, which is identical in both languages, so that Sanskrit *calati* = Prakrit *calai*. As nothing can be substituted for itself, such a Prakrit root is not an *ādēśa*.

2. Those which are regularly derived, according to the ordinary phonetic rules, from the corresponding Sanskrit forms. Thus, under the phonetic rule that Sanskrit medial *ḍ* becomes Prakrit *l*, the Sanskrit root *ḍīḍ-* becomes *ḍīl-* in Prakrit, so that Sanskrit *ḍīḍayati* becomes Prakrit *ḍīlī*. Again, such a root cannot be called an *ādēśa*, for there is no substitution, but only development.¹

3. Those which cannot be connected with any corresponding Sanskrit roots by any admitted phonetic rule. Thus, an *ādēśa* for the Sanskrit root *cal-* is *call-*, with the *l* doubled, so that the Sanskrit *calati* may be represented by *callai*, as well as by the *calai* mentioned under head 1. These are all true *ādēśas*, and a great number of them are borrowed *dēśya* words, and cannot be referred to Sanskrit at all.²

4. Those which are regularly derived from Sanskrit roots, but which have changed their meaning, and which are therefore, by Prakrit Grammarians equated with, and substituted for, some other Sanskrit root which has a meaning more nearly akin to the acquired meaning of the Prakrit word. Being substitutes, they are also properly called *ādēśas*. As an example, we may take the Sanskrit compounded root *prēkṣ-*, the literal meaning of which is 'to look at,' 'behold.' In Prakrit, it becomes quite regularly *ḥecch-*, but this has acquired the meaning of 'seeing' in a more general sense, and is hence divorced by the grammarians from the root *prēkṣ-*, and is given as an *ādēśa* for the much more general Sanskrit root *ḍṛṣ-*. There is no reason for assuming, as is sometimes done, that this ascription to *ḍṛṣ-* is a blunder of the grammarians. It would be absurd to suppose that scholars like Hēmacandra or Mārkaṇḍēya were ignorant of the manifest etymological connexion between *ḥecch-* and *prēkṣ-*. They were certainly fully aware of it, and when they deliberately equated *ḥecch-* with *ḍṛṣ-*, and not with *prēkṣ-*, they did so because there

¹ Grammarians are sometimes careless in this respect. Thus RT. I, viii, 27 gives *hīl-* as an *ādēśa* of *hriḍ-*, and (41) *ḍīl-* as an *ādēśa* of *ḍīḍ-*. This was unnecessary, and the words are ignored, as *ādēśas*, by other grammarians.

² Cf. Jacobi, *Bhavissalla Kaha von Dhanavāla*, p. 63*.

had been a change of meaning. This is well brought out by a remark of Mārkaṇḍeya when dealing with the Śaurasēnī dialect (ix, 112). There are two equally possible Prakrit forms of the word *prēkṣ-*. One is the semi-Tatsama *pecch-*, and the other is the Tadbhava *pekkh-*. In ix, 112, Mārkaṇḍeya differentiates these two forms. He says that *pecch-* is an ādēśa for *dyś-*, but that *pekkh-* is the equivalent of *prēkṣ-*.¹ In other words, while the form *pekkh-* still retains the slightly specialized connotation of *prēkṣ-*, the form *pecch-* has, in Prakrit, acquired the wider connotation of 'seeing' in general.

We thus see that ādēśas are confined to the last two classes of Prakrit roots. They cannot belong to the first or second.

The following pages deal with 1590 Prakrit verbal forms collected from :—

(1) the *Siddhahēmacandra* of Hēmacandra (Hc.), the most generally accepted Prakrit grammarian of Western India.

And from the following works composed in Eastern India :—

- (2) The *Prākṛta-prakāśa* of Vararuci (Vr.).
- (3) The *Samkṣipta-sāra* of Kramadīśvara (KI.).
- (4) The *Prākṛta-kalpataru* of Rāma-śarman (Tarkavāgīśa) (RT.).
- (5) The *Prākṛta-sarvasva* of Mārkaṇḍeya Kavindra (Mk.).

The following remarks are offered regarding the above :—

(1) The *Siddhahēmacandra*. This work is well known to all students of Prakrit from the editions of Pischel (Bonn, 1877, 1880) and of Śaṅkar Pāṇḍurang Paṇḍit (Bombay, 1900). The Dhātv-ādēśas are contained in the first 259 sūtras of the fourth Pāda of this work. There are besides odd dhātv-ādēśas in the subsequent sūtras of this pāda dealing with Śaurasēnī, Māgadhī, Paiśācī, and Apabhraṁśa, and one or two other strays in the earlier pādas. These I have also included. The total number of dhātv-ādēśas taken from this source is about 930. Of these, on Hēmacandra's own showing, 388 are borrowed Dēśya words. They are quoted as such in the commentary to his *Dēśināmamālā* (DNM.), and are there mentioned as not repeated from his grammar. Besides these, there are perhaps half-a-dozen fresh dhātv-ādēśas found only in the *Dēśināmamālā*. These, of course, are also Dēśya words. In Index II, I have marked every word occurring in Hēmacandra's grammar and also in the *Dēśināmamālā* with an asterisk, so that they may easily be identified. As for the few that occur only in the latter work, I have mentioned the fact in the column of remarks. In Index I, I have prefixed to each entry under the head of Hēmacandra a reference to the particular sūtra in which it is to be found. As nearly all occur in the fourth pāda, I have in such cases given only the number of the sūtra. For the few that come from elsewhere, I have given the further necessary particulars.

(2) The *Prākṛta-prakāśa* of Vararuci. This also is well known, and needs no further description from me. The *Dhātv-ādēśas* are contained in the eighth *parichēda*. I have used Cowell's edition (London, 1868). This, for its time was a wonderfully accurate work, but the progress of knowledge during the past half-cen-

¹ But see Hultzsch in ZDMG, lxvi (1912), p. 710. It will be observed that here I venture to differ from the eminent scholar.

tury has revealed in it a few mistakes, which, where necessary, I have corrected, drawing attention to the fact in the appropriate place. One general remark must also be made. Whether ऋ or ॠ was intended, Cowell invariably printed ऋ.¹ I have followed him in this, though, in some cases of initials, ॠ would certainly have been more correct. In order to remedy the possible confusion in alphabetical order, I have given cross references where this occurs in Index II. The later Eastern grammarians always refer to Vararuci, under the name of Kātyāyana, as their ultimate authority,—occasionally opposing him to Śākalya.²

(3) The *Samkṣipta-sāra* of Kramadīśvara. For this work, see Pischel's Prakrit Grammar, § 37. The Prakrit portion of this is divided into (a) *svāra-kārya*, (b) *hal-kārya*, (c) *subanta-kārya*, (d) *tinanta-kārya*, (e) *apabhraṃsa-kārya*, and (f) *chandaḥ-kārya*. The dhātv-ādēśas are given in sūtras 46–83 of the *tinanta-kārya*.³ My authorities for this work are the following:—An edition prepared by Rājēndralāla Mitra (R.L.M.) and printed for the Bibliotheca Indica, but, fortunately for his reputation, never published. The date of the printing is unknown to me, but was probably somewhere about the year 1870. It has just the value of a not very good MS. My other authority is the edition of Delius (D.) published in his *Radices Pracriticæ* (Bonn, 1839). This contains many mistakes due to the editor not being thoroughly familiar with the old Bengali character in which the MS. on which his edition was based was written. It thus not only reproduces the errors of the original MS., but also includes mistakes of decipherment. To Rājēndralāla Mitra, being a native of Bengal, the Bengali character was of course familiar, and hence his edition is free from the latter group of errors, but it reproduces numerous uncorrected errors of the MS. or MSS. which he consulted. In taking Kramadīśvara's Dhātv-ādēśas, I have in the main based my selections on the readings of R.L.M., but, when there is any serious difference with D., I have given the readings of the latter also. That my corrections invariably reproduce the original text of the author, I do not for a moment pretend, and any statement that is unsupported by other authorities must be received with reserve. On the other hand the work will be found useful for controlling or substantiating the statements of other writers.

(4) The *Prākṛta-kalpataru* of Rāma-śarmaṇ (Tarkavāgiśa) exists, so far as is known, in a single copy,—Sanskrit MS. 946 of the India Office Library. The author states that his work is based on a previous grammar by Lanākēśvara,⁴ and is illustrated by examples taken from the *Sctubandha* and other sources. It is described at some length by Lassen on pp. 19ff. of his *Institutiones Linguae Pracriticæ* (Bonn, 1837), who calls the author Rāmatarkavāgiśa, and in an appendix gives an extract from it dealing with the varieties of Apabhraṃsa.

¹ See his preface, p. xiv. Cf. Pischel's Grammar, § 201.

² Cf. R.F. I, viii, 42 in the Appendix below. In I, viii, 1, R.F. in the commentary quotes *ṭvarai* (probably to be read *ṭvai*) as, in Śākalya's opinion, the equivalent of *ṭvate*. Here Śākalya agrees with Hc. iv, 17, as against the *ṭvarai* of Vi, viii, 4.

³ The numbering of Delius's edition differs. R.L.M. 46–53 = D. 1; R.L.M. 54–D. 2, and so on fairly regularly.

⁴ Evidently the *Prākṛta kamadhenu*, described by Rājēndralāla Mitra in Nos. 3157 and 3158 of Vol. IX of his *Notices of Sanskrit MSS.* To my great regret, the work there described has disappeared, and cannot now be traced.

This 'Wishing-Tree of Prakrit' is divided into three *Śākhās*, or 'Branches,' Each *Śākhā* is divided into *Stabakas*, or 'Clusters,' and each *Stabaka* into *Kusumas*, or 'Flowers.' Each 'Flower' consists of a single verse with, in the earlier *Stabakas*, a full prose Commentary. The Dhātṽ-ādēśas form the subject of the 8th *Stabaka* of the first *Śākhā*, which contains 42 *Kusumas*. The MS. is written in an old form of the Bengali character, and, being not at all easy to read, contains many doubtful passages.¹ It is also full of errors, having been written by a scribe who seems to have been ignorant of Prakrit and to have been copying difficult handwriting. It is however often possible to correct with certainty the scribal errors. The metre is an invaluable check, and, moreover, nearly every Prakrit word is repeated in the Commentary. I have therefore found it possible to put together a fairly correct text, leaving comparatively few doubtful passages, and in the Appendix to this essay I give the text of this *Stabaka*, so far as I have been able to restore it. As so restored, the text of the *Prākṛta-kalpataru* is of greater value than that of Kramadīśvara's *Samkṣipta-sāra*; but, as in the case of that work, it cannot be accepted as an authority without reserves, though it will be found useful for controlling or substantiating statements found in other works.

(5) The *Prākṛta-sarvasva* of Mārkaṇḍēya Kavīndra is known through the edition published in the series called the *Grantha-pradarsinī* (Serīngapatam, 1912). This work is divided into twenty *Pādas*,² of which the seventh is devoted to the Dhātṽ-ādēśas of Mahārāṣṭrī. Subsequent *Pādas* give the Dhātṽ-ādēśas for other Prakrit dialects. As the great majority are found in the seventh *Pāda*, I have, in Index I, given only the sūtra numbers for the words occurring therein. When they are found elsewhere, I have also given the number of the *Pāda* in Roman numerals.

My list of Mārkaṇḍēya's Dhātṽ-ādēśas is based on the printed edition above referred to, but I have also consulted MS. materials, and, where I have departed from it, this is in each case duly noted.³

All the Dhātṽ-ādēśas in the above-mentioned works⁴ have been abstracted by me, and arranged in the two indexes that follow. In the first Index, the Sanskrit roots are arranged in alphabetical order, and the various adēśas for each are given opposite them. In the second Index, the Dhātṽ-ādēśas themselves are arranged in

¹ E.g. The same character is used throughout for *ra*, *va*, *ba*, and sometimes *ca*; for *ma* and *sa*, and so on for other letters.

² In such a work, the use of the word *pāda* is exceptional. The word is properly confined to works having four sections, in allusion to four-footed animals.

³ In addition to the printed text (P.), I have collated (1) an old MS. in the Oriya character (O.) lent to me by Mahamahāpādhyaya Sadaśiva Miśra, of Puri; (2, 3) two copies of the Asiatic Society of Bengal's MS. No. 1555 made for Dr. Hoernle, one in the Nāgari (Hu.) and the other in the Bengali (Hb.) character; (4) the India Office Mackenzie MS. No. 70 (Io.); and (5) the Bodleian Wilson MS. No. 158b (Ox.). Examination of these five MSS. shows that they are all derived from the same common ancestor, which was different from the main source of P. This is proved by the fact that the original of the five had some leaves misplaced and that the result of this misplacement appears in all of them. Of the five, O. is by far the most correct. Next in value are Hu. and Hb., which mutually control each other. Io. and Ox. are copies of one and the same MS., or, perhaps, one is copied from the other. Neither is correct.

⁴ The one exception is that I have not included the few Dhātṽ-ādēśas given by Rama-sarman for Prakrit dialects other than Mahārāṣṭrī. At present, the text of those portions of his grammar is too uncertain for it to be of any use

alphabetical order, and opposite each are given the Sanskrit equivalents, as stated by each grammarian.

These Indexes are not confined to true *ādēśas*. They also include many perfectly regular Prakrit words, formed according to accepted rules for Prakrit phonetic changes. Properly speaking these should not be included in the Indexes. They appear there because, as stated by the grammarians, many of the *ādēśas* are optional,—that is to say, either the regular Prakrit form or the *ādēśa* may be used as the equivalent of a given Sanskrit form. In such cases, the grammarians give both the forms, the optional, regular, form being introduced by some such word as ‘*pakṣē,*’ ‘on the other hand.’ Thus, for the Sanskrit *gacchati*, Hēmacandra gives first 21 optional *ādēśas*, and then adds ‘*pakṣē gacchati,*’ the last being the regular form, making 22 in all, and I have therefore included the whole 22 in the Indexes. It will be noticed that some of the words are enclosed in square brackets. These are words which are not given *literatim* by the grammarians, but which are to be inferred from their statements. For instance, under the root *grah-* one of the *ādēśas* for *grahitum* shown against Rāma-śarman is [*gēhiium*]. A reference to RT. I, viii, 4 will show that he gives a series *geṇhiavvam*, *geṇhium*, *geṇhiūna*, and that he then adds that some authorities give *gēhiavvam*, etc., from which it is clearly to be inferred that according to these authorities *gēhiium* may be used as well as *geṇhium*, I have therefore shown *gēhiium* in square brackets.

It will be remembered that the fourth class of Prakrit verbal roots mentioned above (p. 77) consists of those which are regularly derived from Sanskrit, but which have changed their meaning. I quoted as an example the Sanskrit *prēkṣatē*, he looks at. This, by a regular phonetic change, becomes the Śaurasēni *peccadi*, which, as it has acquired the more general connotation of ‘seeing’ instead of the somewhat special connotation of ‘looking at,’ is given as an *ādēśa* for *paśyati*, instead of for *prēkṣatē*. We may here note a difference which I have observed between Hēmacandra and the Eastern Grammarians. Hc. seems to prefer to group his *ādēśas* according to their generalized sense, while the grouping of the Easterners tends towards specialization. Take, for example, the root *gam-*. Here, as already stated, Hc. gives no less than 21 *ādēśas*. It is not to be expected that all these twenty-one are exact synonyms; most of them must have been used to indicate more or less specialized meanings of the verb ‘to go.’ But Hc. clumps them together under one general head. That some of them do have specialized meanings is borne out by the Easterners, not one of whom gives a single *ādēśa* for the Sanskrit *gacchati*. They are all content with the regular form *gacchati*. One only of Hc.’s 21 *ādēśas* to this verb do they accept, and this they attribute to a different Sanskrit verb with a more specialized meaning. The exception is Hc.’s *vōlai*, which the Easterners give as an *ādēśa*, not of *gacchati*, but of *kramatē*, with the specialized meaning of ‘he proceeds.’ A more striking instance is Hc.’s *avasēhai*, *avaharai*, and *ṇivahai*, all of which he equates with *gacchati*, he goes; but here *gam-* must be intended with its specialized sense of ‘going’ in the sense of ‘dying,’ for he himself also equates them with *naśyati*, he perishes. Another example is the word *uddhumai*, which Hc. gives as an

ādēsa for *pūrayati*, he fills. That the word really means 'filling' in a very special sense is shown by the fact that the Easterners equate the word, not with *pūrayati*, but with *uddhamati*. When, therefore, Hc. equates it with *pūrayati*, he does not use the latter word in its general sense of 'filling,' but with the special meaning of 'filling with wind,' 'inflating,' 'blowing a trumpet.'

These instances illustrate a fact, hitherto much neglected by European scholars,—that there was never one uniform school of Prakrit Grammarians for the whole of India. There were certainly at least an Eastern and a Western school¹ which had marked variations in their teachings. Each school had its own distinct line of descent. In each case, teacher succeeded teacher, inheriting the traditions of his predecessors, and each adding his contribution of new facts gathered from literature or from his own experience. But each school developed independently of the other, so that after the lapse of centuries the divergencies became very wide. We have seen how Rāma-śarman acknowledged his debt to his predecessor Lan̄kēśvara, and how he added to what he had inherited from him by collecting examples from the Sētubandha, and so it was with the others. Thus, Mārkaṇḍeya states that his teaching is derived from Śākalya, Bharata, Kōhala, Vararuci, Bhāmaha, Vasantarāja, and others, and that he has added further examples from literature. We know nothing of the nationality of the first three names. Vararuci and Vasantarāja, his commentator, were Easterners, and Bhāmaha belonged neither to East nor to West, but was a native of Kashmir. The Eastern line of teachers was therefore Vararuci (with Vasantarāja), Kramadīśvara, Lan̄kēśvara, Rāma-śarman, and Mārkaṇḍeya.² There were also eminent writers of this school. Bāṇa belonged to it, to mention one of the most celebrated. From internal evidence I consider the author of a great part of the Prākṛta-paiṅgala another example. Of works less known in Europe may be mentioned the *Kīrti-lalā* of Vidyāpati Thākur, the *Dōhakōsas* lately edited by Mahamahāpādhyaya Hara-prasād Śāstrī, and the numerous unpublished dramas by Maithili poets. On the other hand, in the lists of teachers of the Western school, the only name common to it and to the Eastern is that of Bhāmaha, and he, as I have said, was a Kashmirī. The Western school claims descent, not from Vararuci, to whom its writers never refer by name, but from the author of the so-called Vālmiki sutras,³ now extant only in a much expanded form. These were adopted, with their entire grammatical terminology by Trivikrama, Lakṣmīdhara, Sindhuraja, and others. Hēmacandra also followed their teaching, but employed the special terminology used by him for his Sanskrit grammar. We thus see that the two lines of teachers of the East and of the West were entirely distinct from each other. The only link between them was the Kāshmirī Bhāmaha.

Even in the accounts of Maharaṣṭrī, where at least we might expect agreement,

¹ Probably also a Southern. See Barnett, *J.E.A.S.*, 1921, p. 388.

² Mārkaṇḍeya was probably later than Rāma-śarman, for, without naming him, he appears to have borrowed from him the whole account of minor Apabhraṃsa dialects. It is, however, possible that they both have borrowed from some earlier writer. We cannot decide this till we have seen Lan̄kēśvara's grammar.

³ See verses 15, 22 of the Introduction to the *Ṣaḍbhaṣa-candrika*.

there are differences between the two schools. For instance, Hēmacandra (ii, 209) denies the correctness of the rule laid down by Vararuci (ii, 7), and dutifully followed by Kramadīśvara (ii, 28), Rāma-śarman (ii, 5), and Mārkaṇḍeya (ii, 7). In vi, 4, and on other occasions, Mārkaṇḍeya roundly accuses the western Rājaśekhara of carelessly writing bad Prakrit (तस्यैवाविमृश्यकारित्वम्). The gaṇas often differ widely.¹ But the widest difference is in regard to the Dhātv-ādēśas, which form the subject of these pages. Let us take the two authors whose lists are most full,—Hēmacandra (Western) and Mārkaṇḍeya (Eastern)—and compare the statistics.² We have seen that we have altogether 1590 ādēśas. Of these Hc. and Mk. are together responsible for 1548, Hc. for 930 and Mk. for 618. Yet Hc. gives 707 ādēśas which are ignored by Mk., and Mk. gives 395 ādēśas which are ignored by Hc. Only 223 ādēśas are common to the two authorities.

We have a valuable list of admitted Dēśya Dhātv-ādēśas in Hēmacandra's *Dēśināmamālā*. As already stated, of Hc.'s 930 words, 388 are such Dēśyas, while, of Mk.'s 618, there are only 65. While, therefore, 35 per cent of Hc.'s Dhātv-ādēśas are dēśya, Mk. has only 11 per cent of such words. This discrepancy is striking, and leads us to suspect that most of Hc.'s dēśya ādēśas are dēśya words belonging to his part of the country, i.e. are of western origin.³

A further point concerns the Sanskrit meanings attached to the Dhātv-ādēśas. These meanings are necessarily matters of school-tradition. I have already given a few examples of how Hc.'s Sanskrit equivalents to Prakrit words are not the same as those given by the Easterners. If we take statistics, we find that out of the 223 ādēśas common to Hc. and to Mk., no less than 62 are given different Sanskrit equivalents by the two authors.

But these figures are hardly necessary. A cursory perusal of the Indexes themselves is sufficient to show the way in which the two schools differ. The Easterners as a body agree among themselves in their selection of ādēśas and in their translations, and this they do whether they differ from Hc. or not.⁴

Here we are concerned only with Dhātv-ādēśas, but the same contrasts occur throughout the grammatical systems. This is not the place to give such in detail, but I may repeat here the following general remarks concerning dialects from an article of mine published elsewhere⁵ :—

“ If we consider the dialects, the want of agreement is still more marked. I do not refer so much to Śaurasēni, though the eastern grammarians, Rāma-śarman and Mārkaṇḍeya, treat it much more fully than does Hēmacandra or Trivikrama ; but the eastern account of Māgadhī differs in important points of phonetics and accidence

¹ E.g. Compare Mk.'s *nīdadi* (iii, 71) and *sēvādi* (iii, 75) with Hc. ii, 99.

² The figures may not be quite accurate, as the lists have been checked and corrected over and over again since the calculations were made. But they are sufficiently accurate for our purposes.

³ This is borne out in one interesting case by the root *ham-*. See my article *Ham (gatau)* in *J.R.A.S.*, 1922, p. 77.

⁴ E.g. *ukhrīṇite* > *vikīṇai* (Hc.), but *vikīṇai* (all Easterners). Hc. says *jam̐pai* = *kathavati*, but all Easterners say < *jalpati*, and so on for many others.

⁵ *J.R.A.S.*, 1921, p. 420.

(Māgadhi being an eastern language) from that given by the Westerners. The Easterners describe a number of minor dialects and sub-dialects which are altogether omitted from consideration by the others. The Apabhramśa of Kramadiśvara Rāma-śarman, and Markaṇḍēya departs widely from that of Hēmacandra and Trivikrama, and, when we come to Paiśāci, we find two very different dialects described. Vararuci, Rāma-śarman¹ and Mārkaṇḍēya all agree² in their accounts of a language which they call 'Paiśāci' or 'Paiśācika,' and which is not the same as the language described under that name by Trivikrama, Hēmacandra, Lakṣmidhara, and Simhārāja."

I believe that I have now shown enough to prove that there were at least two distinct schools of Prakrit grammarians in India, just as there were divers schools of Sanskrit philology. Amongst the latter Pāṇini has achieved a position of supreme authority among Indians and among Europeans. Among Europeans, Hēmacandra has acquired almost the same authority for Prakrit, but such is not the case in India. I think I may say positively that, up to the time I left India in 1899, no Paṇḍits of the East recognised the authority of Hēmacandra or of other Jaina grammarians. For them the supreme authority in Prakrit was Vararuci, and Vararuci alone. Other writers, such as those I have mentioned, were also studied,—just as the followers of Pāṇini studied the Kāśikā or the Mahābhāṣya,—but (with the exception of the Kāshmiri Bhāmaha) they were all Easterners, and claimed descent from Vararuci.

Before concluding, I would draw attention to a point of detail in Prakrit philology which appears from these Indexes. There are in them a considerable number of pairs of words, in which one contains a doubled consonant, while the other has in its place a single consonant preceded by a nasal. Such are *ālukkhai*, *ālumkhai*, or *alumghai* (*spṛṣati*); *okkhanai*, *oṅganai* (*kaṇṭi*, *kvaṇṭi*); *cacchai*, *camchai* (*takṣṇōti*); *cappai*, *campai* (*carcayātē*); *jujjai*, *jumjai* (*yunakti*); *thippai*, *thimpai* (*tr̥pyati*); *duucchai*, *duumchai* (*juguṣṣātē*); *phuccai*, Hindī *phumcē* (*par̥yāṣṇōti*); *bhassai*, *bhamsai* (*bhraṣyati*); *rappai*, *rampai* (*takṣṇōti*); *lālappai*, *lālampai* (*vilapātī*). The forms with the double consonant follow a well-known Prakrit rule; but none of the grammarians give any general rule authorising the forms with nasal plus consonant.³ We must therefore conclude that the latter are dēśya forms borrowed by Prakrit. We are, in short, justified in assuming that, at least in some words, some dēśya dialects looked upon a double consonant and nasal plus consonant as interchangeable.

It is also a commonplace that in the modern Indo-Aryan vernaculars (excepting those of North-Western India) a Prakrit double consonant becomes simplified, and

¹ Kramadivara's grammar devotes only two sūtras to this language.

² The one exception is that Vararuci does not allow the hardening of sonants at the beginning of a word or in conjuncts, while the later writers do. It is curious that Hēmacandra evidently knew of this discrepancy in writing his very brief account of Cūlikapaisācika (iv. 327), i.e. of the Paiśāci of the Easterners, which he himself differentiates from his own Paiśāci (so also Trivikrama). Here both he and Trivikrama plainly refer to Vr. x. 3, and equally plainly, rightly or wrongly, misunderstand what is there said. Vr. says that sonants become surds *ayujōr*, i.e. when not forming part of a conjunct consonant. Hc. and Tr. both interpret the expression as meaning 'not in the case of the root *yuj-*.' From this it is plain that they read *ayuji* in their copies of Vararuci, and that they had not seen Bhāmaha's commentary. It is hardly necessary to point out that *ayuji* could also have the sense meant by Vararuci and Bhāmaha.

³ The grammarians do mention a few isolated cases, such as *vamha-* (*vakra-*, **vakha-*), etc. Cf. Pischel §74

the preceding vowel is lengthened in compensation. Familiar examples are Pr. *caḥka-*, Hindi *cāḥ*, a wheel ; Pr. *bhatta-*, H. *bhāt*, boiled rice ; Pr. *hattha-*, H. *hāth*, a hand ; Pr. *duddha-*, H. *dūdh*, milk, and thousands of others. When the Prakrit conjunct is a nasal plus consonant, the nasal becomes *anunāsika*, and the vowel is again lengthened in compensation. Thus, Pr. *kaṃkaṇa-*, Bengali *kākan*, a bracelet ; Pr. *kaṃta-*, H. *kātā*, a thorn ; Pr. *caṃda-*, H. *cād*, the moon ; Pr. *kaṃpa-*, H. *kāp*, trembling, and so on.

Sometimes in the literary modern language, and very frequently indeed in rustic speech, when a Prakrit double consonant is simplified as above, we find *anunāsika* unexpectedly inserted. Thus, the Pr. *mugga* becomes H. *mūg* (not, as we should expect, *mūḡ*), a certain pulse ; so, Pr. *majjha-*, H. *mājh*, in ; Pr. *akkhi-*, H. *ākh*, the eye ; Pr. *sappa-*, H. *sāp*, a snake ; Pr. *maggai-*, H. *māḡē*, he asks ; Pr. *kakkara-*, Bg. *kākar*, gravel ; Pr. *paḥkha-*, H. *pākh*, a wing ; Skr. *sajjā*, Kāshmiri *sanj*, preparation ; Skr. *nīdrā*, Ksh. *nēnd'r*, sleep ; Skr. *naḍvala-*, Ksh. *nambal*, a swamp ; Skr. *madhyē*, Pr. *majjhē*, Ksh. *manz*, in, and so on. Turner (*J.R.A.S.*, 1921, p. 344) and Bloch (*La Formation de la Langue Marathe*, § 66) look upon this as a physiological accident, due to the tendency to raise the velum incompletely, especially in enunciating a long vowel. Turner (l.c.) calls this 'spontaneous nasalization.' Whether spontaneous or not, I think that the pairs of Dhātṽādēśas quoted above show that the nasalization is not peculiar to the modern languages, but has been inherited by them, and that the nasalization was there before the vowel was lengthened in compensation. In the pairs quoted, the nasal plus consonant, as a substitute for a doubled consonant, necessarily, in Prakrit, occurs only after a *short* vowel. In the modern languages, the lengthening of the vowel belongs to a later stage of development, and is compensatory, due to the previously existing nasal being weakened by conversion into *anunāsika*. It seems to be a *Dēśya*, as distinct from a Prakrit, inheritance, and was much more common in *dēśya* words than the few instances noted in Prakrit would lead us to suspect. Anyhow, this frequent so-called spontaneous nasalization has not necessarily arisen in the present stage of the development of the modern languages. It existed in previous stages, and is at least as old as the Dhātṽ-ādēśas of the Prakrit Grammarians.

INDEXES.

The first of the two following Indexes gives all the Dhātv-ādēśas recorded by the five Indian writers whom I have taken as my authorities. These are arranged under the various Sanskrit roots to which they are referred by the different grammarians.

In the second Index, the Dhātv-ādēśas are arranged in their own alphabetical order, and opposite to each is given the Sanskrit form to which, according to each authority it corresponds.

It must be clearly understood that these Indexes represent the views of Indian scholars only. I have deliberately refrained from correcting them, even when, according to the results of European scholarship, they are clearly wrong. For instance, I have shown the word *acchai* as equivalent (according to Rāma-śarman and Mārkaṇḍeya) to *asti*, and (according to Hēmacandra) to *āstē*, although it is universally agreed that it is derived from neither of these words. Similarly, I have shown *peccchai* as the equivalent of *paśyati* because, and only because, Hēmacandra and Kramadīśvara said so, although everyone knows that, from the point of view of etymology, it is derived from *prēkṣatē*. As already explained, the Prakrit grammarians classed their Dhātv-ādēśas according to equivalence of meaning, and not according to derivation.

In the printed edition of Mk. the numbering of the sūtras after 163 is incorrect. In every case I have given the correct numbers, which are generally, after 163, less by one than those of P.

INDEX I.

SANSKRIT—PRAKRIT.

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
t- d- rj-	paryatati ..	(230) pariattai	Cf. cakṣ-, svad-
	atti ..	....	....	....	(12) cakkhai ..	....
rj-	arjati ..	(108) ajjai	Cf. vy-ut-pad-.
	arjyate ..	(108) vidhavai	....	....	....	....
		(251) ajjijjai ..	....	....	....	....
		(251) vidhappai	....	....	....	....
		(251) vidhavij- jai.	....	....	....	....
arjitam ..	(258) vidhat- tam.	....	....	....	....

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
as-(1)	asti	....	(xii, 20) atthi ..	....	....	(116) atthi ..	Vr. Śaurasēni ās-
		....	....	....	(26) acchāē ..	(116) acchāi	Śaurasēni.
as-(2)	nyasyati	(199) ṇimai ..	(xii, 19) acchadi	....	....	....	Cf. ṭṭimajjai ni-sad-
		(199) ṇumai ..	....	....	....	....	Cf. chad- numajjai śi- and ni-
	paryasyati	....	....	....	(34) khujjai ..	(121) khujjai ..	Cf. praty- pra-lu-
		(200) palotṭai	....	....	....	....
		(200) pallaṭṭai	....	....	....	(121) pallaṭṭai	
		(200) palhat- thai.	....	....	(34) pallatthai	(121) pallatthai	Cf. vi-ric-
	paryastam	(258) palotṭam (258) palhat- tham.	....	....	....	(121) pallassai	
āp-	paryāpnōti	(390) pahuccai	....	....	....	....	[pr- Apabhraṃs-
	prāpnōti	(239) pāvai ..	....	....	....	....
	vyāpnōti	(141) oaggai ..	....	....	....	....
		(141) vāvēi ..	....	....	....	....
	samāpnōti	(142) samāṇai (142) samāvēi	....	....	....	....	Cf. bhuj- ⁽²⁾
ās-	āstē	(215) acchāi ..	....	....	....	....	Cf. as- (1)
i-	pratyēti	....	....	....	....	(155) pattiāi	
iṣ-	icchati	(215) icchāi ..	....	....	(41) asāi (?) ..	....
		....	....	....	(11) mahai ..	....	Cf. kāṅks-
	praticchati	....	....	....	(41) ogghai ..	(132) ogghai (132) paḍicchai	Cf. prati- Śaurasēni- dṛś-
ikṣ-	prēkṣatē	....	....	....	....	(ix, 112) pek- khadi.	Māgadhi. Cf. prati-
		(297) peskadi	....	....	....	....
	pratikṣatē	(193) paḍikkhai (193) viraṃḷai (193) vibhāi .. (193) sāmāyai	....	....	....	....
ir-	irayati	....	....	....	(28)PELLAI ..	....	Cf. below
		....	....	....	(28) sollai ..	....	Cf. below
	prērayati	....	....	....	....	(58)PELLAI ..	ksip-, pa-
	samīrayati	....	....	....	....	(58) sollai ..	Cf. above
uñch-	prōñchati	....	....	....	(33) puñchāi	(62) puñchāi	ksip-, pa-
		....	....	....	....	(62) puṭṭai ..	Cf. mṛj-
		....	....	....	(33) pusai ..	....	Cf. pus-, mṛj-
		....	....	....	(33) luñchāi ..	(62) luñchāi ..	Cf. mṛj-
(uddhūli-)	uddhūlayati	(29) uddhūlēi (29) guṃṭhāi	....	....	....	....	Cf. granth-
ubh-(?)	ubhati (?)	....	....	....	....	....
(ūrdhva-)	ūrdhvāyatē	....	....	....	....	(101) uhai (?) ¹ (101) ubhāi ²	

¹ My MSS. have *uhanya*, etc., which are certainly wrong. P. *uhāi*.

² So O. Other MSS. corrupt, P. emends to *uñtai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
(kāṇa-)	kāṇēkṣitam ka- rōti.	(192) viluṅpai (192) sihai .. (66) niārai ..	.... .... ....	.... .... ....	.... .... ....	.... .... ....	Cf. sprh.
kās-	avakāsātē ..	....	(35) avavāsai	....	(8) avavāsai ..	....	Hc. and Kl. i All others RT. śabdakut- sāyām.
		(179) ōvāsai ..	(35) ōvāsai ..	(46) ōvāsai ..	(8) ōvasai ōvāsēi	(49) ōvāsai ..	
	prakāśayati ..	....	....	....	(8) (?) vāvāai	....
kit-	cikitsati ..	(45) nuṅvai ..	....	....	....	....
ku-	kauti ..	(45) payāsēi ..	....	....	....	....
kup-	kupyati ..	(240) ciicchai	....	....	....	....
kr-	karōti ..	(233) kavai .. (230) kuppai (65, 234, 239) karai.	(13) karai ..	(54) karai ..	(3, 4) karai ..	(112) karai	
		(65) kuṅai ..	(13) kuṅai ..	(54) kuṅai ..	(4) kuṅai ..	(112) kuṅai	
		....	(xii, 15) karēdi (?)	....	....	(ix, 144) karēdi	Śaurasēni.
	akarōt ..	....	....	....	....	(xvii, 69) karēi	Apabhraṁśa.
	karīṣyati ..	(214) kāhīa ..	(17) kāhīa ..	(55) kāhīa ..	(4) kāhīa ..	(113) kāhīa	
	kriyē (= karōmi)	(214) kāhīi ..	(17) kāhīi (sic)	(55) kāhīi ..	(4) kāhīi ..	(113) kāhīi	
		(389) kijjauṅi	....	....	....	....	Ditto.
		(389) kīsu ..	....	....	....	....	Ditto. See i chel's note to
	kartavyam ..	(214) kāyav- vaṅ.	(17) kāavvaṅ	(55) kāavvaṅ	(4) kāavvaṅ..	(114) kāavvaṅ	
	kartum ..	(214) kāuṅ ..	(17) kāuṅ ..	(55) kāuṅ ..	(4) kāuṅ ..	(114) kāuṅ	
	kr̥taḥ, -au	(i, 126) kayauṅ (290) kadam ..	(i, 27) kaauṅ ..	....	(4) kaauṅ ..	(i, 36) kaauṅ (xii, 35, 36) kadē, kadē.	Māgadhi.
	kr̥tvā	(214) kāūṅa ..	(17) kāūṅa ..	(55) kāūṅa ..	(4) kāūṅaṅ ..	(114) kāūṅa	
	kriyatē ..	(250) karijjai	....	....	(20) karijjai ..	(173) karijjai	
		....	....	....	(20) kirai ..	....
		(250) kirai ..	(60) kirai ..	(80) kirai ..	(20) kirae ..	(173) kirai	
		(316) kiratē ..	....	....	....	....	Paiśāci.
kr̥t-	kārayati ..	....	....	....	....	(101) kārai	
kr̥p-	kr̥ntati ..	....	....	....	....	(78) kaṭṭai	
kr̥ṣ-	kr̥payati ..	....	....	(50) khippai ..	....	....	Not in D.
	karṣati ..	(187) aiṅcai ..	....	....	....	....	Cf. ā- kram-
		(187) aṅacchai	....	....	....	....
		(187) ayaṅchai	....	....	....	....
		(187) aiṅchai	....	....	....	....
		(187) kaḍḍhai	....	....	(27) kaḍḍhai	(76) kaḍḍhai	Cf. kram-
		(187, 235) kari- sai.	(11) karisai ..	(72) karisai ..	(2) karisai ..	(76) karisai	
(kośa-)	utkośayati ..	....	....	....	(33) ukkōsai ..	....
	vikośayati ..	(42) pakkhōḍai (42) vikosai ..	....	....	....	....	Cf. śad-
	asim̐ kośāt kar- ṣati.	(188) akkhōḍēi	....	....	....	....
krand-	krandati ..	....	....	(46) jvarai (?) jūrai).	....	....	Cf. krudh-, k-
	ākrandati ..	(131) akkanidai (131) niharai	....	....	....	....
krap-	krapate ..	(151) avahāvēi	....	....	....	....	Cf. niḥ-ṣ-

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
kram-	kramatē ..	....	....	....	....	(134) āiñchai ..	Cf. kṛṣ-. All my MSS. give āiñchai. P. āiñcai
		....	....	....	....	(134) kamai ..	So MSS. P. omits Cf. carc-
		....	....	....	(30) cappai ..	....
		....	....	....	(30) phullai ..	....
	ākramatē ..	(160) akkamai	....	....	....	(134) vōlai ..	Cf. gam-
		....	....	....	....	(134) akkamai	
		....	....	....	(30) añcai ..	....	Cf. kṛṣ-
		....	....	....	....	(135) appannai	
		(160) utthārai	....	....	....	(135) ahisāai	
		(160) ōhāvai ..	....	....	....	....	[and carc-
	(160) chundai	....	....	....	(135) cappai ¹	Cf. kramatē ab.	
	....	....	....	(30) vollai ..	....	
krāntam ..	atīkrāntaḥ ..	(258) vōliṇō ..	....	....	....	(182) vōliṇam	
ākramyatē ..	upakramayati	(395) caṁpijjai	....	....	....	....	Apabhraṁśa.
	....	....	....	....	....	(100) khaḍuk-kai.	So all my MSS. of Mk. P. has <i>apā-kramayati</i> , <i>khu-ḍukkai</i> .
ākramayati ..	ākraṅtaḥ ..	....	....	....	....	(100) jhampai	Cf. chad-
	(258) apphuṅṇō	....	....	....	....	....	DNM. i, 20, also = pūrṇaḥ.
tri-	kriṇāti ..	(52) kinai ..	(30) kinai ..	(70) kinai ..	(8) kinai ..	(38) kinai	
	vikriṇīte ..	(52) vikinai ..	(31) vikkinai	(71) vikkinai	(8) vikkinai ..	(39) vikkinai	
triḍ- trudh-	kriḍati ..	....	....	....	....	....
	krudhyati ..	(135, 217) kuj-jhai.	....	(46) kujjhai ..	(27) kilāē ..	(130) kujjhai	
	....	(135) jūrai ..	(64) jūrai ..	....	(22) jūrai ..	(130) jūrai ..	Cf. khid-, and jvarai, s.v. krand-
truś-	ākrośati ..	(DNM. i, 13) ajjhassai.	....	....	....	....
trvaṇ-	kvaṇati ..	....	....	....	....	(133) oṅganai	Cf. kaṇ-
trvath-	kvathati ..	(119) aṭṭai ..	....	....	....	(133) kaṇai ..	Cf. kaṇ-
	....	(119, 220) kaḍhai.	(39) kaḍhai ..	(46) kaṭṭhai (D. kaḍḍhai).	(13) kaḍhai ..	(70) kaḍhai	
ṣar-	kṣarati ..	(173) khirai ..	....	....	....	....
	....	(173) jharai ..	....	....	....	(57) jharai ..	Cf. smr-
	....	(173) ṇiḍḍuai	....	....	....	....
	....	(173) niṅvalai, (DNM. iv, 51) -lēi.	....	....	....	....	Cf. niḥ-pad-, duḥ-khaṁ muñcati, s.v. muc-
	....	(173) paccāḍai	....	....	....	....
	....	(173) paḥjharai	....	....	....	....
ṣi-	prakṣarati ..	(20) jhiḥjai ..	(37) jhiḥjai ..	(46) jhiḥjhai (D. jhiḥjhai).	(11) jhiḥjhai ..	(57) paḥjharai	Cf. the next.
	kṣayati, kṣiyatē	(20) ṇijjharai	....	....	....	(20) jhiḥjai ²	Cf. the preceding.
	....	....	....	....	....	....	[yatē.
	....	....	....	....	....	....	DNM. iv, 40, = kṣi-

¹ So my best MSS. P. has *rappai*.

² My best MSS. *jhiḥjai*. P. *jhiḥjai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS			
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadiśvara.	Rāma-śarmaṇ (Tarkavāgīśa).	Mārkaṇḍēya				
kṣip-	kṣipati	(143) aḍḍakkhai	Cf. gavēṣ-.			
		(143) khivai ..	....	....	....	....
		(143) galatthai	....	....	....	....
		(143) ghattai	....	....	....	....
		(143) chuhai ..	....	....	....	....
		(143) ṇullai ..	....	....	....	....
		(143) ṇollai ..	....	....	....	....
		(143) pariī ..	....	....	....	....
		(143) pellai ..	....	....	....	....
		(143) sollai ..	....	....	(46) vijjai ..	....			
		(143) hulai ..	....	....	....	....
		kṣiptam	(258) jhōsiam	Cf. nud-.	
		ākṣipati	(145) akkhivai		
		utkṣipati	utkṣipati	(145) nīravai	Cf. bhuj- (2).
				(144) allatthai	
(144) ukkhivai	....			....	....	....
(144) uttham- ghai.	....			....	....	....
(144) ubbhuttai	....			....	....	....
(144) ussikkai	....			....	....	....
(144) gulagum- chai.	....			....	....	....
(144) hakkhu- vai.	....			....	....	....
(DNM. viii, 64) hukkhuppai.	....			....	....	....
kṣu-	kṣutam	(DNM. iii, 36) chikkam.	So also v. l. 10. 144.			
kṣud- ¹	kṣunatti	(26) khundai	(52) khundai ..	Cf. skhal-.			
		....	....	....	(26) khummai	(52) khummai	
kṣudh- kṣubh-	kṣudhyati	(52) khulai	Śaurasēni.			
		....	....	....	....	(ix, 118) khun- dadi.
		....	....	....	....	(22) dhukkai
		(154) khubbhai	....	....	(26) dhukkai	....			
		(154) khaurai	....	....	....	....
utkṣubhyati	utkṣubhyati	(154) paḍḍuhai	Cf. khac- khav-.			
					
		....	....	....	....	(161) ukkhub- bhai.
(kṣura-) khac-(1)	kṣuram karōti khacati	(72) kammai	Cf. kṣubh- ²			
		(89) khacai ..	....	....	....	....
khac-(2) khan-	khacnāti khanati	(89) vēḍai	Cf. below. Śaurasēni.			
		....	....	....	(27) khaurai	....			
khan-	khanati	(16) khamai	(82) khaṇai	Cf. below. Śaurasēni.			
		....	....	....	(? khaṇai).	....			
		....	....	....	(16) khammai	(82) khammai	
khan-	khanati	(ix, 145) khaṇa- di.	Cf. below. Śaurasēni.			
					
khan-	khanati	(244) khaṇijjai	Cf. above.			
		(244) khammai	....	....	....	....

¹ So all my MSS. Printed edition of Mk. has *kṣudh-*, which is an evident misprint.

² So my best MSS. P. *ubbhūai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
khav-	utkhātam ..	(i, 67) ukkha- yāñ.	.....	.....	.....	(182; i, 13) uk- khaañ.	Cf. kṣubh-, kha- (2).
	khaunāti ¹ ..	.....	.....	.....	.....	(127) khaai (127) khaurai	
khād-	khādāti ..	(228) khāai .. (228) khāi ..	(27) khāi ..	(77) khāi ..	(10) khāi ..	(59) khāai (59) khāi	Cf. krudh- an jvarai, s.v. krand- Cf. vi-smṛ-.
	khādatu .. khādiṣyati ..	..... .....	(27) khāu .. (27) khāhii ..	..... .....	..... .....	..... .....
chid-	khidyatē ..	(132, 224) khij- jai. (132) jūrai ..	.....	.....	.....	(126) khijjai	Cf. naś- Cf. naś-.
	khēdayati .. gacchati ..	(132) visūrai (162) aicchai .. (162) aīi .. (162) akkusai .. (162) anuvajjai .. (162) avajjasai .. (162) avasēhai .. (162) avaharai .. (162) ukkusai .. (162, 215) gac- chai. (162) nimmahai .. (162) niriṇāsai .. (162) nīvahai .. (162) nīi .. (162) nīnai .. (162) nīlukkai .. (162) paccaddai .. (162) paccham- dai. (162) padaai .. (162) parialai .. (162) pariallai .. (162) rāmbhai .. (162) vōlai ..	(63) visūrai ..	(46) visūrai ..	(22) visūrai .. (22) viṇabhai	(126) visūrai .. (63) vilabhēi		Cf. takṣ- Cf. kram- Cf. grah-.
gam	āgacchati ..	(163) ahipac- cuai. (163) āgacchai ..	.....	.....	..... (34) aijjatthai (34) āhammai	(140) āacchai (140) ājatthai (140) āhammai	Cf. ā-hamm-.
	abhyāgacchati ..	(165) abbhāgac- chai. (165) ummat- thai.	.....	.....	.....	.....
	pratyāgacchati ..	(166) paccāgac- chai (166) paloṭtai	.....	.....	.....	.....	Cf. pary-as-, pra- luṭ-.

¹ So P. All my MSS. = have *kaunāti*, of which I can make nothing. According to Hc. *khaurai* = *kṣubhyati*. RT. gives *khaurai* = *khacūti* (or *khacati*). In the Dhātupāṭha, *khac-* is merely a variant reading for *khav-*, both representing the same verb.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
	saṃgacchatē	(164) abhiḍai (164) saṃgac- chai.	....	....	....	....
	gamyatē	(249) gamijjai	(58) gamijjai ....	....	....	(172) gamijjai (172) gamīai (ix, 147) gamī- adi.	Śaurasēni.
		(249) gammai	(58) gammai ....	....	(15) gammai	(172) gammai (xi, 9) gammaē (xii, 35, 36) gadē, gadē. (182) ulluam	Āvanti. Māgadhi.
	gataḥ	(302) gadē	....	....	....	....
garj-	udgatam garjati	.... (98) gajjai (98) bukkai	.... ....	.... ....	.... ....	.... ....
gal-	vṛṣabhō garjati vigalati	(99) dhikkai (175) niṭṭuhai (175) thippai (175) vigalai	.... ....	.... ....	.... ....	.... ....	Cf. tṛp.
gavēś-	gavēśayati	(189) gamēsai (189) gavēsai (189) ghattai (189) dhamḍhō- lai. (189) dhumḍhu- llai.	.... .... ....	.... .... ....	.... .... ....	.... ....	Cf. kṣip. Cf. bhram.
gāh-	avagāhatē	....	(34) avavāhai	....	(8, 24) avavā- hai	....
		(205) oḡāhai (205) ovāhai	.... (34) ovāhai	.... (46) ovāhai	.... (24) ovāhaē (8) ovāham	(102) oḡāhai (49, 102) ovāhai	
gup-(1)	avagādham gupyati	(150) guppai (150) naḍai (150) virai	.... ....	.... ....	.... ....	.... ....	Cf. naṭ. Cf. bhāñj.
gup-(2)	saṃgōpāyati	....	....	....	....	(51, 102) sañ- gōvai. (51, 102) sañja- vai.	
	jugupsatē	(4) juucchai (4) jugucchai (4) jhunai (4) duucchai (4) duumchai (4, 240) duguc- chai. (4) dugumchai	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....
guh-	upagūhati	....	....	....	....	(145) āvaāsai (145) uvauhai	Cf. upa-grah.
grdh- gī- gai-	grdhyati girati, gilati gāyati	(217) gijjhai (6) gāai, gāi	.... .... (26) gāai, gāi	.... .... (76) [gāai, gāi]	.... .... (15) gijjhai (9) gāaē, gāi	(77) gijjhai (24) gilai (60, 102) gāai, gāi.	
	gāyatu gāyanti gāsyati	.... .... ....	(26) gāau, gāu (25) gāanti (26) gāahii, gā- hii.	.... (75) gāanti	(9) gāu (9) gāhii	.... .... ....
	glyatē	....	....	....	....	(181) gijjai	

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
granth- gras-	grathnāti ..	(120) gaṅṭhai	(23) gunthai ¹	
	grasate ..	(204) gasai .. (204) ghisai ..	(28) (?) ghisai (text visai).	(46) ghasai (D. ghisai).	(6) ghisai ..	(44) ghisai	
grah-	grṇhāti ..	(209) ahipac- cuai.	Cf. ā-gam-
		(209) geṅḥai ..	(15) geṅḥai ..	(63) geṅḥai ..	(4) geṅḥai ..	(96) geṅḥai	
		(209) niruvārai	
		(209) paṅgai	
		(209) valai	Cf. val-
		(209) harai	Cf. hr-
		(4) hiṅṅai ..	(96) hindai (ix, 128) geṅḥa di. [hai	Śaurasēni.
		(38) āvasāi ..	(xvii, 68) guṅ-	Apabhraṁśa. Cf. upa-guḥ-, dṛ
	upa grṇhāti	
	grḥitam ..	(210) geṅḥiam	Śaurasēni.
		(ix, 130) gahi- dam.	
	grḥitvā ..	(210) geṅḥia	(4) geṅḥiūṅa	(97) geṅḥiūṅa	
		(210) ghettuṁ	(4) gēhiūṅa	
		(210) ghettuṅa	(16) ghettuṅa	(4) ghettuṅa	
		(210) ghettuāṅa	
	.....	.....	.....	(64) ghēūṅa ..	(97) ghēūṅa	
grahitavyam	.....	.....	.....	.....	(97) hindīūṅa	
	.....	.....	.....	(4) geṅḥiavvaṁ	.....	
	(210) ghettav- vaṁ.	(16) ghettav- vaṁ.	.....	(4) gēbiavvaṁ	.....	
	.....	.....	.....	(4) ghettavvaṁ	.....	
grahitum ..	.....	.....	.....	(64) ghēavvaṁ	(97) ghēavvaṁ	
	.....	.....	.....	(4) geṅḥium	.....	
	(210) ghettuṁ	(16) ghettuṁ	.....	(4) [gēhium]	.....	
grḥyatē ..	.....	.....	.....	(64) ghēum ..	(4) ghēum ..	(97) ghēum ..
	.....	(61) gahijjai. gāhijjai.	.....	.....	.....	.....
	(256) geṅḥijjai	.....	.....	(21) gejjai ..	(178) gejjhai ..	
	.....	.....	.....	(21) geṅḥijjai	.....	
	.....	.....	.....	(21) geṅḥiai ..	(178) geṅḥiai	
	(256) gheppai	.....	.....	(21) ghejjai ..	(178) ghejjhai	
	.....	.....	.....	(21) gheppai	(178) gheppai	
	.....	.....	.....	(82) gheppijjai	.....	
		
	.....	.....	.....	(21) hindijjai	(102) ggēkhai ² (178) hindiai	Śaurasēni
	.....	.....	.....	.....	(ix, 129) gejjha- di.	Śaurasēni.
udgrahayati ..	.....	.....	.....	.....	(ix, 129) ghep- padi.	
ghaṭ-	ghaṭatē ..	(112) gaḍhai (112) ghaḍai	(123) uggāhai, oggāhai	
		.....	.....	(46) gaḍhai ..	(11) gaḍhai .. (11) ghaṭṭai ..	.....

¹ So all my MSS. P. has *gumḍhai*.

² So P. and all my MSS., except that in the Oriyā character it may also be read as *ggēkhai*. Perhaps we should read *gheppai*. I must add that I alone am responsible for the equation with *grḥyatē*. Mk. himself gives no clue, but a v.l. to Mk. 179 gives *ggēkhai* = *grḥyatē*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
	vighaṭatē ..	....	....	....	(31) vijjhai ..	(109) viñchēi (109) vihaḍēi	
	saṁghaṭate ..	(113) saṁgalai (113) saṁgha- ḍai.	....	....	....	....
	ghaṭayati ..	(50) ghaḍēi .. (50) parivāḍēi	....	....	....	....
	udghāṭayati ..	(33) uggai .. (33) ugghāḍai	....	....	....	(110) ugghaḍēi	
ghūrṇ-	ghūrṇate ..	(117) ghummai (117) ghulai. ghōlai. (117) pahallai	(6) ghōlai	(46) ghōṇai ..	(31) ogghaē .. (2) ghummai (2) ghōṇai ..	(110) ogghēi (9) ghummai (9) ghōlai ..	
ghrā-	jighrati ..	....	....	....	....	(ix, 119) ghum- madi. (43) ijihai .. (43) oḅimbhai (ix, 115) jiggha- di.	Śaurasēni. Śaurasēni.
	ājighrati ..	(13) agghāai .. (13) āigghai ..	(20) pāai, pāi	....	(28) jīnghaē ..	....
caṣ-	ācaṣṭē ..	(297) ācaskadi	....	....	....	....	Māgadhi. Apabhraṁśa ad-, svad-
car-	vicārayati ..	....	....	....	....	(xvii, 66) cak- khai.	
carc-	carcayātē ..	....	....	(46) caccai (D.) (65) cāmpai ..	(40) viṇai .. (46) cappai ..	(111) viārēi (111) vīṇēi (151) caccai (151) cappai	Cf. carv- Cf. kram- kram- Śaurasēni.
carv. ¹ cal-	carvati calati ..	.... (231) calai .. (231) callai ..	.... (53) calai .. (53) callai ..	(46) cavvai .. (61) calai .. (61) callai ..	.... (15) calai .. (15) callai ..	.... (85) calai .. (85) callai	Cf. carc- Cf. pari-cur-
(cātu-) ci-	cātu karōti cinōti ..	(73) gulalai .. (238, 241) ciṇai .. (238) cuṇai ..	(20) ciṇai ..	(46) ciṇai ..	(6) ciṇai ..	(35) ciṇai	
	uccinōti ..	(241) uccinai .. (241) uccei ..	....	....	....	(36) uccinai (36) uccei	
	ciyate ..	(242, 243) ciṇij- jai. (243) cimmai (242, 243) civvai	....	....	....	....
cint- (?) cuḍ- cumb- cur-	cintayati (?) cuḍati cumbati cōrayati ..	.... (239) cumbai	(71) cumbai ..	....	.... (40) cuḍai ..	(101) cintai ² (101) cōrai, (122) cōrēi (122) thaṇillai	
	paricōrayati ..	....	....	....	(37) phaṇillai (37) calai .. (37) chulai ..	.... .... ....	Cf. cal-

¹ ? *caccadi*. In the Oriyā character *mv* and *cc* are very similar.

² Perhaps a mistake for *carc*.

³ So P., but doubtful. Cf. (ūrdhva-)

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
irṅ-	cūrṇayati ..	.....	.....	.....	.....	(159) cūrṇēi (159) cūrai (159) mummu- rai.	
yu- īad-	cyavatē .. chādayati ..	(233) cavai .. (21) ombālai .. (21) chāyai .. .....	.....	.....	(36) mamūrai	..... ..... (141) chāēi (100,141) jham- pai.	Cf. kath-. Cf. ā-kram-.
nid-	chinatti ..	(21) dhakkai .. (21) numai, nū- mai, nūmai. (21) pabbālai .. (21) sannumai .. (124) chindai, (38) chindai .. (216) chindai. (124) nicchallai .. (124) nijjhōdai .. (124) ñillūrai .. (124) ñivvarai ..	.....	(46) chindai, (D. chiyai).	(14) chindai ..	(66) chindai	Cf. sthag-. Cf. ni-as-. Cf. plu-.
	chittvā .. chinnam .. chēttum .. chēttavyam ..	(124) duhāvai .. (124) lūrai ..	.....	.....	.....	(102) chettūna (182) chinnañ (102) chettum (102) chettav- vañ.	Cf. duḥkh arñ kē thayati s. kath-.
	ācchinatti ..	(125) acchim- dai .. (125) uddālai ..	.....	.....	.....	.....	DNM. i, 163, od dālai.
huṭ- hup-	ācchōṭayati .. chupati ..	(125) oam̐dai .. (71) ñilum̐chai .. ..... ..... .....	.....	.....	.....	(102) chuvai ¹ (102,169) chivai (168) chuai (175) chuvvai ¹ (ix, 123) chig- gadi. (ix, 123) chuva- di. (175) chippai (175) chuppai (175) chuvijjai ¹ (ix, 124) chuvi- adi ²	Cf. niḥ-pat-.
	chupyate ..	(249) chuppai .. (249) chuvijjai .. .....	.....	.....	.....	(ix, 123) chuva- di. (175) chippai (175) chuppai (175) chuvijjai ¹ (ix, 124) chuvi- adi ²	Cf. spr̐s-.
an-	chuptam ..	.....	.....	.....	.....	(182) chikkam̐ (182) chittam̐	Cf. kṣu-, spr̐s-.
alp-	jāvate .. jalpati ..	(136) jammai .. (136, 240) jāai. jāi. ....	.....	.....	.....	.....	Cf. yā-.
		.....	(24) jāmpai ..	(46) jāmpai ..	(13) jāmpai ..	(19) jāmpai	Cf. kath-.

¹ My best MSS. *chuvai*, *chuvvai*, *chuvijjai*. P. has *chavai*, *chavijjai*, *chuvijjai*.

² So all my best MSS. P. has *chaviadi*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śaīman. (Tarkavāgīśa)	Mārkaṇḍeya.	
jāgr-	jāgarti ..	(80) jaggai ..	....	....	....	(154) jaggai	
ji-	jayati ..	(80) jāgarai .. (241) jayai .. (241) jīnai ..	....	....	....	....
	jitam ..	....	....	....	(18) jaai ..	(90) jaai	
	jitavān ..	....	....	....	(18) jīnai ..	(87, 90) jīnai	
	jitvā ..	(241) jīniūna .. (241) jēūna ..	....	....	....	(ix, 134) jīnadi	Śaurasēni.
	jīyatē ..	(242) jīnijjai ..	(56) jīnai ..	(73) jīnai ..	(19) jīam .. (19) jīantō ..	....
		(242) jīvvai ..	(57) jīnijjai ..	(74) [jīnijjai]	(19) [jīnijjai]	(95) [jīnijjai]	
jīn-	jēmati ..	(230) jīmmai ..	(57) jīvvai ..	(74) [jīvvai] ..	(19) jīppai ..	....
jīmbh-	jīmbhate ..	(157, 240) jāi- bhāai, jāi- bhāi.	(14) jāmbhāai	(46) jāmbhāai	(19) jīvvai ..	(95) jīvvai	
		....	....	....	(5) jāmbhāai, jāmbhāai.	(32) jāmbhāai	Cf. bhuj- (2) R.T.'s jāmbhāi ' according Kātyāyana.
	ujjīmbhatē ..	....	....	....	....	(32, 34) jāmb- bhāhai, jāmb- bhāhai.	
	vijjīmbhatē ..	(157) viāmbhai	....	....	....	(33) uj jāmbhai	
	vijjīmbhamānah ..	....	....	....	(5) viāmbhantō	(33) viāmbhai	
jī-	jarati ..	(234) jarai ..	....	....	....	....
	jīryate ..	(250) jarijjai .. (250) jīrai ..	....	....	....	....
	jīṇam ..	....	....	(80) jīrai ..	....	....
jīnā-	jānāti ..	....	....	....	....	(182) jīṇam (182) jūṇam	
		(7) jāṇai ..	(23) jāṇai ..	(47) āṇai .. (47) jāṇai ..	(6) anai .. (6) āṇai .. (6) jāṇai ..	....
	ājānati ..	(7) muṇai ..	(23) muṇai ..	....	(31) (?) ahimā- hai, (?) ahisā- hai.	(13) jāṇai (13) muṇai	
		....	....	....	(31) salāi ..	....
	jīṇāyate ..	....	....	(81) āṇai ..	....	....
		(252) jānijjai ..	....	(81) jāṇai ..	....	(180) jāṇai	
		(252) ṇajjai ..	....	(81) ṇajjai, ṇaj- jīai.	(20) ṇajjai ..	(180) ṇajjai	
		(252) ṇavvai ..	....	(81) ṇavvai, ṇavvai.	(20) ṇavvai ..	(180) ṇavvai	
		(252) ṇāijjai ..	....	....	....	....
		(252) muṇijjai ..	....	....	....	(180) muṇai	
	ajīṇāyate ..	(252) aṇāijjai ..	....	....	....	....
	vijīṇapayati ..	(38) avukkai .. (38) vinnavai .. (38) vokkai ..	....	....	....	....
ḍi-	ḍayate ..	....	....	....	....	....
	udḍayate ..	(237) udḍei ..	....	....	(13) ḍei ..	....
	udḍiyate (pass.) ..	....	....	....	....	....
takṣ-	takṣati ..	(194) cacchai .. (395) chollai .. (194) takkhai, tacchai.	....	cacchai ² ..	....	(181) uddijjai (48) cacchai ³	
		....	....	....	....	....	Apabhraṃśi

¹ In Mk. 102. P. has *īmai*, it correct for *temai*.

² Corrected from D. 1 (=46) *vacchai*. R.I.M. om.

³ So my best MSS. P. has *ca^h*

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
taḍ-	tāḍayati ..	(194) rāmpai, rāmphai.	....	rappai ¹	.. (22) rambhai	(48) rampai, rambhai.	Cf. gam-.
		(27) āhōḍai .. (27) tāḍēi ..	....	....	(40) taḍḍai ..	(170) tālēi .. (170) tiḍḍavai	Cf. tan-. Cf. tan-.
tan-	tanōti ..	(27) vihōḍai .. (137) taḍai, taḍḍai, taḍ- ḍavai.	....	....	....	....	Cf. taḍ-.
tap-	samtapyate ..	(137) taṇai .. (137) virallai	....	....	....	....	....
	paritāpayati	(140) jhamkhai (140) samtap- pai. (DNM. v, 48) dumai.	....	....	....	....	Cf. dū-.
tam-	tāmyati ..	....	....	(46) tamhai (D. tammai.)	....	(85) tamai, tam- mai.	....
tij-	tējayati ..	(104) ōsukkai	....	....	(39) tikkhālai	(160) tikkhālai	....
tim-	tīmyati ..	....	....	....	....	(160) tejai	....
		....	....	....	(33) tiṇḍai .. (33) tillāsai ..	(148) tiṇṇai, tiṇṇāi.	....
tir- tuḍ-	tīrayati ..	(86) tirai ..	....	....	....	(148) timmai (102) tēmai ²	....
	tuḍati ..	(116) ukkhuḍai (116) ullukkai (116) ullūrai (116) khuttai, khuḍai. (116) nilukkai (116) tuṭṭai tuḍai. (116) tōḍai .. (116) lukkai ..	....	....	....	(xvii, 75) tiai (xvii, 75) tiu- mai. (xvii, 75) thim- mai.	Apabhraṃśa. Apabhraṃśa. Apabhraṃśa.
tul-	tolayati ..	(25) ōhāmai ..	....	....	....	(64) khuttai	Cf. khoḍḍai, truṭ-.
		(25) tulai ..	....	....	....	(64) tuṭṭai, tuḍai. (64) tōḍai	Cf. ni-li- Cf. truṭ-.
tuṣ- tṛp-	tuṣyati .. tṛpyati ..	(236) tūsai .. (138) thippai	(46) tūsai .. (22) thimpai	(68) tūsai .. (46) thippai, theppai.	(12) tūsai .. (7) thippai	(83) tūsai (12) thippai ..	Cf. vi-gal-.
		(86, 234) tarai (250) tarijjai (250) tirai .. (85) ōarasai .. (85) ohai	(174) tarijjai (174) tirai ..	Cf. śak- Cf. śak- Cf. tir-, śak-

¹ Corrected from D. 1 (=46) *vahpai*. RLM om.² So all my MSS. P. has *jēmai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚĀ. ACCORDING TO:—					REMARKS
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
tyaj-	tyajati	(86) cayai	.....	.....	.....	(104) caai	Cf. śak.
		.....	.....	.....	(25) chakkai	.....
		.....	.....	.....	(25) chattai, (?) chadḍai.	(104) chaḍḍai	Cf. muc.
tras-	tyaktam trasyati	(258) jaḍham (198) ḍarai (108) tasai (198) bajjai (DNM. vii. 41) vajjai. (198) bojjai. (DNM. vii. 96) vojjai.	(66) vajjai	(46) vajjai	(22) vajjaē	(101, 157) tasai (157) vajjai	Cf. drś.
		.....	.....	.....	(7) (?) hūmai	.....	Cf. satra.
truṭ-	trastam truṭyati	.....	(62) hittham	.....	(26) khoḍḍai	.....	Cf. khuttai. tuḍ- Cf. tuḍ.
		(230) tuṭṭai	.....	(59) tuṭṭai	(26) tuṭṭai, tu- ḍai, tōḍai.	.....
trai- tvac- tvar-	paritrāyatē tvacati tvaratē	..... ..... (170) jaḍai	.....	.....	..... (22) (?) vappai	(102) parittāi	
		(170) tuvarai (171) tūrai (172) turiō	(4) tuvarai	(46) tuvarai	(1) tuvarai	(102) turai ¹ (6, 102) tuvarai (6) tūrai (7) turiam	
daś-	tvaritah, -am daṣṭam dalati	(176) dalai (176) viṣattai (208) ahiṅḷai (208) ālumkhai (208) ḍahai	(5) turiam	.....	(1) turiam	(182) ḍakkam	Cf. vi-kas.
dah-	dahati	.....	.....	.....	.....	.....	Cf. sprś.
	dagdham dahyatē	(246) ḍajjhai (246) dahijjai	(62) daḍḍham	.....	.....	.....
dā-	dadāti	(238) dēi	.....	.....	(13) dēi	(102) dēi (ix, 126) dēdi	Śaurasēni.
	dāsyati	.....	(xii, 14) dēdi	.....	.....	(ix, 125) dais- sadi.	Śaurasēni.
	dattam	(i, 46; ii, 43) dinnam.	(62) dinnam	(83) dinnam	(21) dinnam	(182) dinnam	
	dattvā diyate	.....	.....	.....	.....	(ix, 126) daia (181) dijjai (ix, 126) diadi	Śaurasēni. Cf. ā-bhāṣ.
diś-	saṁdiśati	(180) appāhai (180) saṁdisai	.....	.....	.....	.....
dip-	dipyatē	.....	.....	.....	.....	(102) dhippai (102) dhuppai	Cf. snā.
	pradipyatē	(152) abbhuttai (152) tēavai (152) palivai (152) saṁdu- mai.	.....	.....	.....	.....

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
dul-	dōlayati	(152) saṁdhuk- kai.	.....	.....	.....	.....
duṣ-	duṣyati	(48) dōlēi ..	.....	.....	.....	.....
duh-	duhyatē	(48) raṁkhōlai ..	.....	.....	.....	.....
		(236) dūsai ..	.....	(68) dūsai ..	(12) dūsai ..	(83) dūsai	
		(245) dubbhai	.....	(80) ducchai, dubbhai (D. dujjhai).	(20) dubbhai	(176) dubbhai	
		(245) duhijjai	.....	.....	.....	(176) duhijjai, duhiai.	Āvanti.
		.....	.....	.....	.....	(xi, 9) dubbha- di.	Śaurasēni.
		.....	.....	.....	.....	(ix, 146) duhia- di.	Śaurasēni.
dū-	dugdham dūyate	.....	(8) dūmai ..	(46) dummai	(17) dummai, dūmai.	(182) dubbham (10) dūmai ..	Cf. below, and pari-tap- Āvanti.
	dāvayati	(23) dūmēi ..	.....	.....	.....	(xi, 9) duvvai ¹	Cf. above, and pari-tap-.
ḍṛ-	ādriyatē	(83) ādarai ..	.....	.....	.....	.....
ḍṛṣ-	paśyati	(83) sannāmēi ..	.....	.....	.....	.....
		(181) avaak- khai, avayac- chai, avayaj- jhai.	.....	.....	.....	.....
		(181) avaāsai	.....	.....	.....	.....	Cf. upa-guh-, upa- grah-.
		(181) avakkhai, ōakkhai.	(60) avakkhai	(66) avakkhai, avajjhai.	(23) avakkhai	(105) avakkhai	
		(DNM. iii, 4) cajjai.	.....	.....	(23) ghaṇai ..	.....
		(181) dekkhai	.....	.....	.....	(105) jōvai	Cf. below.
		(181) niai ..	.....	.....	(23) niai ..	(105) niai	
		(181) niacchai	(69) niacchai	(66) niakkai (D.) niacchai.	(23) niacchai	(105) niacchai	
		(181) pāsai ..	.....	.....	.....	(105) passai	
		(181) pulāēi, (DNM. vi, 55) pulaai.	(69) pulaai ..	(66) pulaai (D.) puṇai.	(23) puṇai ..	(105) pulaai, pulai.	
		(181) pulōēi, (DNM. vi, 53) pulōi.	.....	.....	.....	(105) pulōai	
		(181) pecchai	.....	(66) pekkhai, pecchai.	.....	.....	Cf. below and pra- ikṣ-.
		(181) vajjai ..	.....	.....	.....	.....	Cf. tras-.
		(181) saccavai	.....	.....	.....	.....	Śaurasēni.
		.....	(xii, 18) pek- khadi.	.....	.....	.....	Śaurasēni.
		.....	.....	.....	.....	(ix, 112) pec- chadi.	Śaurasēni.
		.....	.....	.....	.....	(xi, 7) peccchadi	Āvanti.

¹ The equation with *dūyati* is doubtful. The text gives no clue as to the Sanskrit equivalent.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya	
		....	....	....	....	(xvii, 64) dek- khai.	Apabhrāṣa
		....	....	....	....	(xvii, 64) pum- mai.	Apabhrāṣa
		(393) prassadi (213) daṭṭhūna	....	....	....	....	Apabhrāṣa
	dr̥ṣṭvā ..	(213) daṭṭhūna	....	....	....	....
	draṣṭum ..	(213) daṭṭhūna	....	....	....	....
	draṣṭavyam ..	(213) daṭṭhav- vañ.	....	....	....	....
	dr̥ṣyatē ..	(iii, 161) disai	....	....	(24) disaē	(177) disai (177) [pulijjai], pulīai.	
	darśayati ..	(32) daṁsai ..	....	....	(24) daṁsēi	(106) daṁsēi, daṁsāvēi.	
		(32) dakkhavai	....	....	....	....	Cf. below.
		(32) darisai ..	....	....	(24) darisēi	(106) darisāvēi, darisēi.	
		(32) dāvai ..	....	....	(24) dāvēi	....
		....	....	....	....	(xi, 8) darasēdi darisēdi.	Āvanti.
		....	....	....	....	(xvii, 65) dāk- khavai.	Apabhrāṣa above.
drā-	nidrāti ..	(12) umghai .. (12) oḥirai ..	....	....	....	....
(dhavala-)	dhavalayati ..	(12) niddāi .. (24) dumai ..	....	....	....	....
	dhavalitam ..	(24) dhavalai	....	....	....	....
dhā-	dadhāti ..	(24) dūmiam (240) dhāi, dhāi.	....	....	(13) dhēi	....	Cf. dhāv-
	śraddadhāti ..	(9) saddahai ..	(33) saddahai	(46) saddahai	(7) saddahai	(37) saddahai	
	śraddhitam ..	....	(34) saddahiam	....	....	....
dhāv-	dhāvati ..	(228) dhāi ..	(27) dhāi ..	....	(10) dhāi	(59) dhāi dhāi.	Cf. dhāv-
		(228, 238) dhā- vai.	....	....	....	....
		(238) dhuvai	....	(69) dhuvai, dhuvvai.	(24) dhuvai, (? dhuvai).	....	Cf. dhū-
		....	....	....	(24) dhūai, dhōai, (10) dhōaē.	(100) dhōai	
		....	....	(69) dhōvai ..	....	....
	dhāvatu ..	....	(27) dhāu	....	....	....
	dhāviṣvati ..	....	(27) dhāhii	....	....	....
dhū-	dhunōti ..	(59, 241) dhu- nai.	(56) dhunai ..	(73) dhunai	(18) dhunai	(87, 93) dhunai	
		(59) dhuvai ..	....	....	(18) dhuvai, dhuvai.	(93) dhuvai ..	Cf. dhāv-
		....	....	....	....	(ix, 134) dhua- di, dhunadi.	Śaurasēni
	dhunvati ..	....	....	....	(18) dhuvanti, dhuvanti.	....
	dhūtam ..	....	....	....	(19) dhuañ ..	....
	dhūtavān ..	....	....	....	(19) dhuantō	....
	dhūyatē ..	(242) dhunijjai (242) dhuvvai	(57) dhunijjai (57) dhuvvai	(74) [dhunijjai] (74) [dhuvvai]	(19) [dhunijjai] (19) dhuvvai	(95) [dhunijjai] (95) dhuvvai	

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hémacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
dhūma-	dhūmāyati ..	.....	.....	.....	.....	(107) dhūmāai, dhūmāi.	
lhr-	dharati .. uddhrtam ..	(234; dharai .. (258) nicchūd- ham.	.....	.....	.....	.....
lhmā-	dhamati .. uddhamati ..	..... (8) uddhumāi	(32) uddhumāi	(46) uddhūmai	(6) dhamai .. (6) uddhamai, (? uddhumai).	(42) uddhumā- ai, (41) uddhu māi.	Cf. pī-.
lhyai-	dhmāyate .. dhyāyati ..	..... (6, 240) jhāai, jhāi.	(26) jhāai, jhāi	(76) [jhāai, jhāi].	..... (9) jhāāē, jhāi	(40) dhamijjai (60) jhāai, jhāi	
	dhyāyatu .. dhyāyanti .. dhyāsyati ..	..... ..... .....	(26) jhāau, jhāu (25) jhāamti (26) jhāahii, jhāhii.	..... (75) jhāanti ..	(9) jhāu (9) jhāhii ..	..... ..... .....
	nidhyāyati ..	(181) nijjhāai, (6) nijjhāi.	.....	.....	.....	.....
laṭ-	naṭati .. unnaṭati ..	(230) naṭtai.	.....	.....	.....	(85) naṭtai (85) naṭai (143) vokkai	Cf. gup (1). Cf. vi-jñā-, un- nad-
lad-	unnadati ..	.....	.....	.....	(38) vokkhai	(143) unṇai (143) vokkai	Cf. vi-jñā-, un- naṭ-.
lam-	namati .. vinamati ..	(226) ṇavai ..	.....	.....	..... (31) (?) rāṇai, (?) vāṇai.	.....	Cf. ni-sah-.
	bhārākranto namati. unnāmāyati (sic), ¹ unna- mayati.	(158) ṇavai, ṇi- sudḥai. (36) unnāmāi	.....	.....	.....	(156) unṇāmēi	Cf. ut-kṣip-, rudh-.
		(36) uttham- ghai. (36) uppelai .. (36) ullālai .. (36) gūlaguṇi- chai.	.....	.....	(32) utthaṅghai (32) ullālai .. (32) (?) gūlai	(156) unṇālai (156) gūlaguṇi- chai. (156) thaṅgai	Cf. ut-kṣip-.
		.....	.....	.....	(32) (?) vaṅjai, (?) vuṅjai.	.....
aś-	upanamāyati ² naśyati ..	(178) avasēhai (178) avaharai (178) niraṇāsai, (DNM. iv, 51) niraṇāsai. (178) nivahai (178, 230) nas- sai, (238) nā- sai. (178) paḍisāi (178) sēhai	.....	.....	.....	(102) paṇāmēi	Cf. ṛ-. Cf. gam-. Cf. gam-. Cf. gam-, piṣ-.
		.....	.....	.....	.....	.....	Cf. gam-, piṣ-.
		.....	.....	.....	.....	.....	Cf. śam-.

¹ Mk. has the incorrect *unnāmi*, which the metre shows to be intentional.

² So to be read. P. has *upanayati*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara	Rāma-śarma (Tarkavāgīśa).	Mārkaṇḍeya.	
ni-	nāśayati ..	(31) nāśai, nā-savai.	....	....	....	....
	naṣṭaṅ	(31) palāvai	....	....	....	....
	nayati ..	(31) viṣṭai ..	....	....	....	....
	ānayati ..	(31) vippagālai	....	....	....	....
		(31) hāravai ..	....	....	....	....
nud-	naṣṭaṅ	(258) lhikkō	....	....	....	....
	nayati ..	(237) nēi ..	....	....	(13) nēi ..	(102) nēi	Apabhraṁśa.
	ānayati ..	....	....	....	....	(xvii, 77) ānā-vai.	
nud-	nīyatē	....	....	....	....	(xvii, 77) ānēi	Apabhraṁśa
	uudati ..	....	(7) ṇollai ..	(46) ṇoṇṇai ..	(2) ṇollai ..	(181) niṅjai	Cf. kṣip.
nṛt- pac-	pranudati ..	....	(7) paṇollai ..	....	....	(8) ṇollai	
	nṛtyati ..	(225) naccai	(47) naccai ..	(46) naccai ..	(15) naccai ..	(79) naccai	
paṭ-	pacati ..	(90) paulai ..	....	....	....	....
	paṭati ..	(90) payai ..	....	....	....	....
paṭh-	paṭati ..	(90) sollai ..	....	....	....	....	Cf. sam-ir, k
	paṭitam	....	....	(46) phalai (D. phālai).	....	....
paṭh-	paṭayati ..	....	(9) phaliam ..	....	....	....
	paṭhati ..	....	....	....	(2) phālai, phā-lēi.	(11) phālai	Cf. Hc. i. 232.
pat-	pāṭhayati ..	....	....	(46) paḍhai ..	....	....
	patati ..	(219) paḍai (DNM. vi, 86)	(51) paḍai ..	(46) paḍai ..	(13) paḍai ..	(101) pāḍhai	
pad-	niṣpatati ..	phellusai.	....	....	....	....
	pāṭayati ..	(71) ṇilumchai	....	....	....	....	Cf. chuṭ-
	nipāṭitah	(22) niḥōḍai ..	....	....	....	....	Cf. vṛ-
		(22) pāḍēi ..	....	....	....	....
pā-(1)	nipāṭitah	(258) nisuddhō	....	....	....	....	See Pischel's translation
	padyate ..	....	(10) pālei ..	....	....	....
pā-(1)	niṣpadyate ..	(128) nippajjai	....	....	....	....
	vyutpadyate	(128) nivvalai (DNM. iv, 51. nivvalēi).	....	....	(10) nivvasai	(25) niḥbalai	Cf. kṣar, dūḥkham, cati, s.v. m.
pā-(1)	sāmpadyate ..	(224) sāmpajjai	....	....	....	(28) viḍhappai	Cf. arj-
	pibati ..	(10) ghottai (DNM. ii, 109) ghuttai.	....	....	....	....
pā-(2)	piyate ..	(10) dallai ..	....	....	....	....
	pāṭi ..	(10) paṭṭai ..	....	....	....	....
pā-(2)	pratipālayati	(10) piāi ..	....	....	(11) pivai ..	(115) piāi	
		(10) piṅjai ..	....	....	....	....
piṣ-	pināṣṭi ..	(240) pāai, pāi	....	....	....	(181) piṅjai	Cf. below.
		....	....	....	....	(60) pāai, pāi ¹	Cf. above.
piṣ-		....	....	....	(41) viramāṅgai	(158) cīramālai	
		....	....	....	(41) virihai ..	(158) padivālei	
piṣ-		(185) caḍḍai ..	....	....	....	(158) virihai	
		(185) nīrinajjai	....	....	....	....	Cf. bhuj-(2)

¹ So all my MSS. P. has *rāai*, *rāi* (*rāti*).

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO :--					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Taṅkavāgīśa).	Mārkaṇḍēya.	
		(185) nirañāsai	....	....	....	....	Cf. gam- and nira- nāsai, s.v. naś-.
		(185) nivabai	....	....	....	....	Cf. gam-, naś-.
		(185) pīśai	....	....	....	....
		(185) roñcai	....	....	....	....
l- mja-)	piḍayati .. puñjayati ..	.... (102) ārōlai .. (102) puñjai .. (102) vamālai ..	....	....	(41) pīlai ..	....
ṣ-	puṣyati ..	(236) pūśai ..	....	....	(24) puśai, pū- śai, pōśai, (12) pūśai.	(83) pūśai ¹	Cf. pra-uñch- mṛj-, las-.
	puñāti .. pūyatē (pass.)	(241) puñai .. (242) puñijjai .. (242) puṣvai ..	....	....	....	....
	vyāpriyatē ..	(81) āaddēi .. (81) vāvareī ..	....	....	....	....
thak)	pārayati .. pṛthag bhavati .. pūrayati ..	(86) pārai .. (62) nivaḍai .. (169) agghavai .. (169) agghāḍai .. (169) aṅgumai .. (169) ahirēmai .. (169) uddhu- māi.	....	....	....	....	C. śak- C. spaś-.
	pūrnam ..	(169) pūrai .. (DNM. i, 20) apphuṅgam	....	....	....	....	DNM. i, 117 = pūr- yatē. Cf. uddhmā.
ich- l-	prechati .. plāvayati ..	(97) pucchai .. (41) ombālai .. (41) pabbālai .. (41) pāvēi ..	....	(46) pucchai	....	(153) pucchai	Cf. ā-kram-.
is-	plōṣati ..	....	....	....	(25) khuppai .. (25) bhisai ..	(46) khuppai .. (46) bhisai ..	Cf. masj- Cf. bhās-, bhi- Cf. sthā-.
akk- ndh-	phakkati .. badhyatē ..	(87) thakkai .. (247) bajjhai .. (247) bandhij- jai.	....	....	....	....
kk- dh-	udbukkati .. budhyatē .. buddham ..	(2) ubbukkai .. (217) bujjhai ..	(48) vujjhai ..	(46) bujjhai ..	(15) bujjhai ..	(77) bujjhai .. (182) buddham ..	
i-	braviti ..	....	....	....	(11, i, 27) vuc- cadi.	(ix, 113) vuc- cadi.	Śaurasēni. Cf. vac-.
aij-	bhanakti ..	(391) bruvai ..	....	....	....	(xviii, 10) brō- di.	Apabhraṁśa. Vṛacaḍa Apa- bhraṁśa.
		(106) karañjai .. (106) nirañjai .. (106) pavirañ- jai.	....	....	....	....
		(106) bhañjai .. (106) musumū- rai.	....	....	....	(142) parirañ- jai. (142) piarañjai .. (142) bhañjai	Cf. pariañjai, be- low. Cf. below.

¹ So only in P. Read *mūśai*, q.v.s.v. *muś-*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA. ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
		(106) mūrai .. (106) virai .. (106) vēmayai	.....	.....	.....	.....	Cf. guṇ-(1). Cf. ahivēmai, below.
		(106) sūḍai .. (106) sūrai ..	.....	.....	.....	.....	.....
bhaṇ-	abhibhanakti paribhanakti pibhanakti .. bhaṇati .. bhaṇyatē ..	..... ..... ..... (239) bhaṇai (249) bhaṇijjai (249) bhaṇṇaē	.....	.....	(32) ahivēmaē (32) pariāṅjai (32) piarāṅjaē (15) bhaṇnai	..... ..... ..... .....	Cf. above. Cf. above. Cf. above.
bhaṣ-	bhaṣati ..	(186) bhasai .. (186) bhukkai	.....	.....	.....	(xi, 9) bhaṇṇaē	Āvanti.
bhā- bhāṣ- bhās-	bhāti .. ābhāṣatē .. bhāsatē ..	..... ..... (203) bhāsai (203) bhīśai ..	.....	.....	.....	(ix, 116) bhādi (100) appāhai	Śaurasēni. Cf. sam-dīś.
bhid-	bhinatti .. bhinnam ..	(216) bhindai	(38) bhindai	(46) bhindai	(14) bhindai ..	(66) bhindai (182) bhinnam (29) bhāhai ¹ (29) bihēi	Cf. pluṣ-, bhī-
bhi-	bibhēti ..	(238) bihēi .. (53) bihai .. (53) bhāi ..	(19) vihai .. (19) bhāi ..	(48) bihai .. (48) bhāi ..	(7) bihai, bihēi .. (7) bhāi ..	(29) bhāi. (ix, 121) bhādi (30) bhāai, bhāēi. (30) bhāāvēi	Śaurasēni.
	bhāyayati ..	.....	.....	.....	.....	.....	.....
	bhīṣayātē ..	.....	.....	.....	(7) bhāsai .. (7) bhāsāvēi ..	.....	.....
		.....	.....	.....	.....	(30) bhīśai, bhīśēi. (30) bhīśāvēi (30) bhīśēi	Cf. pluṣ-, bhās-
		.....	.....	.....	(7) bhīśai .. (7) bhīśāvēi .. (7) bhēsai .. (7) bhēsāvēi ..	.....	Cf. bhēṣ-
bhuj-(1) bhuj-(2)	bhujati .. bhukṅtē ..	(110) aṅhai .. (110) kammēi .. (110) caḍḍai (110) camaḍḍhai (110) jimai, jē- mai.	.....	.....	(46) vialai ² ..	.....	.....
		(110) bhunṅjai (110) samāṅjai	.....	.....	.....	(67) bhunṅjai	Cf. piṣ-, mṛd-.
	upabhukṅtē ..	(111) uvahum- jai. (111) kamma- vai.	.....	.....	.....	.....	Cf. jim-.
	bhuktvā ..	(212) bhottūṅa	(55) bhottūṅa	.....	(17) bhottūṅam	(102) bhottūṅa	Cf. sam-āp-
		.....	.....	(78) bhōūṅa ³	(16) bhōūṅam	.....	.....

¹ So all my MSS. P. *bhihai*.² So D. R.L.M. corrupt.³ Text. *bhōūṅa*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.	
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.		
bhū-	bhōktavyam	(212) bhottav- vañ.	(55) bhottav- vañ.	....	(17) bhottav- vañ.	(102) bhottav- vañ.	
		....	....	(78) bhōav- vañ. ¹	(16) bhōavvañ	....	
	bhōktum	(212) bhottum	(55) bhottum	....	(17) bhottum	(102) bhottum	
		....	....	(78) bhōum ..	(16) bhōum ..	....	
	bhujyate	(249) bhujjai (249) bhujjij- jai.	....	....	....	....
	bubhukṣatē	(5) nīravai .. (5) buhukkhai	....	....	....	....	Cf. ā-kṣip-.
	bhavati	(60) bhavai (60) havai .. (60) huvai .. (60) hōi .. (269) bhavadi (269) bhuvadi	.... .... (1) huvai .. (1) hōi (xii, 12) bhuva- di.	.... .... (56) huvai .. (56) hōi .. ....	.... .... (1) huvai .. (1, 24) hōi .. ....	.... .... (24) bhūvai (1, 102) huvai (1, 102) hōi	.... .... Cf. hu- Cf. hu- Śaurasēni. Śaurasēni.
		(269) bhōdi .. (269) havadi (269) huvadi (269) hōdi (302) bhōdi ..	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....	.... .... .... (ix, 109) bhōdi (ix, 109) hōdi (xi, 6) hōi	.... .... .... Śaurasēni Śaurasēni. Śaurasēni. Śaurasēni. Āvanti Māgadhi. Vrācaḍa Apa- bhrāmśa.
	abhibhavati	....	....	....	....	(1) ahibhavai	....
	āvīrbhavati	....	....	....	....	....	(2) āvīrbhavai
	udbhavati	(60) ubbhvai	(3) ubbhvai	....	....	(1) ubbhvai	....
	paribhavati	(60) paribhavai	(3) paribhavai	....	....	....	....
	prabhavati	(60) pabhvai. (63) pabhvai	(3) pabhvai..	....	....	(1) parihvai (1) pabhvai	(2) parihvai
	 (390) pahuccai (63) pahuppai	(58) pahvai..	(1) pahvai ..	(2) pahvai (5) pahuppai (xviii, 8) paha- vai.	[par-āp- Apabhramśa. Cf.
	dusprabhavati	....	....	....	....	(1) duppahvai	....
	prādurbhavati	....	....	....	....	....	(2) pādubbha- vai. [vai.
	bahirbhavati	....	....	....	....	....	(4) bahibbha- vai.
	sāmbhavati	(60) sāmbhavai	(3) sāmbhavai	....	....	(1) sāmbhavai	....
	bhavanti	....	(1) huvanti .. (1) hoṃti ..	.... ....	.... ....	.... ....	.... ....
	bhaviṣyati	....	....	....	....	....	(ix, 110) bha- vissadi.
	sāmbhāvayati	(35) āsānghai (35) sāmbhāvai	....	....	....	....	....
	bhūtaḥ (-am)	(64) hūam	(57) hūam ..	(1) hūō ..	(3) hūō	Cf. lubh-.
		....	2) hūam (? hūam).	....	....	....	[dañ (ix, 111) bhū-
	anubhūtam	(64) anuhūam	....	....	....	....	....

¹ Text, bhōlavai.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.	
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.		
bhṛ- bhṛṣ- bhramś-	āvīrbhūtaḥ ..	.....	.....	.....	(1) āvīrbhūō ..	(4) āvīrbhūō	
	udbhūtaḥ ..	.....	.....	.....	(1) ubbhūō ..	(4) ubbhūō	
	parībhūtaḥ ..	.....	.....	.....	.....	(4) parīhūō	
	prabhūtaḥ (-am).	(64) pahūam ..	.....	.....	.....	(1) pahūō ..	(4) pahūam
	prādurbhūtaḥ ..	.....	.....	.....	(1) pādubbhūō ..	(4) pādubbhūō	
	bahīrbhūtaḥ ..	.....	.....	.....	.....	(4) bahīrbhūō	
	saṁbhūtaḥ ..	.....	.....	.....	(1) saṁbhūō ..	(4) saṁbhūō	
	bhūtā ..	.....	.....	.....	.....	(ix, 110) bhavia	Saurasēni
	bharati ..	.....	.....	.....	(3) bharaī ..	.....	Cf. smṛ.
	bhṛṣayati ..	.....	.....	.....	.....	(30) bhṛṣēī ..	Cf. bhī.
	bhraśyati ..	(177) cukkai ..	.....	.....	.....	.....	Cf. hā.
		(177) phīṭṭai, phīḍai.	(166) phīṭṭai	
		(177) phūṭṭai, phūḍai.	Cf. sphuṭ.
		(177) bhamsai	(166) bhassai	
	(177) bhullai ..	.....	.....	.....	.....	.....
bhram-	bhraṣṭam ..	.....	.....	.....	.....	(166) mhasai	
	bhramati ..	(161) gumai ..	.....	.....	.....	(183) cukkam ¹	
		(161) cakkam- mai.	.....	.....	.....	.....	.....
		(161) jhamṭai ..	.....	.....	.....	.....	.....
		(161) jhampai ..	.....	.....	.....	.....	.....
		(161) tiriṭṭai ..	.....	.....	.....	.....	.....
		(161) dhamḍh- allai.	.....	.....	.....	.....	.....
		(161) dhunḍh- ullai.	(137) dhunḍh- ullai.	Cf. gavṛṣ-
		(161) dhumai	
		(161) dhusai	
		(161) talaamṭai	
		(161) parai	
		(161) pariī	Cf. kṣip-
		(161) phumai	
	(161) phusai ..	.....	.....	.....	.....	.....	Cf. mṛj-
	(161, 239) bha- mai.	.....	(71) bhamai ..	.....	.....	(85) bhamai	
	(161) bhama- ḍai, bhamāḍai	.....	.....	.....	.....	.....
	(161) bhamma- ḍai.	.....	.....	.....	.....	(85) bhammāi	
	(161) bhumai ..	.....	.....	.....	.....	.....
	(DNM. vii, 14) ruṁṭai.	.....	.....	.....	.....	.....	Cf. ru- and v. 14 Hc. iv, 161.
	parībhramati ..	.....	.....	.....	.....	(171) parībha- mai. [mai.	
	bhramavati ..	(30) tamāḍai ..	.....	.....	.....	(171) parībha-	
	(30) tāliamṭai ..	.....	.....	.....	.....	.....	DNM. v. II = bhramati. Cf. tāliamṭai above.

¹ This is doubtful. It may = *hinam*. See *hā*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS	
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.		
mag-(magi, gatau).	bhrāmayati ..	(30) bhamāḍēi (30) bhamāvēi	.....	.....	.....	.....
	maṅgati ..	(30) bhāmai .. (230) maggai [ciṁcai.	.....	.....	.....	.....
	maṇḍayati ..	(115) ciṁcaai, (115) ciṁcillai (115) tiṁḍikkai (115) maṇḍai (115) riḍai	.....	.....	.....	.....
	mādyati ..	(225) maccai ..	.....	.....	.....	.....
mad- man- manth-	manyatē ..	(7) maṇai ..	.....	.....	.....	.....
	mathnāti ..	(121) ghusalai (121) maṁthai (121) virōlai ..	.....	.....	.....	.....
masj-	majjati ..	(101) āuḍḍai ..	.....	.....	.....	.....
		(101) khuppai ..	(68) khuppai ..	(51) khuppai ..	(23) khuppāē	(98) khuppai ..	Cf. pluṣ-	
		(101) niuḍḍai ..	.....	.....	.....	.....
		(101) buḍḍai ..	(68) vuttai ..	(51) buḍḍai (D. vuttai).	(23) bujjai (? buḍḍai).	(98) buḍḍai		
mā-	māti ..	(101) majjai ..	.....	.....	.....	.....	Cf. mṛj- Śaurasēni.
		.....	.....	.....	.....	(ix, 142) buḍ- ḍadi.	
		.....	.....	.....	.....	(ix, 142) maj- jadi.	Śaurasēni.
		.....	.....	.....	.....	(60) māai, māi (27) ṇimmai, (26) ṇimmāi	
mil- miśr-	saṁmilatē miśrayati ..	(19) nimmavai (19) nimmāṇai	(36) ṇimmāṇai	(46) ṇimmāṇai	(10) ṇimmāṇai (30) galai ..	(26) ṇimmāṇai		
		(28) missai .. (28) mēlavai .. (28) vīsālai ..	.....	.....	.....	.....
mil-	milati ..	(232) milai ..	.....	.....	.....	.....
		unmilati ..	(232) ummillai (232) ummilai	.....	.....	(86) milai (16) ummillai (16) ummilai ..	
	nimilati ..	(232) nimillai .. (232) nimilai	(86) nimillai (86) nimilai	
		pramilati ..	(232) pamillai (232) pamilai	(54) pamillai .. (54) pamilai ..	(62) pamillai .. (62) pamilai ..	(16) pamillai .. (16) pamilai ..	(86) pamillai (86) pamilai	
muc-	saṁmilati ..	(232) saṁmillai (232) saṁmilai	.....	.....	(16) saṁmillai (16) saṁmilai	.....	
		muñcati ..	(91) avahēḍai (91) ussikkai (91) chadḍai .. (91) nilluñchai (91) dhamsāḍai (91) muai	Cf. ut-kṣip- Cf. tyaj-
		(102, 108) muai (108) muñcai ¹	
		(91) mellai (91) réavai	(102) mōai	
		.....	.....	.....	.....	(xvii, 74) muai	Apabhraṁśa.

¹ So all my MSS. P. *mañcai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
		....	....	....	....	(xvii, 74) muk- kai.	Apabhraṁśa.
		....	....	....	....	(xvii, 74) muñ- cai.	Apabhraṁśa.
		....	....	....	....	(xvii, 74) mul- lai.	Apabhraṁśa.
		....	....	....	....	(xvii, 74) mōai	Apabhraṁśa.
	duḥkhaṁ muñ- cati.	(92) nivalēi..	....	....	....	....	Cf. kṣar-, niḥ-pa-
	muktam ..	....	....	....	(21) mukkaṁ	(182) mukkaṁ	
	muktvā ..	(212) mottūṇa	....	....	(17) [mottū- nām].	(102) mottūṇa	
	mōktavyam ..	(212) mottav- vaṁ.	....	....	(17) [mottav- vaṁ].	(102) mottav- vaṁ.	
	mōktum ..	(212) mottum	....	....	(17) [mottum]	(102) mottum	
muṣ-	muṣṇāti ..	(239) musai ..	....	(68) mūsai ..	....	(83) mūsai ¹ .	
	pramuṣṇāti ..	(184) pamhusai	....	....	....	....	Cf. pra-mṛṣ-,
	pramuṣitaḥ ..	(258) pamhuṭ- thō.	....	....	....	....	Cf. pra-mṛṣ-.
muh-	muhyati ..	(207) gummai	....	....	....	....
		(207) gumma- ḍai.	....	....	....	....
		(207, 217) muj- jhai.	....	....	....	....
mṛ-	mriyatē ..	(234) marai ..	(12) marai ..	....	....	(54) marai	
	mṛtāḥ ..	....	(1, 27) maō ..	....	....	(1, 35) muō.	
		....	....	....	....	(xii, 35, 36) maḍē, madē.	Māgadhi.
mṛj-	mārṣṭi ..	(105) ugghusai	....	....	....	....
		(105) puṁsai ..	....	....	....	....
		(105) puṁchai	....	....	....	....	Cf. pra-uñch-
		(105) pusai ..	....	....	(23) pusaē ..	(56) pusai ..	Cf. puṣ-, pra-uñ-
		(105) phusai ..	....	....	....	....	Cf. bhram-
		(105) majjai ..	....	....	....	....	Cf. masj-. Also below.
		(105) rōsānai ..	....	....	....	(56) rōsānai	
		(105) luṁchhai	....	....	....	....	Cf. pra-uñch-
		(105) luhai ..	(67) lubhai ..	(53) lubhai (D. luḍai).	(23) luhai ..	(56) luhai	
		....	(67) supai (? pusai).	(53) supai (D. prasai) (? pu- sai).	....	....
		(105) hulai ..	....	....	....	....	Cf. kṣip- Saurasēni.
		....	....	....	....	(ix, 117) phum- sadi.	
	parimārṣṭi ..	....	....	(46) parimailai	....	....
	mārjayati ..	....	....	....	....	(56) majjai	See above.
mṛd-	mṛdnāti ..	(126) khaddai	....	....	....	....	Cf. piṣ-, bhuj-
		(126) caḍḍai ..	....	....	....	....	Cf. vi-lul-
		(126) pannāḍai	....	....	....	....	Cf. vi-lul-
		(126) parihattai	....	....	....	....
		(126) maḍḍai	....	....	....	(73) maḍḍai	
		(126) maḍhai	....	....	....	....
		(126) malai ..	(50) malai ..	(46) malai (D. maṇai).	(25) malēi ..	(73) malai	

¹ So all my MSS. P. *pūsai*, q.v.s.v. *puṣ-*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍēya.	
mṛṣ-	pramṛṣati ..	(184) pamhusai	Cf. pra-muṣ-, vi smṛ- Cf. pra-muṣ-.
	pramṛṣtaḥ ..	(258) pamhuṣ- thō.	....	....	....	....
mṛṣ- mrakṣ-	mṛṣyati ..	(235) marisai	(11) marisai ..	(72) marisai ..	(2) marisai ..	(53) marisai	
	mrakṣati ..	(191) coppaḍai	....	....	....	....
	mrakṣitam ..	(191) makkhai (1, 200; DNM. v. 22) tuppaii.	....	....	....	(182) tuppaii
	mlāyati ..	(18) pavvāyai (18, 240) milāai milāi. (18) vāi ..	(21) vāai, vāi	(65) vāai, vāi..	....	(31) milāai (31) vāai, vāi (ix; 133) milā- adi.
	pramlāyati	(171) pavāai, pavvāai.	Śaurasēni
yam- yā-	yacchati ..	(215) jacchai	Cf. jan-.
	yāti ..	(240) jāai, jāi	....	....	....	(60) jāai, jāi ..
	yāpayati ..	(40) javai, jāvēi	....	....	....	....
yuj-	(?) āyati	(102) āi ¹	
	yunakti ..	(109) jujjai, jumjai. (109) juppai ..	....	....	....	....
	niyunakti ..	....	....	....	....	(68) niunjai (68) nimēi
yudh- ac-	prayunakti	(67) pauñjai	
	yudhyatē ..	(217) jujjhai ..	(48) jujjhai ..	(46) jujjhai ..	(15) jujjhai ..	(77) jujjhai	
	racayati ..	(94) avahai .. (94) uggahai .. (94) raai .. (94) vidavidḍai	....	....	....	....
	viracayati ..	....	....	....	....	(146) viraēi (146) vihivillai
	samāracayati ..	(95) uvahatthai (95) kēlayai .. (95) samārayai, samārai. (95) sāravai ..	....	....	....	....
añj-	rañjayati ..	(49) rañjēi .. (49) rāvēi ..	....	....	....	....
abh-	raktam	(02) rattam	
	ārabhatē ..	(155) ādhavai (155) ārabhai (155) āraimbhai	....	(46) ādhavai..	(11) dhavai ..	....
	ārabhyatē ..	(254) ādhappai (254) ādhavai	....	....	....	....
	parirabhatē ..	(DNM. i, 11) avarunḍai	....	....	....	....
	parirabhyatē ..	(DNM. i, 11) avarunḍijjai	....	....	....	....
am-	ramatē ..	(168) ubbhāvai (168) kilikimcai	....	....	....	....

¹ The printed edition has *antabbhai*, marked with a query. All my MSS. have *āi*, *vōi*, without any Sanskrit equivalent. With *āi*, cf. *āmī* in (ala 821 (Weber).

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚĀ, ACCORDING TO:—					REMARKS		
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya			
rā- rāj-	rāmyatē	(168) koṭṭumai	Cf. niḥ-sr.		
		(168) kheḍḍai	....	....	....	....
		(168) nīsarai ..	....	....	....	....
		(168) moṭṭāyai	....	....	....	....
		(168) ramai ..	....	....	....	(101) ramai
		(168) vellai ..	....	....	....	....
		(168) saṁkhud- ḍai.	....	....	....	....
		(58) ramijjai		(172) [ramijjai]	
		(58) rammai		(172) [ramīai]	
			(172) rammai	
rādh-	rādh- rāj-	(100) agghai	(ix, 147) ramīa- di.	Śaurasēni.		
		(100) chajjai ..	....	....	....	(60) rāai, rāi. ¹
		(100) rāyai ..	....	....	....	....
		(100) rīrai ..	....	....	....	(103) rāai. ²
		(100) rēhai ..	....	....	(27) rēhaē ..	(ix, 143) rāadi	
		(100) sahai ..	....	....	....	(103) rēhai
rū-	rū-	rādhnoṭi	(27) randhai	See below.		
		ārādhyati	(77) ārajjai	See above.		
		rādhayati	....	....	....	(99) randhai ..
rū-	rū-	virēcayati	(26) ulluṁḍai, ōluṁḍai.	Cf. pari-as-		
		....	(26) palhatthai	....	....	....
		....	(26) virēai ..	....	....	....
		....	(233) ravai ..	....	....	....
rū-	rū-	(57) ruñjai	Cf. bhram- Cf. rud- Cf. vi-str-		
		....	(57) ruṅtai ..	....	....	....
		....	(57) ruvai ..	....	....	....
		....	....	....	(37) (?) vihallai	....		
				
rū-	rū-	virauti	Cf. ru- Cf. below.		
		rugnaḥ	(258) luggō ..	....	....	....
		rōditi	(69) ruai ..	(11) ruai ..		(80) ruai	
		(226, 238) ruvai	(42) ruvai ..	(69) ruvai ..	(11) ruvai ..		(80, 102) ruvai	
		(69) ruvvai		(80) ruvvai ..	
		(69) rōai		(80) rōai	
			(102) rōi ³	
		(226, 238) rōvai	(69) rōvai ..	(11) rōvai ..		(80, 102) rōvai	
			(ix, 141) rōdadi	
			(182) ruṅṅam	
rū-	rū-	ruditam	(62) ruṅṅam ..	(83) ruṅṅam ..	(21) ruṅṅam ..	(182) ruṅṅam		
		rudityā	(212) rottūṅa	(55) rottūṅa	(17) [rottūṅam]	(102) rottūṅa		
		rōditavyam	(212) rottav- vam.	(55) rottavvaṅ vam.	(17) [rottav- vam.]	(102) rottavvaṅ vam.		
		roditum	(212) rottuṅ ..	(55) rottuṅ ..	(78) rōuṅ (only D.)	(17) [rottuṅ]	(102) rottuṅ		
		rudyate	(249) ruvvai	Cf. above.	
		(249) ruvijjai.		
		rū-	rū-	ruṅaddhi	(133) uttamghai	DNM. i. 137 utthamghai. Cf. un-nam- ut-kṣip-
				

¹ So only in P. Read *pāai*, *pāi*, q.v.s.v. *pā* (2).

² So to be read. P. has *rājai*.

³ The printed edition has *antabbhai*, marked with a query. All my MSS. have, instead, *ai*, *iōi*, without any Sanskrit equivalent.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA. ACCORDING TO :—					REMARKS
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rama-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
		(218) rujjhai .. (133, 218, 239) rumdhai. (218) rumbhai	(49) rundhai ..	(52) rundhai ..	(12) rundhai ..	(69) rundhai	
		.....	(49) rumbhai ..	(52) rumbhai (D. rustai).	(12) rumbhai	(69) rumbhai	
	nirunaddhi ..	.....	.....	.....	(12) nirundhai (12) nirumbhai	(ix, 441) rōvadi	Śaurasēni.
	rudhyatē ..	(245) rubbhai (245) rumdhij- jai.	.....	.....	.....	.....
	anurudhyatē ..	(248) aṇuruj- jhai. (248) aṇurum- dhijjai.	.....	.....	.....	.....
	uparudhyatē ..	(248) uvaruj- jhai. (248) uvarum- dhijjai.	.....	.....	.....	.....
	saṁrudhyatē	(248) saṁruj- jhai. (248) saṁrum- dhijjai.	.....	.....	.....	.....
ruṣ-	ruṣyati ..	(236) rūśai ..	(46) rūśai ..	(68) rūśai ..	(12) rūśai .. (24) (?) rōśai ..	(83) rūśai	
ruh-	ārōhati ..	(206) āruhāi ..	.....	.....	.....	(102, 136) aru- hai. (102) ārōhai (136) ullūḍhai	
		(206) caḍai ..	.....	.....	.....	(31) cummai .. (31) valaggai ..	(136) cumpai ² (136) valaggai
	ārōpayati ..	(206) valaggai (47) ārōvēi .. (47) balai ..	.....	.....	.....	.....	DNM. vii, 86, valai.
(rōmanth-)	rōmanthayati	(43) oggālai .. (43) rōmanthai (43) vaggōlai ..	.....	.....	.....	.....
lag-	lagati	(230) laggai ..	(52) laggai ..	(59) laggai ..	(14) laggai .. (36) vilaggai ..	(84) laggai	
lajj-	vilagati lajjatē ..	(103) jihai .. (103) lajjai ..	.....	.....	.....	.....
laḍ-	ladati	.....	.....	.....	.....	(128) murai .. (128) lalai	Cf. sphuṭ .
lap-	vilapati ..	(148) jhamkhai	.....	.....	.....	.....	Cf. upa-ā-labh-, niḥ-śvas-.
		.....	.....	.....	(35) lālappai .. (35) lālampai	(129) lālappai (129) lālabbhai (129) lālampai	Cf. DNM., vii, 27, lālampiarṁ = ā- kranditam.
		.....	.....	.....	(35) lālambhai (35) lālamhai	(129) lālambhai	

¹ So P. but very doubtful.

² So all my MSS. P. *campai*.

The corresponding passage (x, 32) of RT. gives *rōcadi* from \sqrt{ruc} . I suspect that the real root should be *rud*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA. ACCORDING TO:—					REMARKS.	
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.		
labh-	upālabhatē ..	(148) vaḍavaḍai	DNM. vi, 92, baḍabaḍai.	
		(148) vilavai ..	....	....	....	(120) vilavai
		(156) uvālan- bhai.	Cf. niḥ-svas-, n [ap Cf. vañc.	
		(156) jhamkhai	....	....	....	....
		(156) paccārai (156) vēlavai.	....	....	....	....
labhyatē ..	(249) labbhai (249) lahijjai ..	....	....	....	(172) labbhai (172) [lahijjai] (172) [lahiai]	
lamb- las-	lambatē lasati ..	(70) payallai	Cf. śithila-, pras-	
		....	....	....	....	(117) lasai (117) lhasai ..
	ullasati ..	(202) ārōai	(38) ? pūsai	Cf. srams- Cf. puṣ- Cf. vi-lul-
		(202) ullasai ..	....	....	....	....
		(202) ūsalai ..	....	....	....	....
		(202) ūsumbhai	....	....	....	....
		(202) gumjullai, gumjollai.	....	....	....	....
		(202) ṇillasai ..	....	....	....	....
		(202) pulāāi ..	....	....	....	....
		(238) lēi ..	....	....	....	....
lā- likh-	lāti likhati ..	....	....	....	....	(102) lihāi (102) lēhāi
lip-	limpati ..	....	....	....	....	(108) liai
		(149) liṃpai ..	....	....	....	(108) liṃpai (182) liam (182) littam
lih-	lihyatē ..	....	(59) lijjai ..	....	....	....
		(245) libbhāi ..	....	(80) libbhāi (D. lijjai).	(20) libbhāi ..	(176) libbhāi	
li-	liyatē ..	(245) lihijjai	(176) [lihijjai] (176) [lihiāi]	Śaurasēn.	
		....	....	....	....	(ix, 146) lihiāi
		(181) lijjai	Āvanti. DNM. i, 58, all.	
		....	....	....	....	(xi, 9) lijjai ..
		āliyatē ..	(54) alliai	
		niliyatē ..	(55) nirigghai	Cf. tuḍ- Cf. tuḍ-
			(55) ṇilijjai	
			(55) ṇiliai	
			(55) ṇilukkai	
			(55) likkai	
(55) lukkai ..	....		....	....	....
viliyatē ..	(55) lhikkai ..	....	....	....	....	Cf. pari-as- ā-gam- Cf. svap- Cf. vi-kas-
	(56) virāi ..	....	....	....	....
	(56) vilijjai ..	....	....	....	....
luṭ-	pralōṭati ..	(230) palōṭtai	....	....	....	(124) loṭṭai ! ..
luṭh-	luṭhati ..	....	....	....	....	....
	bhṛtōlluṭhitam	(DNM. vii, 81) vōsaṭṭam.	....	....	....	....

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS	
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.		
l-	lumpati	(108) lui (108) lumpai	Cf. lū-.	
	luptam ..	....	....	....	....	(182) luam .. (182) luttam
lh-	lubhyati ..	(153) lubbhai (153) sambhā- vai.	Cf. sam-bhū-.	
-	vilulati ¹	[lai. (38) (?) guñcel- (38) (?) parihaṭ- tai. (38) (?) pahōḍai	Cf. ud-las-. Cf. mṛd-. Cf. mṛd-.	
	lunāti ..	(241) luṇai ..	(56) luṇai ..	(73) luṇai ..	(18) luṇai ..	(87) luṇai (ix, 134) luṇadi	Śaurasēnī.	
-	ullunāmi	(18) [luvai]	Cf. lup-.	
	ullunāti ..	....	....	....	(18) ulluvāmi	(91) ulluvai
	lavitavyam ..	....	....	....	(18) laviavvam	....	
	lavitum ..	....	....	....	(18) laviuṇ ..	....	
	lūtṽ ..	....	....	....	(18) laviūṇam	....	
	lūnam ..	(258) luam ..	....	....	(19) luam ..	....	
	lūnavān ..	....	....	....	(19) luantō ..	....	
	lūyatē ..	(242) luṇijjai (242) luvvai ..	(57) luṇijjai .. (57) luvvai ..	(74) luṇijjai .. (74) luvvai ..	(19) [luṇijjai] (19) luvvai ..	(95) [luṇijjai] (95) luvvai		Apabhraṁśa. Cf. kath-, cyu-. Cf. kath-, vad-. Śaurasēnī.
	vakti ..	....	....	....	....	(xvii, 72) cavai ²
	-	ucyatē ..	(iii, 161) vuccai	(16) bollai ..		....	Cf. brū-.
uktvā ..		(211) vottūṇa	....	....	(II, i, 27) vuc- cadi.	....	
vaktavyam ..		(211) vottav- vam.	....	....	....	(102) vottūṇa (102) vottav- vam.
āñc-	vaktum ..	(211) vottum	(102) vottum	[macchai.	
	vañcati ..	(93) umacchai (93) jūravai .. (93) vañcai .. (93) vēlavai .. (93) vēhavai	DNM. i, 117, um- Cf. vraj-. Cf. upa-ā-labh-.	
	vadati	(16) voccai, vōcai	Apabhraṁśa. Cf. kath-, vac-. Cf. sprś-.	
	visaṁvadati ..	(129) phaiṁsai (129) viatṭai (129) vilotṭai (129) visaṁva- yai.	....	....	....	(xvii, 63) bollai
udyatē ..	....	....	(80) vacchai ..	....	....	Cf. vap-.

¹ Cf. dhatupāṭhu, *lul-* (*lud-, lul-*), *vilōḍanē*. It belongs to the 1st and 6th classes. But this root is different. It is the sautra root *lul-*, *vimar-*
lanē. See note to RT. 38. In Mk. P. reads *guñjellai*, but all my MSS. have *guñjellai*. Cf. DNM. ii, 92, *guñjellam*, *piṇḍikṭam*.
² This is doubtful. The text contains two words of the sūtra, and one word as an example. The sūtra forms the conclusion of an Anuṣṭubh line.
and must therefore scan *u-u-u*. The printed text reads *chupēs chavah. chavai*, but this is not borne out by any of my MSS., and appears to be a
conjectural emendation. My MSS. read (O.) *vacēs cavavah. vavai*; (Hnb.) *vatēs cavavah. vavai*; (Io, Ox.) *vacēśca vacah. vavai*. In all these there is
one syllable too many in the sūtra. In the Orlyā character, the letters *ca* and *va* closely resemble each other, and I therefore emend the whole to
vacēs cavai. cavai. This may be compared with Hc. iv, 2, where *cavai*=*kathavai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavagiśa).	Mārkaṇḍeya.	
vap- val-	vapati valati	..... (176) vaṃphai (176) valai	.....	(46) vacchai	.....	.....	Cf. vad. Cf. kāṅks. Cf. grah.
vas-	prōṣitam	.....	.....	.....	(16) valai, vallai	(182) pauttham (182) pavasiām	
vah-	ūḍham vōḍhavyam vōḍhum uhyatē	..... ..... ..... (245) vahijjai (245) vubbhai	.....	..... ..... ..... (80) vabbhai, (D. vajjhai).	..... ..... ..... (20) vabbhai..	..... ..... ..... (176) [vahijjai] (176) [vahiai] (176) vubbhai	
vā-	udvāti	(II 240) uvvā- ai, uvvāi. (II) ōrummāi (II) vasuāi	.....	.....	.....	(ix, 146) vahīadi	Śaurasēni.
vij-	udvijatē	..... (227) uvvivai	(43) uvvivai	..... (46) ovvēvai (D. uvvēvai).	.....	(81) uvvīai (81) uvvijjai (81) uvvivai, uvvivvai. (81) uvvēai, uvvēvai.	Cf. śuṣ.
vid-	udvēgaḥ vēdmi viditvā vēditavyam vēditum	(227) uvvēvō (238) bēmi, vēmi.	..... (55) vettūna (55) vettavvam (55) vettum	.....	.....	.....	See Pischel's tra- slation.
viś-	pariviśati praviśati	..... (183) pavisai	.....	.....	(37) pariviālai	(150) pariviālai (150) parivisai (149) ḍhukkai (149) paisai	
vij-	vijayati	(183) riāi (5) vijai (5) vojjai	.....	.....	.....	(xvii, 71) paisai (xvii, 71) pasa- vai.	Apabhraṃśa. Apabhraṃśa.
vṛ-	vṛṇōti saṃvṛṇōti	(234) varai (82) saṃvarai (82) sābaṭṭai (82) sāharai	(12) varai	.....	(3) varai	.....	Cf. tras.
vṛt-	nivārayati apavartatē udvartatē	(22) nivārēi (22) nihōḍai	.....	.....	.....	(119) avattai (119) ḍallai (119) ḍavattai (120) ullattai (120) uvvattai	Cf. pat. Cf. below

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
	parivartatē ..	.....	.....	.....	(34) ovaṭṭai ..	.....	Cf. above.
	vivartatē ..	(118) dhaṁsai	.....	.....	.....	.....
rdh-	vardhatē ..	(118) vivaṭṭai	.....	.....	.....	.....
		(220) vaḍḍhai	(44) vaḍḍhai..	(46) vaḍḍhai..	(14) vaḍḍhai..	(75, 101) vaḍḍhai.	
ṣ-	varṣati ..	(235) varisai ..	(11) varisai ..	(72) varisai ..	(2) varisai ..	(53) varisai	Vrācaḍa Apa
		.....	.....	.....	.....	(xviii, 9) vahadi	bhraṁśa.
ēp-	vēpatē ..	(147) āyajjhai	.....	.....	.....	.....
		(147) āyambai	.....	.....	.....	.....
		(147) vēvai ..	.....	.....	.....	.....
ēṣ-	vēṣtatē ..	(221) vēḍhai	(40) vēḍhai ..	(67) vēḍhai ..	.....	(71) vēḍhai ..	Cf. below.
	udvēṣtatē ..	(223) uvvellai	(41) uvvellai..	(67) uvvellai..	(14) uvvellai..	(72) uvvellai	Cf. pra-sṛ-
		(223) uvvēḍhai	.....	.....	.....	.....
	saṁvēṣtatē ..	(222) saṁvellai	(41) saṁvellai	(67) saṁvellai	(14) saṁvellai	(72) saṁvellai	
	vēṣṭyatē ..	(221) vēḍhijjai	.....	.....	.....	.....
	vēṣṭayati ..	(51) pariālēi	.....	.....	.....	.....	DNM. vi, 35, pari-
		(51) vēḍheī ..	.....	.....	(11) vēḍhai ..	.....	vālai.
yadh-	vidhyati ..	.....	.....	.....	(6) viddhai ..	.....	Cf. above.
vaj-	vrajati ..	(225) vaccai ..	(47) vaccai ..	(46) vaccai ..	(15) vaccai ..	(79) vaccai ..	Cf. kāṅkṣ-
		(294) vañṇadi	.....	.....	.....	.....	Māgadhī.
		.....	.....	.....	.....	(xvii, 70) vañ-	Apabhraṁśa. Cf.
		(392) vuñai ..	.....	.....	.....	cai.	vañc-
		.....	.....	.....	.....	.....	Apabhraṁśa.
	anuvrajati	(107) aṇuvaccai	.....	.....	.....	.....
		(107) paḍiaggai	.....	.....	.....	.....
k-	śaknōti ..	(86) cayai ..	(70) (?) caai' ..	(60) caai ..	(25) (?) caai' ..	(55) caai ..	Cf. tyaj-
		(86) tarai ..	(70) tarai ..	(60) tarai ..	(25) tarai ..	(55) tarai ..	Cf. tṛ- [tṛ-
		(86) tīrai ..	(70) tīrai ..	(60) tīrai ..	(25) tīraē ..	(55) tīrai ..	Cf. below and tīr-
		(86) pārai ..	.....	.....	.....	.....	Cf. pr-
		(86, 230) sak-	(52) sakkai ..	(60) sakkai ..	(14) sakkai ..	(84) sakkai ..	Cf. below and sṛp-
		kai.	.....	.....	.....	.....
		.....	.....	.....	.....	(ix, 131) sak-	Śaurasēni.
		.....	.....	.....	.....	kadi.	
	śakyatē ..	.....	.....	.....	.....	(ix, 131) sak-	Śaurasēni.
		.....	.....	.....	.....	kunadi.	
		.....	.....	.....	.....	(55, 174) sak-	Cf. above and
		.....	.....	.....	.....	kai.	sṛp-
		.....	.....	.....	.....	(174) tīrai ..	Cf. above and tīr-
		.....	.....	.....	.....	.....	tṛ-
		.....	.....	.....	.....	(ix, 132) sak-	Śaurasēni.
		.....	.....	.....	.....	kīadi.	
l-	śīyatē ..	(130) jhaḍai ..	.....	.....	.....	(ix, 132) sak-	Śaurasēni.
		(130) pakkhō-	.....	.....	.....	kunādi	
		ḍai.	.....	.....	.....	.....	Cf. kōśa-
		.....	(51) saḍai ..	(46) saḍḍhai,	.....	(74) saḍai ..	Cf. saḍ-
bdā-)	śabdāyatē ..	(395) dhuddhu-	.....	(D. saḍai).	.....	.....
		ai.	.....	.....	.....	.....	Apabhraṁśa.
n-	sāmyati ..	(167) paḍisāi	.....	.....	.....	.....	Cf. naś-

¹ Text, *vaai*.

² Text, *luai*.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.	
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Parkavāgīsa).	Mārkaṇḍeya.		
		(167) paḍisāmai (167) samai .. (239) uvasamai	.... .... ....	.... .... ....	.... .... ....	(15) sammāi .. .... ....	.... .... (85) uasamai, uasammāi.
śal- (śithila-) śiṣ- śi-	ucchalati .. śithilībhavati śiṣaṣṭi .. śētē ..	(174) utthallai (70) payallai (236) sīsai .. ....	.... .... .... ....	.... .... .... ....	(46) utthalai .. .... .... ....	.... .... .... (138) ṇumajjai	Cf. ut-str. Cf. lamb. pra. Cf. kath. Cf. ni-sad. G also ṇimai and ṇumai, s. v. 2. as- (2). Śaurasēni.
śudh- śuṣ-	śudhyati .. śuṣyati .. śuṣkam (236) sūsai (46) sūsai	(15) sujghai (21) sukkaṁ ..	(ix, 141) suādi (77) sujghai (139) vasuāai (83, 139) sūsai (183) vasuāai	Cf. vā.
śram-	viśrāmyati ..	(159) ṇivvāi .. (159) viśamai ..	.... ....	.... ....	.... ....	.... ....	.... ....
śru-	śramam karōti śrṇōti ..	(68) vāvamphai (58, 241) suṇai (58) haṇai	(56) suṇai ..	(73) suṇai ..	(18) suṇai ..	(87) suṇai (ix, 134) suṇadi	Cf. han- Śaurasēni.	
	śrutam .. śrutavān .. śrutvā ..	.... .... (241) suṇiūṇa (241) sōūṇa ..	.... .... ....	.... .... ....	.... .... ....	(19) suam .. (19) suantō (18) sōūnam .. (18) sōavvam .. (18) sōūm ..	.... .... .... .... ....
	śrōtavvam .. śrōtum .. śrūvatē ..	.... .... (242) suṇijjai (242) suvvai	(57) suṇijjai .. (57) suvvai ..	(74) [suṇijjai] (74) [suvvai]	.... .... ....	(95) suṇijjai (95) suvvai (ix, 135) suṇjadi (xi, 9) suvvai	Śaurasēni. Āvanti
ślāgh- śliṣ-	ślāghatē .. śliṣyati ..	(88) salahai .. (190) avayāsai (190) pariamtai (190) sāmaggai (190) silēsai ..	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....	.... .... .... .... ....
	āśliṣyati .. āśliṣtam ..	.... (ii, 49) āliddh- am	.... ....	.... ....	.... ....	(xvii, 73) ārun- nai. (182) āliddham	Apabhraṁśa.
śvas-	niḥśvasiti ..	(201) jhamkhai (201) nisāsai	.... ....	.... ....	.... ....	.... ....	Cf. vi-lap.
satra- (P tras-) sad-	satrayatē, (?) trasyati. sīdati .. niṣīdati ..	.... .... (219) saḍai .. (123) ṇumajjai	.... .... .... ....	.... .... .... (46) ṇumajjai	.... .... .... (13) saḍai .. (6) ṇimajjai ..	.... .... .... ....	Cf. śad- Cf. śi- ṇimai and s. v. ni-as-
sali-	niṣahate ..	.... ....	.... ....	.... ....	.... (40) niṣudhai	(118) niṣahai (118) niṣudhai ²	Cf. bhāṛak- namati. nam-

¹ Doubtful. The text may also be read as *drūma-* or *hṛūma-*, *hūsa-*, *drūsa-*, or *hṛūsa-*. The Sanskrit root may very possibly be a scribble for *tras-*.
² P. *niṣudhai*, which is incorrect.

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
	sōḍham ..	.....	.....	.....	(28) sahiam ..	.....
	sōḍhavyam ..	.....	.....	.....	(28) sōḍham ..	.....
	sōḍhum ..	.....	.....	.....	(28) sahiavvam ..	.....
	sōḍhum ..	.....	.....	.....	(28) sōḍhavvam ..	.....
sic-	siñcati ..	(96, 239) siñcai ..	.....	.....	(28) sahiam ..	.....
		(96) siñpai ..	.....	.....	.....	.....
		(96) seai ..	.....	.....	.....	.....
	sicyatē ..	(255) sippai ..	.....	.....	.....	.....
sidh-(1)	sidhyati ..	(217) sijjhai ..	.....	.....	(15) sijjhai ..	(77) sijjhai	Cf. snih-
sidh-(2)	niṣēdhati ..	(134) niṣēhai ..	.....	.....	.....	.....
		(134) hakkai ..	.....	.....	.....	.....
siv-	sīvyati ..	(230) sivvai ..	.....	.....	.....	.....
sū-	sūtē ..	(233) savai ..	.....	.....	.....	.....
	prasūtē ..	(233) pasavai ..	.....	.....	.....	.....
sr-	sarati ..	(234) sarai ..	(12) sarai ..	.....	(3) sarai ..	(54) sarai ¹ ..	Cf. smṛ-
	nihsarati ..	(79) dhāḍai ..	.....	.....	.....	.....
		(79) nilai ..	.....	.....	.....	.....
		(79) nisarai ..	.....	.....	.....	.....	Cf. ram-
		(79) niharai ..	.....	.....	.....	.....	Cf. ā-krand-
		(79) varahāḍai ..	.....	.....	.....	.....
	prasarati ..	(77) uvellai ..	.....	.....	.....	.....	DNM. i, 117, uv-
		(77) payallai ..	.....	.....	(40) paallai ..	(167) paallai	vellai. Cf. ud-
		(77) pasarai ..	.....	.....	.....	(167) pasarai	vēṣṭ-
		.....	.....	.....	(40) (?) muggā-	.....	Cf. lamb-, śithila-
		.....	.....	.....	hai, moggāhai ²	.....
srj-	gandhah prasa-	(78) mahama-	.....	.....	.....	.....
	rati.	hai.	.....	.....	.....	.....
	srjati ..	.....	.....	.....	.....	(ix, 122) gha-	Śaurasēni.
		.....	.....	.....	.....	sadi. ³	
srp-	avasrjati ..	(229) vōsirai ..	.....	.....	.....	.....
	nīsrjati ..	(229) nisirai ..	.....	.....	.....	.....
	sarpati ..	.....	.....	.....	(26) sakkai ..	(47) sakkai ..	Cf. śak-
	upasarpati ..	(DNM. i, 58)	.....	.....	(26) sappai ..	(47) sappai	Cf. ā-lī-
skhal-	skhalati ..	alliai.	.....	.....	.....	.....
		.....	.....	.....	(27) (?) khudh-	.....
		.....	.....	.....	ai, (?) khudai.	.....
etambh-	uttambhayati ..	.....	.....	.....	(27) khundai ..	.....	Cf. kṣud-
	avaṣṭambham	(67) samdānai	.....	.....	.....	(100) uttamghai	
	karōti.	.....	.....	.....	.....	.....
	niṣṭambham	(67) nitthuhai	.....	.....	.....	.....
	karōti.	.....	.....	.....	.....	.....
stu-	stauti ..	.....	.....	.....	.....	(65) tavai	
		.....	.....	.....	.....	(65) thuai	
		(241) thunai	.....	.....	(30) thunai ..	.....
		.....	.....	.....	(30) thuvai ..	(65) thuvai	

¹ So all my MSS. P *marai* (*mriyatē*).

² Doubtful. Text may also be read as *suggāha-*, *soggāha-*.

³ The printed text has *ghasah sṛjāḥ. pasadi*, which Hultzsch (ZDMG. lxxvi, 720) conjecturally emends to *ghasah sṛjāḥ. phasadi*. But all my MSS. agree in having *ghasah sṛjāḥ. ghasati*, which I adopt with the obvious emendation of the last word to *ghasadi*. Trivikrama, III, i, 48, gives *ghasati*=*mārsṭi*

SANSKRIT.		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.	
Root.	Form quoted.	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa)	Mārkaṇḍeya		
str-	utstr̥ṇōti ..	....	....	....	....	(ix, 120) thunadi. (163) uttharai (163) utthallai, otthallai.	Śaurasēni. Cf. ut-śal.
	vistr̥ṇōti ..	....	....	....	....	(164) vittharai (164) virillai	Cf. vi-ru.
styai- sthag-	saṁstyāyatē sthagati ..	(15) saṁkhai	(36) vihallai .. (35) otthai (45, 102) otthai (45, 102) ḍhak- kai. ¹	Cf. chad.
	(102) thaaī, (45) thaēi.	
sthā-	tiṣṭhati ..	(16) ciṭṭhai .. (16) ṭhāai, ṭhāi. (16) thakkai .. (16) nirappai	(26) ṭhāai, ṭhāi	(76) ṭhāai, ṭhāi	(9) ṭhāi .. ....	.... (102) thakkai	Cf. phakk.
	....	(208) ciṣṭhadi	(xii, 16) ciṭṭha- di. ....	....	....	(ix, 136) ciṭṭha- di. (xii, 32) ściṣṭa- di, (?) ściṣṭadi. (xvii, 67) thak- kai.	Śaurasēni. Māgadhi. Apabhraṁśa.
....	tiṣṭhanti ..	(395) ṭhaṁti	(25) ṭhāamti	(75) ṭhāanti	(9) ṭhāanti .. ....	....	Apabhraṁśa.
....	tiṣṭhatu ..	....	(26) ṭhāau, ṭhāu. ....	....	(9) ṭhāu .. ....	....	
....	sthāsyati ..	....	(26) ṭhāahii, ṭhābii. ....	....	(9) ṭhāhii .. ....	....	
....	uttiṣṭhati ..	(17) ukkukku- rai. (17) uṭṭhai .. ....	....	....	....	....
....	sthāpayati ..	....	....	....	....	(ix, 137) utthē- di. (162) ṭhavai, ṭhāvai. (xvii, 76) thak- kavai (xvii, 76) ṭha- vai.	Śaurasēni. Apabhraṁśa. Apabhraṁśa.
....	prsthāpayati ..	(37) paṭṭhavai, paṭṭhāvai. (37) peṇḍavai (258) nimiam (14) abhuttai (14) ṇhāi ..	....	....	....	....
snā-	sthāpitam ..	....	....	....	....	....
	snāti ..	....	....	....	....	....	Cf. pra-dip.
snih- spaud-	snihyatē ..	(255) sippai .. ....	....	....	....	....	Cf. sic.
	spaudatē ..	(127) culuculai (127) phaiṇḍai (258) phuḍam (62) nivvadai ..	....	....	....	....	Cf. sphur.
spāś-	spāṣṭam ..	....	....	....	....	....
sprś-	spāṣṭo bhavati ..	....	....	....	....	....	Cf. pṛthak
	sprśati ..	(182) ālihai .. (182) ālūṁkhai	....	....	....	(20) ālukkhai (144) ālūṁkhai ²	Cf. dah.

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO:—					REMARKS.
Root.	Form quoted	Hemacandra.	Vararuci	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
		(182) chivai ..	....	....	....	....	Cf. below and chup-.
		(182) chihai ..	....	....	....	....
		(182) phamsai	....	....	(29) phamsaē	(144) phamsai	Cf. vi-sam-vad-.
		(182) pharisai	....	....	....	....
		(182) phāsai ..	....	....	....	....
	parispr̥ṣāti ..	....	....	....	(29) chivai ..	....	Cf. above and chup-.
		....	....	....	(29) chuai ..	....	Cf. chup-.
	spr̥ṣtam ..	(DNM iii, 36) chikkaṁ.	....	....	(29) chikkaṁ	(182) chikkaṁ	Cf. kṣu-, chup-.
		(258) chittaṁ	....	....	(29) chittiaṁ	(182) chittaṁ	Cf. chup-.
		....	....	....	(29) chiviaṁ	....
	spr̥ṣyatē ..	(257) chippai	....	....	(29) chippai ..	....	Cf. chup-.
		(257) chivijjai	....	....	....	....
ṛh-	sprhayati ..	(34) sihai ..	....	....	....	....	Cf. kāūks-.
hū-	sphuṭati ..	(231) phuṭṭai	(53) phuṭṭai ..	(61) phuṭṭai ..	(15) phuṭṭai ..	(85) phuṭṭai ..	Cf. bhraṁś-.
		(231) phuḍai ..	(53) phuḍai ..	(61) phuḍai ..	(15) phuḍai ..	(85) phuḍai ..	Cf. bhraṁś-.
	prasphuṭati ..	....	....	....	....	(147) papphuṭ- ṭai.	
		....	....	....	(35) papphōḍaē	(147) papphō- ḍai.	
hur-	hāsena sphuṭati	(114) murai ..	....	....	....	....	Cf. laḍ-.
	sphurati ..	....	....	....	....	(165) culuculai	Cf. spand-.
		....	....	....	....	(165) phurai	
ar-	smarati ..	(74) jharai ..	....	....	....	....	Cf. kṣar-.
		(74) jhūrai ..	....	....	....	....
		(74) pamhuhai	....	....	....	....
		(74) payarai ..	....	....	....	....
		(74) bharai ..	(18) bharai ..	(49) bharai (D. marai).	(3) bharai ..	(14) bharai ..	Cf. bhṛ-.
		(74) bhalai ..	....	....	....	....
		(74) laḍhai ..	....	....	....	....
		(74) vimharai	....	....	....	....	Cf. below.
		(74) sarai ..	....	....	....	....	Cf. sṛ-.
		
		(74) sumarai	(18) sumarai	(40) sumarai (D. sumārai)	(3) sumarai ..	(14) suḍhai (14) sumarai	
		....	(xii, 17) suma- radi.	....	....	(ix, 140) suma- radi.	Śaurasēni.
	prasmarati ..	....	....	....	....	(18) pammai ²	
	vismarati ..	(75) pamhusai	....	....	....	....	Cf. pra-muṣ-, pra- mṣ-.
		(75) vimharai	....	....	....	(17) vimharai	Cf. above.
		....	....	....	(3) vissarai ..	(16) visarai	
		....	....	....	....	(15) visurai ³ ..	Cf. khid-.
	(75) visarai ..	....	....	....	(3) visarai ..	(16) visarai	
		....	....	....	....	(ix, 140) visu- maradi.	Śaurasēni.
arabīs-	sraṁsātē ..	....	....	(46) ōsai (D uttasai).	....	....
		(197) ḍimbhai	....	....	....	....
		(197) lhasai ..	....	....	....	....	Cf. las-.
		(197) saṁsai ..	....	....	....	....

¹ Text, *phuṭai*

² So all my MSS. P. *pammai*.

³ So all my MSS. P. *visurai*.

SANSKRIT		PRAKRIT DHĀTV-ĀDEŚA, ACCORDING TO :—					REMARKS.
Root.	Form quoted.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
svad-	parisramisatē svadatē ..	(197) parilhasai .....	.....	.....	.....	..... (100, 152) cak- khai. (152) saai	Cf. ad-, cakṣ-
svap-	āsvāditam svapiti ..	(258) cakkhiam (146) kamava- sai. (146) lisai .. (146) loṭṭai .. (146) suai ..	.....	.....	.....	..... (28) suai .. (28) sōai. sōi	Cf. luṭh-.
	svapsyati ..	.....	.....	.....	.....	(50) suai, suvai (50) sōai, sōvai (ix, 138) suadi (ix, 139) suvis- sadi.	Śaurasēni. Śaurasēni.
	suptam ..	.....	.....	.....	.....	(ix, 139) suvi- dam.	Śaurasēni.
	suptvā svaptavyam ..	.....	.....	.....	.....	(102) sottūna (102) sottav- vam. (ix, 139) suvi- davam.	Śaurasēni.
	svaptum ..	.....	.....	.....	.....	(102) sottum (ix, 139) suvi- dum.	Śaurasēni.
han-	hanti ..	..... (244) hammai	(45) hammai	(46) hammai	.....	(82) hanai .. (82) hammai (ix, 145) hanadi	Cf. śru. Cf. below hamm- Śaurasēni.
	hatah hatvā ..	(244) haō .. (244) haṃtūna	.....	.....	.....	.....	.....
	hantavyam ..	(244) haṃtav- vam.	.....	.....	.....	.....	.....
	hanyatē ..	(244) haṃjjai (244) hammai	.....	.....	.....	.....	Cf. above hamm-.
hamm-	hammati ..	(162) hammai	.....	.....	.....	.....	Cf. han-.
	āhammati ..	(162) āhammai	.....	.....	.....	.....	Cf. ā-gam-.
	nihammati ..	(162) nihammai	.....	.....	.....	.....	.....
	nirhammati ..	(162) nirhammai	.....	.....	.....	.....	.....
	prahammati ..	(162) paham- mai.	.....	.....	.....	.....	.....
has-	hasati ..	(106) gumjai (106, 239) hasai	.....	.....	.....	(16) hasai .. (16) hassai ..	(101) hasai Cf. below.
	hasyatē ..	(240) hasijjai (240) hassai ..	(58) hasijjai .. (58) hassai ..	.....	.....	.....	Cf. above.
hā-	jahāti hīnam ..	.....	.....	.....	.....	(21) cukkai ¹ (184) cukkam	? = bhraṣṭam- bhraṣṭ- Cf. bhū-
hu-	juhōti ..	(238) havai ² .. (238) hivai ² ..	.....	.....	.....	..... (88) huai	.....

¹ This is doubtful. Three of my MSS. (O, Io, and Ox) read *bhākaś cukkah*, and two read *bhātus cukkah*. P. emends to *bākaś cukkah*. He. 177 gives *bhāśvati = cukkai*, but in Mk. *√bhāś-* is provided for elsewhere, in vii, 167. I therefore adopt P.'s emendation of *bhāka* to *bāka*. So also, *cukkam* is doubtfully referred to *hīnam*. Cf. *bhyaś-*.

² The affiliation of these two to *juhōti* is doubtful. See Pischel's translation of the sūtra. They may = *bhavati*. Cf. Pischel's Grammar § 1.1.1.

SANSKRIT.		PRAKRIT DHĀTV-ĀDĒŚA, ACCORDING TO:—					REMARKS
Root.	Form quoted.	Hēmacandra	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
		(241) huṇai ..	(56) huṇai ..	(73) huṇai ..	(18) huṇai ..	(87, 88) huṇai (88) huvai ..	Cf. bhū- Śaurasēnī.
		.....	.....	.....	.....	(ix, 134) huṇa- di.
	hutam	(19) huam	Śaurasēnī.
	hutavān ..	.....	.....	.....	(19) huantō ..	.....
	hūyatē ..	(242) huṇijjai ..	(57) huṇijjai ..	(74) [huṇijjai]	(19) [huṇijjai]	(95) huṇijjai	
		(242) huvvai ..	(57) huvvai ..	(74) [huvvai]	(19) [huvvai]	(95) huvvai (ix, 135) huṇi- adi.	
hr-	harati ..	(234, 239) harai	Cf. grah-.
	praharati ..	(84) paharai ..	.....	.....	.....	.....
		(84) sārāi	Cf. grah-.
	vyāharati ..	(76) kukkai. kokkai.	.....	.....	.....	.....
		(76) pokkai	Cf. grah-.
	hriyatē ..	(76) vāharai ..	.....	.....	.....	.....
		(250) harijjai ..	.....	.....	(20) harijjai, harijai.	(173) harijjai
		(250) hīrai ..	(60) hīrai ..	(79) hīrai ..	(20) hīrai ..	(173) hīrai	Cf. grah-.
		.....	.....	(80) hīrijjai, hīriai. hīrii	.....	.....
	vyāhriyatē ..	(253) vāharijjai	Cf. grah-.
		(253) vāhippai	.....	.....	.....	.....
hr̥-	harsati ..	(235) harisai ..	(11) harisai ..	(72) harisai	(53) harisai	Cf. grah-.
hēs-	hēṣitam ..	(258) hīsama- nām.	.....	.....	.....	.....
hnu-	hnutē ..	(233) nihavai †	Cf. grah-.
	nihnutē ..	(233) nihavai	.....	.....	.....	.....
hlād-	hlādatē ..	(122) avaacchai	Cf. grah-.
	hlādayati ..	(122) avaacchai	.....	.....	.....	.....

INDEX II.

PRAKRIT—SANSKRIT.

In the following Index, for the purpose of alphabetical order, the letter *y*, indicating the *ya-sruti* described by Hēmacandra, is ignored, and treated as if it did not exist.

Thus, *ayamchai*, so far as the alphabetical order is concerned, is treated as if it were *aamchai*. This is necessary in order to permit of easy comparison being made with the forms quoted by the other grammarians, who do not indicate the *ya-sruti*.

For similar reasons, all words beginning with *n* are treated, so far as alphabetical order is concerned, as if they began with *ṇ*; that is to say, all words beginning with *n* will be found under *ṇ*.

In the column allotted to Hēmacandra, the sign * indicates that the word is also found with this meaning in the *Dēśināmamālā*. In the column for Kramadiśvara, the letter D. indicates the reading found in the edition of the relevant chapter of that author's grammar in *Delius's Radices Pracriticæ*.

† Pischel, Grammar, § 473, equates this with *nihnutē*.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
			a.			
ayam̐chai	karṣati *	.....	.....	.....	.....
aicchai	gacchati *	.....	.....	.....	.....
aīi	gacchati *	.....	.....	.....	.....
akkam̐dai	ākrandati	.....	.....	.....	.....
akkamai	ākramatē	.....	.....	.....	ākramatē	
akkusai	gacchati *	.....	.....	.....	.....
akkhivai	ākṣipati	.....	.....	.....	.....
akkhoḍēi	asim̐ kōśāt karṣati.*	.....	.....	.....	.....	DNM. i, 37, ak- khōḍai.
agghai	rājatē	.....	.....	.....	.....
agghavai	pūrayati *	.....	.....	.....	.....
agghāi	ājighrati	.....	.....	.....	.....
agghāḍai	pūrayati *	.....	.....	.....	.....
aṅgumai	pūrayati *	.....	.....	.....	.....
acchai	āstē	.....	.....	.....	asti	
acchāē	.....	.....	.....	asti	.....
acchadi	.....	asti	.....	.....	.....	Śaurasēni.
acchin̐dai	ācchinatti	.....	.....	.....	.....
ajjai	arjati	.....	.....	.....	.....
ajjatthai	.....	.....	.....	āgacchati	.....	Cf. ājatthai.
ajjijjai	arjyatē	.....	.....	.....	.....
ajjhassai	ākrośati *	.....	.....	.....	.....	Only in DNM. i. 13.
aṅcai	karṣati *	.....	.....	.....	.....
aṅcai	.....	.....	.....	ākramatē	.....
aṅṭai	kvathati *	.....	.....	.....	.....
aḍḍakkhai	kṣipati *	.....	.....	.....	.....
aṅai	.....	.....	jānāti	.....	.....	Cf. āṅai.
aṅacchai	karṣati *	.....	.....	.....	.....
aṅāijjai	ajñāyatē	.....	.....	.....	.....
aṅurujjai	anurudhyatē	.....	.....	.....	.....
aṅurum̐dhijjai	anurudhyatē	.....	.....	.....	.....
aṅuvaccai	anuvrajati	.....	.....	.....	.....
aṅuvajjai	gacchati	.....	.....	.....	.....
aṅuhām̐	anubhūtam	.....	.....	.....	.....
aṅhai	bhūṅktē *	.....	.....	.....	.....
atthi	.....	asti	.....	.....	asti	Vr. Śaurasēni.
appannai	.....	.....	.....	.....	ākramatē	
appāhai	sam̐diśati *	.....	.....	.....	ābhāṣatē	
appēi	arpayati	.....	.....	.....	.....
apphun̐ḍo	ākraṅtaḥ *	.....	.....	.....	.....	DNM. i, 20, also = pūrṅaḥ.
abbhāgacchai	abhimukham āgacchati.	.....	.....	.....	.....
abbhidai	sam̐gacchatē *	.....	.....	.....	.....
abbhuttai	snāti, pradip- yatē.*	.....	.....	.....	.....
allatthai	utkṣipati *	.....	.....	.....	.....
alliai	upasarpati	.....	.....	.....	.....	Cf. alliai.
allivai	arpayati	.....	.....	.....	.....
alliai	āliyatē *	.....	.....	.....	.....	DNM. i, 58, alliai.
avaakkhai	paśyati	.....	.....	.....	.....
avaacchai	hlādatē, hlā- dayati.*	.....	.....	.....	.....
avayacchai	paśyati *	.....	.....	.....	.....	DNM. i, 59, ava- acchai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS
	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya	
avayajjhai ..	paśyati *	.....	.....	.....	.....	DNM i, 48, avajjhai.
avaśai ..	paśyati *	.....	.....	.....	.....	DNM. i, 59, avāśai.
avayāśai ..	ślisīyati *	.....	.....	.....	.....
avakkhai ..	paśyati *	paśyati ..	paśyati ..	paśyati ..	paśyati ..	Cf. ovaṭṭai. Only in DNM. i, II.
avajjasai ..	gacchati *	.....	.....	.....	.....
avajjhāi ..	.....	.....	paśyati ..	.....	.....	Cf. ovaṭṭai. Only in DNM. i, II.
avaṭṭai ..	.....	.....	.....	.....	apavartatē ..	
avarumḍai ..	parirabhatē *	.....	.....	.....	.....	Cf. ovāśai. Cf. ovāhai.
avarumḍijjai ..	parirabhyatē *	.....	.....	.....	.....
avavāśai ..	.....	avakāsatē ..	.....	avakāsatē ..	.....	Cf. ovāśai. Cf. ovāhai.
avavāhai ..	.....	avagāhatē ..	.....	avagāhatē ..	.....
avasāai ..	.....	.....	.....	upagrḥṇāti ..	.....	DNM. i, 37, avahai.
avasēhai ..	gacchati, naśyati *	.....	.....	.....	.....
avahai ..	racayati *	.....	.....	.....	.....	Cf. vokkal.
avaharai ..	gacchati, naśyati.*	.....	.....	.....	.....
avahāvēi ..	krapatē *	.....	.....	.....	.....	Cf. vokkal.
avahēḍai ..	muṭcāti *	.....	.....	.....	.....
avukkai ..	vijñāpayati *	.....	.....	.....	.....	Cf. vokkal.
(?) asāai ..	.....	.....	.....	icchati ..	.....
ahiulāi ..	dahati *	.....	.....	.....	.....	See ahisāhai.
ahipaccuāi ..	āgacchati, grḥṇāti.*	.....	.....	.....	.....
abibhavai ..	.....	.....	.....	abhibhavati ..	.....	Cf. sāhai.
ahimāhai (?) ..	.....	.....	.....	.....	.....
abirēmai ..	pūrayati *	.....	.....	.....	.....	Cf. sāhai.
ahilamkhāi ..	kāṅksati *	.....	.....	.....	.....
ahilamghāi ..	kāṅksati *	.....	.....	.....	.....	Cf. sāhai.
ahivēmaē ..	.....	.....	.....	.....	.....
ahisāai ..	.....	.....	.....	abhibhanakti ..	.....	Cf. sāhai.
ahisāhai, (?) ahimāhai.	.....	.....	.....	ajānāti ..	ākramatē ..	
ā.						
āacchāi ..	.....	.....	.....	.....	āgacchati ..	DNM. i, 71, āaḍḍai.
āyajjhāi ..	vēpatē *	.....	.....	.....	.....
āaḍḍai ..	vyāpriyatē *	.....	.....	.....	.....	Cf. sāhai.
āyambāi ..	vēpatē *	.....	.....	.....	.....
āi ..	.....	.....	.....	.....	(?) āyāti ..	Cf. sāhai.
āigghāi ..	ājighrati *	.....	.....	.....	.....
āimchāi ..	karṣati *	.....	.....	.....	.....	Cf. sāhai.
āiñchāi ..	.....	.....	.....	.....	.....
āuḍḍai ..	majjati *	.....	.....	.....	kramatē ..	Cf. sāhai.
āgacchāi ..	āgacchati ..	.....	.....	.....	.....
ācaskadi ..	ācaṣṭē ..	.....	.....	.....	.....	Cf. sāhai.
ājatthāi ..	.....	.....	.....	.....	.....
āḍhappai ..	ārabhyatē *	.....	.....	.....	āgacchati ..	Cf. dhavai.
āḍhavai ..	ārabhatē *	.....	ārabhatē ..	.....	.....

Ādeśā.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
āḍhaviāi	ārabhyatē	.....	.....	.....	.....
ānai	.....	.....	jānāti	jānāti	.....	Cf anai.
āṇāvai	.....	.....	.....	.....	ānayati	Apabhraṁśa.
āṇīai	.....	.....	jñāyatē	.....	.....
āṇēi	.....	.....	.....	.....	ānayati	Apabhraṁśa.
ādarai	ādriyatē	.....	.....	.....	.....
ārajjai	.....	.....	.....	.....	ārādhyati	
ārabhai	ārabhatē	.....	.....	.....	.....
āraṁbhai	ārabhatē	.....	.....	.....	.....
āruṅṅai	.....	.....	.....	.....	āśliṣyati	Apabhraṁśa
āruhai	ārōhati	.....	.....	.....	ārōhati	
ārōai	ullasati *	.....	.....	.....	.....
ārōlai	puñjayati *	.....	.....	.....	.....
ārōvēi	ārōpayati	.....	.....	.....	.....
ārōhai	.....	.....	.....	.....	ārōhati	
āliddham	āśliṣtam *	.....	.....	.....	āśliṣtam	
ālihai	spṛṣati *	.....	.....	.....	.....
ālukkhai	.....	.....	.....	spṛṣati	.....
ālumkhai	dahati, spṛṣati *	.....	.....	.....	spṛṣati	
āvaāsai	.....	.....	.....	.....	upagūhati	
āvibbhavai	.....	.....	.....	.....	āvirbhavati	
āvibbhūō	.....	.....	.....	āvirbhūtaḥ	āvirbhūtaḥ	
āsamghai	sambhāvayati *	.....	.....	.....	.....
āhai	kāṅkṣati *	.....	.....	.....	.....
āhammai	āhammati	.....	.....	āgacchati	āgacchati	
āhōḍai	tāḍayati *	.....	.....	.....	.....
			i, ī.			
icchai	icchati	.....	.....	.....	.....
ijjai	.....	.....	.....	.....	jighrati	
			u, ū.			
uasamai	.....	.....	.....	.....	upaśāmyati	Cf. uvasamai.
uasammai	.....	.....	.....	.....	upaśāmyati	
ukkukkurai	uttiṣṭhati	.....	.....	.....	.....
ukkusai	gacchati *	.....	.....	.....	.....
ukkōśai	.....	.....	.....	utkōśayati	.....
ukkōśam	utkṛṣtam	.....	.....	.....	.....
ukkham	.....	.....	.....	.....	utkhātam	
ukkhayam	utkhātam	.....	.....	.....	.....
ukkhivai	utkṣipati	.....	.....	.....	.....
ukkhūḍai	tūḍati	.....	.....	.....	.....
ukkhubbhai	.....	.....	.....	.....	utkṣubhyati	
uggai	udghāṭayati *	.....	.....	.....	.....
uggahai	racayati	.....	.....	.....	.....
uggāhai	.....	.....	.....	.....	udgrāhayati	Cf. oggāhai.
uggaḍḍai	.....	.....	.....	.....	udghāṭayati	Cf. oggāhai.
uggāḍai	udghāṭayati	.....	.....	.....	.....
ugghusai	mārṣti *	.....	.....	.....	.....
umghai	nidrāti *	.....	.....	.....	.....
uccinai	uccinōti	.....	.....	.....	uccinōti	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadiśvara	Rāma śarman. (Tarkavāgīśa).	Mārkaṇḍeya.	
uccei	uccinōti	.....	.....	.....	uccinōti	
ujjambhai	.....	.....	.....	.....	ujjambhatē	
utt̥hai	uttiṣṭhathi	.....	.....	.....	.....
uddijjai	.....	.....	.....	.....	uddīyatē	
uddēi	uddayate	.....	.....	.....	.....
unnāai	.....	.....	.....	.....	unnadati	
unnāmei	.....	.....	.....	.....	unnāmayati (sic).	Cf. unnāmai.
unnālai	.....	.....	.....	.....	unnāmayati (sic).	
uttaiṅghai	ruṅaddhi *	.....	.....	.....	uttambhayati	DNM. i, 137, ut- thaiṅghai.
uttasai	.....	.....	.....	.....	.....	See ōśai.
utthamghai	utkṣipati, un- namayati *	.....	.....	.....	.....	Cf. uttaiṅghai. DNM. i, 137 om unnamayati.
utthaiṅghai	.....	.....	.....	unnamayati ..	.....
uttharai	.....	.....	.....	.....	utstṛṇōti	Cf. ottharai.
utthalai	.....	.....	ucchalati	.....	.....
utthallai	ucchalati	.....	.....	.....	utstṛṇōti	Cf. otthallai.
utthārai	ākramatē *	.....	.....	.....	.....
utthēdi	.....	.....	.....	.....	uttiṣṭhathi	Śaurasēni.
uddālai	ācchinatti *	.....	.....	.....	.....	DNM. i, 117, od dālai.
uddhamai	.....	.....	.....	uddhamati ..	.....	? uddhumai.
uddhumāai	.....	.....	.....	.....	uddhamati	
uddhumai	uddhamati. pū- rayati.*	uddhamati	.....	.....	uddhamati	DNM. i, 117, pū- ryatē, and om. uddhamati.
uddhūmai	.....	.....	uddhamati	.....	.....
uddhūlēi	uddhūlayati	.....	.....	.....	.....
unnāmai	unnamayati	.....	.....	.....	.....
uppālai	katthiyati *	.....	.....	.....	.....	Cf. unnāmēi. DNM. i, 117, up- phālai.
uppēlai	unnamayati *	.....	.....	.....	.....
ubbukkai	udbukhati	.....	.....	.....	.....
ubbhai	.....	.....	.....	.....	.....
ubbhavai	.....	udbhavati	.....	udbhavati	ūrdhvāyatē.	
ubbhāvai	ramatē	.....	.....	.....	.....
ubbhuai	udbhavati	.....	.....	.....	.....
ubbhuttai	utkṣipati *	.....	.....	.....	.....
ubbhuhai	.....	.....	.....	.....	.....
ubbhūo	.....	.....	.....	.....	utkṣubhyati	
umacchai	vaṅcati *	.....	.....	udbhūtaḥ	udbhūtaḥ	
ummatthai	abhyāgaccha- ti.*	.....	.....	.....	.....	DNM. i, 117, um- macchai.
umillai	unmilati	.....	.....	unmilati	.....
umilai	unmilati	.....	.....	unmilati	.....
ullaṭṭai	.....	.....	.....	.....	.....
ullaḍḍai	.....	.....	.....	.....	udvartatē	
ullasai	ullasati	.....	.....	udvartatē	.....
ullālai	unnamayati *	.....	.....	.....	.....
ulluani	.....	.....	.....	unnamayati ..	.....
ullukkai	tuḍati	.....	.....	.....	udgatam	
ulluṅḍai	virēcayati *	.....	.....	.....	.....	Cf. ōluṅḍai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāna-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
ulluvai ..	.....	.....	.....	.....	ullūnāti	
ulluvāmi ..	.....	.....	.....	ullunāmi ..	.....
ullūḍhai ..	.....	.....	.....	.....	ārōhati	
ullūrai ..	tuḍati *	.....	.....	.....	.....
uvaūhai ..	.....	.....	.....	.....	upagūhati	
uvarujjhai ..	uparudhyatē	.....	.....	.....	.....
uvaumdhijjai ..	uparudhyatē	.....	.....	.....	.....
uvasappai ..	upasarpati ..	.....	.....	.....	.....
uvasamai ..	upaśāmyati ..	.....	.....	.....	.....	Cf. uasamai.
uvahatthai ..	sa nāracyati	.....	.....	.....	.....
uvahumjai ..	upabhuṅktē ..	.....	.....	.....	.....
uvālabhai ..	upālabhatē ..	.....	.....	.....	.....
uvellai ..	prasarati *	.....	.....	.....	.....	DNM. i, 117, uvellai.
uvvaṭṭai ..	.....	.....	.....	.....	udvartatē	
uvvāai, uvvāi ..	udvāti ..	.....	.....	.....	.....
uvvai ..	.....	.....	.....	.....	udvijatē	
uvvijjai ..	.....	.....	.....	.....	udvijatē	
uvvivi ..	udvijatē ..	udvijatē ..	.....	.....	udvijatē	
uvvivvai ..	.....	.....	.....	.....	udvijatē	
uvvellai ..	udvēṣtatē *	udvēṣtatē ..	udvēṣtatē ..	udvēṣtatē ..	udvēṣtatē ..	DNM. i, 117, prasarati. Cf. uvellai.
uvvēai ..	.....	.....	.....	.....	udvijatē	
uvvedhai ..	udvēṣtatē ..	.....	.....	.....	.....
uvvēvai ..	.....	.....	.....	.....	udvijatē ..	Cf. ovvēvai.
uvvēvō ..	udvēgah	.....	.....	.....	.....
ussikkai ..	muñcati, utkṣipati.*	.....	.....	.....	.....
uhai (?) ..	.....	.....	.....	.....	(?) ubhati	
ūsalai ..	ullasati ..	.....	.....	.....	.....
ūsūmbhai ..	ullasati ..	.....	.....	.....	.....
o, ō.						
okkhanai ..	.....	.....	.....	kaṇati ..	.....	Cf. oiganai.
oggahai ..	.....	.....	.....	praticchati ..	praticchati ..	Cf. uggahai.
oggālai ..	romanthayati.*	.....	.....	.....	.....
ogēhai ..	.....	.....	.....	.....	udgrāhayati ..	Cf. uggāhai.
ogghaē ..	.....	.....	.....	udghāṭayati ..	.....
ogghēi ..	.....	.....	.....	.....	udghāṭayati	
oiganai ..	.....	.....	.....	.....	kvaṇati ..	Cf. okkhanai.
otthai ..	.....	.....	.....	sthaḡati ..	sthaḡati	
ottharai ..	.....	.....	.....	utstrñōti ..	.....	Cf. uttharai.
otthallai ..	.....	.....	.....	utstrñōti ..	utstrñōti ..	Cf. utthallai.
oddālai ..	ācchinatti *	.....	.....	.....	.....	Only DNM. i, 117 Cf. uddālai.
ombālai ..	chādayati, plāvayati.*	.....	.....	.....	.....
ovvēvai ..	.....	.....	udvijate ..	.....	.....	D. ovvēvai. Cf. ovvēvai.
ōakkhai ..	paśyati *	.....	.....	.....	.....
ōaggai ..	vyāpnōti *	.....	.....	.....	.....
ōamḍai ..	ācchinatti *	.....	.....	.....	.....

SANSKRIT EQUIVALENT, ACCORDING TO :--

Ādeśa	SANSKRIT EQUIVALENT, ACCORDING TO :--					REMARKS.
	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa)	Mārkaṇḍeya.	
ōarai ..	avatarati ..	.....	.....	.....	.....
ōallai ..	.....	.....	.....	avavartatē, (?) apavartatē.	apavartatē	
ōgāhai ..	avagāhatē ..	.....	.....	.....	avagāhatē	
ōjimbhai ..	.....	.....	.....	.....	jighrati	
ōrasai ..	avatarati * ..	.....	.....	.....	.....
ōrummāi ..	udvāti * ..	.....	.....	.....	.....
ōlumḍai ..	virēcayati * ..	.....	.....	.....	.....
ōvatṭai ..	.....	.....	.....	parivartatē ..	apavartatē ..	Cf. ullumḍai.
ōvāsai ..	avakāśatē * ..	avakāśatē ..	avakāśatē ..	avakāśatē ..	avakāśatē ..	Cf. avatṭai.
ōvāsēi ..	.....	.....	.....	avakāśatē ..	.....	Cf. avavāsai.
ōvāhai ..	avagāhatē * ..	avagāhatē ..	avagāhatē ..	.....	avagāhatē ..	Cf. avavāhai, ogā- hai.
ōvāhaē ..	.....	.....	.....	avagāhatē ..	.....
ōvāhiam ..	.....	.....	.....	avagāḍham ..	.....
ōsai ..	.....	.....	sramśatē ..	.....	.....	D. uttasai.
ōsukkai ..	tējayati * ..	.....	.....	.....	.....
ōhai ..	avatarati * ..	.....	.....	.....	.....
ōhāv ai ..	ākramatē * ..	.....	.....	.....	.....
ōhīrai ..	nidrāti ..	.....	.....	.....	.....
k.						
kaam ..	kṛtam ..	kṛtam ..	.....	kṛtam ..	kṛtam ..	
kamkhai ..	kāṅkṣati ..	.....	.....	.....	.....
kaṭṭai ..	.....	.....	.....	.....	kṛntati	
kaṭṭhai ..	.....	.....	kvathati ..	.....	.....
kaḍē ..	.....	.....	.....	.....	kṛtaḥ ..	D. kaḍḍhai.
kaḍḍhai ..	karṣati ..	.....	.....	karṣati ..	karṣati ..	Māgadhi. Cf. karisai, kaṭ- ṭhai.
kaḍhai ..	kvathati ..	kvathati ..	.....	kvathati ..	kvathati ..	Cf. kaṭṭhai.
kanai ..	kanati ..	.....	.....	.....	kvanati	
katthai ..	kathyatē ..	.....	.....	.....	.....
kadam, kadē ..	kṛtam ..	.....	.....	.....	kṛtaḥ ..	Cf. kahijjai.
kadbēdi ..	kathayati ..	.....	.....	.....	kathayati ..	Māgadhi.
kamai ..	.....	.....	.....	.....	kramatē	Śaurasēni.
kamavasai ..	svapiti * ..	.....	.....	.....	.....
kampēi ..	kampayati ..	.....	.....	.....	.....
kammai ..	kṣuram karōti* ..	.....	.....	.....	.....
kammavai ..	upabhūktē * ..	.....	.....	.....	.....
kammei ..	bhūktē * ..	.....	.....	.....	.....
karai ..	karōti ..	karōti ..	karōti ..	karōti ..	karōti ..	[mai. DNM. ii, 56, kam- Cf. kuṇai.
karai ..	.....	.....	.....	.....	karōti ..	Apabhramśa.
karamjai ..	bhanakti * ..	.....	.....	.....	.....
karijjai ..	kriyatē ..	.....	.....	.....	.....
karisai ..	karṣati ..	karṣati ..	karṣati ..	kriyatē ..	kriyatē ..	
kariai ..	.....	.....	.....	karṣati ..	karṣati ..	Cf. kaḍḍhai.
karēdi ..	.....	.....	.....	kriyatē ..	.....
kavai ..	.....	karōti ..	.....	.....	karōti ..	Śaurasēni
kabai ..	kauti ..	.....	.....	.....	.....
kahai ..	kathayati ..	.....	.....	.....	.....
kahijjai ..	kathyatē ..	.....	.....	kathayati ..	.....
kahiai ..	.....	.....	.....	.....	.....	Cf. katthai.
kahēi ..	.....	.....	.....	.....	kathyatē	
kahēdi ..	.....	.....	.....	.....	kathayati	
kāvvaṁ, kāya- vvaṁ.	kathayati ..	.....	.....	.....	.....	Śaurasēni.
	kartavyam ..	kartavyam ..	kartavyam ..	kartavyam ..	kartavyam ..	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarmau (Tarkavāgiśa).	Mārkaṇḍeya.	
kāum	.. kartum	.. kartum	.. kartum	.. kartum	.. kartum	
kāūṇa	.. kṛtvā	.. kṛtvā	.. kṛtvā	.. kṛtvā	.. kṛtvā	
kāūṇam	.. ..	.. ..	.. ..	.. kṛtvā	.. ..
kāmēi	.. kāmayatē	.. ..	.. ..	.. ..	.. ..
kārai	.. ..	.. ..	.. ..	.. ..	.. kārāyati	
kāhīa	.. akarōt	.. akarōt	.. akarōt	.. akarōt	.. akarōt	
kāhīi	.. kariṣyati	.. kariṣyati	.. kariṣyati	.. kariṣyati	.. kariṣyati	
kijjauṇi	.. kriyē	.. ..	.. ..	.. ..	.. ..	Apabhrāmśa.
kinai	.. kṛiṇāti	.. kṛiṇāti	.. kṛiṇāti	.. kṛiṇāti	.. kṛiṇāti	
kilikimcai	.. ramatē *	.. ..	.. ..	.. ..	.. ..
kīrai	.. kriyatē	.. kriyatē	.. kriyatē	.. ..	.. kriyatē	
kīraē	.. ..	.. ..	.. ..	.. kriyatē	.. ..
kīratē	.. kriyatē	.. ..	.. ..	.. ..	.. ..	Paiśāci.
kīlaē	.. ..	.. ..	.. ..	.. kṛiḍati	.. ..
kīsu	.. kriyē	.. ..	.. ..	.. ..	.. ..	Apabhrāmśa. Cf. kokkai.
kukkai	.. vyāharati	.. ..	.. ..	.. ..	.. ..
kujjhai	.. krudhyati	.. ..	.. krudhyati	.. ..	.. krudhyati	
kuṇai	.. karōti	.. karōti	.. karōti	.. karōti	.. karōti	Cf. karai.
kuppai	.. kupyati	.. ..	.. ..	.. ..	.. ..
kēlāyai	.. samāracayati *	.. ..	.. ..	.. ..	.. ..
kokkai	.. vyāharati *	.. ..	.. ..	.. ..	.. ..	Cf. kukkai
koṭṭumai	.. ramatē *	.. ..	.. ..	.. ..	.. ..
kōāsai	.. vikasati *	.. ..	.. ..	.. ..	.. ..
<i>kh.</i>						
khaai	.. ..	.. ..	.. ..	.. ..	.. khaunāti	
khanrai	.. kṣubhyati *	.. ..	.. ..	.. khacnāti	.. khaunāti	
khacai	.. khacati	.. ..	.. ..	.. ..	.. ..
khaḍukkai	.. ..	.. ..	.. ..	.. ..	.. upakramayati	P. khaḍukkai
khaḍḍai	.. mṛḍnāti *	.. ..	.. ..	.. ..	.. ..
khanai	.. ..	.. ..	.. ..	.. (?) khanati	.. khanati	Śaurasēni.
khaṇadi	.. ..	.. ..	.. ..	.. ..	.. khanati	
khaṇijjai	.. khanyatē	.. ..	.. ..	.. ..	.. ..
khamai	.. ..	.. ..	.. ..	.. (?) khanati	.. ..
khammai	.. khanyatē	.. ..	.. ..	.. khanati	.. khanati	
khāai, khāi	.. khādati	.. khādati	.. khādati	.. khādati	.. khādati	
khāu	.. ..	.. khādātu	.. ..	.. ..	.. ..
khābii	.. ..	.. khādīsyati	.. ..	.. ..	.. ..
khijjai	.. khidyatē	.. ..	.. ..	.. ..	.. khidyatē	
khippai	.. ..	.. ..	.. kṛpayati	.. ..	.. ..
khirai	.. kṣarati *	.. ..	.. ..	.. ..	.. ..
khivai	.. kṣipati	.. ..	.. ..	.. ..	.. ..
khujjai	.. ..	.. ..	.. ..	.. paryasyati	.. paryasyati	
khuttai	.. tuḍati *	.. ..	.. ..	.. ..	.. tuḍati	
(?) khudai, (?) khudhai.	.. ..	.. ..	.. ..	.. skhalati	.. ..
khudai	.. tuḍati *	.. ..	.. ..	.. ..	.. ..	Cf. khoḍḍai. Cf. (?) khudai.
khundai	.. ..	.. ..	.. ..	.. kṣuṇatti, skha- lati	.. kṣuṇatti	
khundadi	.. ..	.. ..	.. ..	.. ..	.. kṣuṇatti	Śaurasēni.
khuppai	.. majjati *	.. majjati	.. majjati	.. plōṣati	.. plōṣati, majjati	
khuppaē	.. ..	.. ..	.. ..	.. majjati	.. ..
khubbhai	.. kṣubhyati	.. ..	.. ..	.. ..	.. ..
khummai	.. ..	.. ..	.. ..	.. kṣuṇatti	.. kṣuṇatti	

Ādesa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-sarman (Tarkavāgīśa).	Mārkaṇḍeya.	
khulai ..	.....	.....	.....	.....	kṣuṇatti	
khedḍai ..	ramatē *	.....	.....	.....	.....
khodḍai ..	.....	.....	.....	truṭyati ..	.....	Cf. khudai.
8.						
gacchai ..	gacchati ..	.....	.....	.....	.....
gajjai ..	garjati ..	.....	.....	.....	.....
gaḍhai ..	ghaṭatē ..	.....	ghaṭatē ..	ghaṭatē ..	.....
gaṇṭhai ..	grathnāti ..	.....	.....	.....	.....	Cf. gaṇṭhai.
gamijjai ..	ganyate ..	gamyatē ..	.....	.....	gamyatē ..	
gamīai ..	.....	.....	.....	.....	gamyatē ..	
gamfadi ..	.....	.....	.....	.....	gamyatē ..	Śaurasēni.
gamēsai ..	gavēṣayati ..	.....	.....	.....	.....	Cf. gavēsai.
gammai ..	gamyatē ..	gamyatē ..	.....	ganyatē ..	gamyatē ..	
gammaē ..	.....	.....	.....	.....	gamyatē ..	Āvanti.
galai ..	.....	.....	.....	saṁmilatē ..	.....
galatthai ..	kṣipati ..	.....	.....	.....	.....
gavēsai ..	gavēṣayati ..	.....	.....	.....	.....	Cf. gamēsai.
gasai ..	grasatē ..	.....	.....	.....	.....
gahijjai ..	.....	grhyatē ..	.....	.....	.....
gahidam̄ ..	.....	.....	.....	.....	grhitam ..	Śaurasēni.
gāai ..	gāyati ..	gāyati ..	[gāyati] ..	.....	gāyati ..	
gāau ..	.....	gāyatu ..	.....	.....	.....
gāaē ..	.....	.....	.....	gāyati ..	.....
gāam̄ti, gāanti ..	.....	gāyanti ..	gāyanti ..	.....	.....
gāahii ..	.....	gāsyati ..	.....	.....	.....
gāi ..	gāyati ..	gāyati ..	[gāyati] ..	gāyati ..	gāyati ..	
gāu ..	.....	gāyatu ..	.....	gāyatu ..	.....
gāhii ..	.....	gāsyati ..	.....	gāsyati ..	.....
gāhijjai ..	.....	grhyatē ..	.....	.....	.....
gijjai ..	.....	.....	.....	.....	gīyatē ..	
gijjhai ..	grdhayati ..	.....	.....	grdhayati ..	grdhayati ..	
gilai ..	.....	.....	.....	.....	girati ..	
guñcellai ..	.....	.....	.....	.....	.....
gum̄jai ..	hasati *	.....	.....	vilulati ..	.....	Cf. guñjellai.
gum̄jullai, gum̄- jollai.	ullasati *	.....	.....	.....	.....
guñjellai ..	.....	.....	.....	.....	.....
gunḥai ..	.....	.....	.....	.....	vilulati ..	Cf. guñcellai.
gum̄ṭhai ..	uddhūlayati *	.....	.....	.....	grṇhāti ..	Apabhraṁśā. Cf. grṇhai.
gunṭhai ..	.....	.....	.....	.....	.....
guppai ..	gupyati ..	.....	.....	.....	grathnāti ..	Cf. gaṇṭhai
gumai ..	bhramati *	.....	.....	.....	.....
gummai ..	muhyati *	.....	.....	.....	.....
gummaḍai ..	muhyati *	.....	.....	.....	.....
gulaguṁchai ..	unnamayati, ut kṣipati ..	.....	.....	.....	.....	Cf. guluguṁchai.
gulalai ..	cāṭu karōti *	.....	.....	.....	.....
guluguṁchai ..	.....	.....	.....	.....	unnamayati ..	Cf. gulaguṁchai.
(?) gūlai ..	.....	.....	.....	.....	(sic).	
grṇhai ..	grṇhāti ..	.....	.....	unnamayati ..	.....	Apabhraṁśā, Cf. gunḥai.

Ādēsa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadīśvara	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
gejjai ..	.....	.....	.....	gr̥hyatē ..	.....	Cf ghejjai.
gejjhai ..	.....	.....	.....	.....	gr̥hyatē ..	.....
gejjhadi ..	.....	.....	.....	.....	gr̥hyatē ..	.....
geñhai ..	gr̥hñāti ..	gr̥hñāti ..	gr̥hñāti ..	gr̥hñāti ..	gr̥hñāti ..	.....
geñhadi ..	.....	.....	.....	.....	gr̥hñāti ..	.....
geñhia ..	gr̥hītvā ..	.....	.....	.....	.....	.....
geñhiam̐ ..	gr̥hītam ..	.....	.....	.....	.....	.....
geñhiavvam̐ ..	.....	.....	.....	grahītavayam ..	.....	.....
geñhiuṃ ..	.....	.....	.....	grahītum ..	.....	.....
geñhiūna ..	.....	.....	.....	gr̥hītvā ..	gr̥hītvā ..	.....
geñhijjai ..	gr̥hyatē ..	.....	gr̥hyatē ..	gr̥hyatē ..	.....	.....
geñhiai ..	.....	.....	.....	gr̥hyatē ..	gr̥hyatē ..	.....
gēhiavvam̐ ..	.....	.....	.....	grahītavayam ..	.....	.....
[gēhiuṃ] ..	.....	.....	.....	grahītum ..	.....	.....
[gēhiūna] ..	.....	.....	.....	gr̥hītvā ..	.....	.....
(?) ggēkhai ..	.....	.....	.....	.....	gr̥hñāti ..	.....
<i>gh.</i>						
ghaṭṭai ..	.....	.....	.....	ghaṭatē ..	.....	.....
ghaḍai ..	ghaṭatē ..	.....	.....	.....	.....	.....
ghaḍēi ..	ghaṭayati ..	.....	.....	.....	.....	.....
ghanai ..	.....	.....	.....	paśyati ..	.....	.....
ghattai ..	kṣipati, gavē- śayati.* ..	.....	.....	.....	.....	.....
ghasai ..	.....	.....	grasatē ..	.....	.....	.....
ghasadi ..	.....	.....	.....	.....	gr̥jati ..	.....
ghisai ..	grasatē ..	grasatē ..	(D. grasatē) ..	grasatē ..	grasatē ..	D. ghisai Śaurasēni. Cf. ghasai. Vr text has visai. See ghoṭṭai.
ghuṭṭai ..	.....	.....	.....	.....	.....	.....
ghuinmai ..	ghūrnatē * ..	.....	.....	ghūrnatē ..	ghūrnatē ..	.....
ghummadi ..	.....	.....	.....	.....	ghūrnatē ..	.....
ghulai ..	ghūrnatē * ..	.....	.....	.....	.....	.....
ghusalai ..	mathnāti * ..	.....	.....	.....	.....	.....
ghejjai ..	.....	.....	.....	gr̥hyatē ..	.....	.....
ghejjhai ..	.....	.....	.....	.....	gr̥hyatē ..	.....
ghettavvam̐ ..	grahītavayam ..	grahītavayam ..	.....	grahītavayam ..	.....	.....
ghettuāṇa ..	gr̥hītvā ..	.....	.....	.....	.....	.....
ghettum̐ ..	grahītum, gr̥- hītvā. ..	grahītum ..	.....	.....	.....	.....
ghettūna ..	gr̥hītvā ..	gr̥hītvā ..	.....	gr̥hītvā ..	.....	.....
gheppai ..	gr̥hyatē ..	.....	gr̥hyatē ..	gr̥hyatē ..	gr̥hyatē ..	.....
gheppadi ..	.....	.....	.....	.....	gr̥hyatē ..	.....
gheppijjai ..	.....	.....	gr̥hyatē ..	.....	.....	.....
ghēavvam̐ ..	.....	.....	grahītavayam ..	.....	grahītavayam ..	.....
ghēuṃ ..	.....	.....	grahītum ..	grahītum ..	grahītum ..	.....
ghēūna ..	.....	.....	gr̥hītvā ..	.....	gr̥hītvā ..	.....
ghoṭṭai ..	pibati * ..	.....	pibati ..	.....	pibati ..	.....
ghōṇai ..	.....	.....	ghūrnatē ..	gbūrnatē ..	.....	.....
ghōlai ..	ghūrnatē * ..	ghūrnatē ..	.....	.....	.....	.....
caai ..	.....	(?) śaknōti ..	śaknōti ..	(?) śaknōti ..	śaknōti, tya- jati. ..	Vr. text has vai. RT. text has tuai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
cayai ..	śaknōti.* tyajati.	....	....	....	....	DNM. iii, 4, om tyajati.
cakkammai ..	bhramati *	....	....	....	....
cakkhai ..	....	....	....	atti ..	svadatē	
cakkhai ..	....	....	....	....	ācaṣṭē ..	Apabhraṁśa.
cakkhiam ..	āsvāditam ..	....	....	....	....
caccai ..	....	....	(D) carcayatē	....	carcayatē ..	In KI, RLM. has cappai.
caccuppai ..	arpayati *	....	....	....	....
cacchai ..	takṣati *	....	(D) takṣati ..	....	takṣati ..	In KI., emended from vacai.
cajjai ..	paśyati *	....	....	....	....	Only in DNM. iii, 14.
caḍai ..	ārōhati ..	....	....	....	....
caḍḍai ..	pinaṣṭi, bhūiktē, mṛḍṇāti.*	....	....	....	....
cappai ..	....	....	carcayatē ..	kramatē ..	carcayatē, ākramatē.	Cf. caccai.
camadhāi ..	bhūiktē *	....	....	....	....
campai ..	....	carcayatē ..	....	....	....
campijjai ..	ākramyatē ..	....	....	....	....
calai ..	calati ..	calati ..	calati ..	calati, paricōrayati.	calati	Apabhraṁśa.
callai ..	calati ..	calati ..	calati ..	calati ..	calati	
cavai ..	kathayati, cyavatē.*	....	....	....	....	DNM. iii, 4, om cyavatē.
cavai ..	....	....	....	....	vakti ..	Apabhraṁśa.
cavvai ..	....	....	carcayatē ..	....	....
cavvadi ..	....	....	....	....	carcayatē ..	Śaurasēnī.
ciicchai ..	cikitsati ..	....	....	....	....
ciincaai, ciincai ..	maṇḍayati *	....	....	....	....	DNM. iii, 11, om. ciincaai.
ciñcillai ..	maṇḍayati *	....	....	....	....
ciṭṭhai ..	tiṣṭhati ..	....	....	....	....
ciṭṭhadi ..	....	tiṣṭhati ..	....	....	....
cinai ..	cinōti ..	cinōti ..	cinōti ..	cinōti ..	tiṣṭhati ..	Śaurasēnī.
cinijjai ..	ciyatē ..	....	....	....	cinōti ..	
cintai ..	....	....	....	....	....
cimmai ..	....	....	....	....	cintayati ..	
ciramālai ..	ciyatē ..	....	....	....	....
ciivai ..	....	....	....	....	pratiṭpālayati.	Cf. viramānai.
ciṣṭhadi ..	ciyatē ..	....	....	....	....
cukkai ..	tiṣṭhati ..	....	....	....	....
cukkam ..	bhraśyati *	....	....	....	....	Māgadhi.
cuḍai ..	....	....	....	....	jahāti (?)	
cunai ..	....	....	....	....	(?) bhraṣṭam,	See bhraṁś- and hā-
cunṇai ..	....	....	....	(?) cuḍati ..	(?) hīnam.	
cumpai ..	....	....	....	....	....
cumbai ..	....	....	....	....	cūrṇayati ..	
cumbai ..	cumbati ..	....	....	....	ārōhati ..	Cf. cummai.
cummai ..	....	cumbati ..	....	....	....
culuculai ..	spandatē *	....	....	ārōhati ..	....	Cf. cumpai.
cūrai ..	....	....	....	....	sphurati ..	
....	....	....	....	....	cūrṇayati ..	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
coppaḍai ..	mrakṣati *	.....	.....	.....	.....
cōrai, cōrēi ..	.....	.....	.....	.....	cōrayati	
chakkai ..	.....	.....	.....	.....	.....
chajjai ..	rājatē *	.....	.....	.....	.....
chadḍai ..	muñcati *	.....	.....	.....	.....
chattai ..	.....	.....	.....	.....	.....	RT. chattai may be incorrect for chadḍai.
chāyai ..	chādayati ..	.....	.....	.....	.....
chāēi ..	.....	.....	.....	.....	.....
chikkam̐ ..	kṣutam, sprṣ- tam.*	.....	.....	.....	chūptam, sprṣ- tam.	Cf. chittam̐. He gives this only in DNM. iii, 36.
chikkiam̐ ..	.....	.....	.....	.....	.....
chiggadi ..	.....	.....	.....	.....	.....
chiṅṅam̐ ..	.....	.....	.....	.....	.....
chittam̐ ..	sprṣtam *	.....	.....	.....	.....
chittiam̐ ..	.....	.....	.....	.....	.....
chimdai ..	chinatti ..	.....	.....	.....	.....
chindai ..	chinatti ..	chinatti	chinatti	chinatti	chinatti	
chippai ..	sprṣyatē ..	.....	.....	.....	.....	Cf. chuppai.
chiyai ..	.....	.....	.....	.....	.....
chivai ..	sprṣati *	.....	.....	.....	.....	Cf. chuvai.
chiviam̐ ..	.....	.....	.....	.....	.....
chivijjai ..	sprṣyatē ..	.....	.....	.....	.....	Cf. chuvijjai.
chihai ..	sprṣati *	.....	.....	.....	.....
chuai ..	.....	.....	.....	.....	.....
chundai ..	ākramatē ..	.....	.....	.....	.....
chuppai ..	chupyatē ..	.....	.....	.....	.....	Cf. chippai
chulai ..	.....	.....	.....	.....	.....
chuvai ..	.....	.....	.....	.....	.....
chuvadi ..	.....	.....	.....	.....	.....
chuvijjai ..	chupyatē ..	.....	.....	.....	.....	Cf. chivijjai
chuviadi ..	.....	.....	.....	.....	.....
chuvvai ..	.....	.....	.....	.....	.....
chuhai ..	kṣipati ..	.....	.....	.....	.....
chettavvam̐ ..	.....	.....	.....	.....	.....
chettum̐ ..	.....	.....	.....	.....	.....
chettūna ..	.....	.....	.....	.....	.....
chollai ..	takṣati ..	.....	.....	.....	.....	Apabhraṃśa
jaai ..	.....	.....	.....	.....	.....
jayai ..	jayati ..	.....	.....	.....	.....
jaadai ..	tvaratē *	.....	.....	.....	.....
jaggai ..	jāgati ..	.....	.....	.....	.....
jacchai ..	yacchati ..	.....	.....	.....	.....
jadham̐ ..	tyaktam ..	.....	.....	.....	.....
jampai ..	kathayati *	jalpati	.....	.....	.....
jampai ..	.....	.....	.....	.....	.....
jambhāai ..	.....	.....	.....	.....	.....
jambhāi ..	jṛmbhatē ..	.....	.....	.....	.....
jaai ..	.....	.....	.....	.....	.....
jayai ..	.....	.....	.....	.....	.....
jaadai ..	.....	.....	.....	.....	.....
jaggai ..	.....	.....	.....	.....	.....
jacchai ..	.....	.....	.....	.....	.....
jadham̐ ..	.....	.....	.....	.....	.....
jampai ..	.....	.....	.....	.....	.....
jampai ..	.....	.....	.....	.....	.....
jambhāai ..	.....	.....	.....	.....	.....
jambhāi ..	.....	.....	.....	.....	.....

Ādeśa	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
jambhāai ..	.....	jṛmbhatē ..	.....	jṛmbhatē ..	jṛmbhatē	
jambhāi ..	jṛmbhatē ..	.....	.....	.....	.....
jambhāhai, jam- bhāhāi.	.....	.....	.....	.....	jṛmbhatē	
jammai ..	jāyatē ..	.....	.....	.....	.....
jarai ..	jarati ..	.....	.....	.....	.....
jarijjai ..	jiryatē ..	.....	.....	.....	.....
javai ..	yāpayati *	.....	.....	.....	.....
jāai, jāi ..	jāyatē ..	.....	.....	.....	.....
jāai, jāi ..	yāti ..	.....	.....	.....	yāti	
jāgarai ..	jāgarti ..	.....	.....	.....	.....
jānai ..	jānāti ..	jānāti ..	jānāti ..	jānāti ..	jānāti ..	
jānijjai ..	jñayatē ..	.....	.....	.....	.....
jānai ..	.....	.....	jñāyatē ..	.....	jñāyatē	
javei ..	yāpayati ..	.....	.....	.....	.....
jiani ..	.....	.....	.....	.....	.....
jiantō ..	.....	.....	.....	.....	.....
jigghadi ..	.....	.....	.....	.....	.....
jigghae ..	.....	.....	.....	.....	jighrati	Śaurasēni.
jīnai ..	jayati ..	jayati ..	jayati ..	jayati ..	jayati	
jīnadi ..	.....	.....	.....	.....	jayati	Śaurasēni.
jīniūna ..	jitva ..	.....	.....	.....	.....
jīnijjai ..	jīyatē ..	jīyatē ..	[jīyatē] ..	[jīyatē] ..	[jīyatē]	
jīnani ..	.....	.....	.....	.....	jīṇam	
jīppai ..	.....	.....	.....	.....	.....
jīnai ..	bhūktē ..	.....	.....	.....	.....
jīnmai ..	jēmati ..	.....	.....	.....	.....	Cf. jēmai.
jīvvai ..	jīvatē ..	jīyatē ..	[jīyatē] ..	jīyatē ..	jīyatē	
jīrai ..	jīryatē ..	.....	jīryatē ..	.....	.....
jīhai ..	lajjatē *	.....	.....	.....	.....
jūcchai, juguc- chai.	jugupsatē ..	.....	.....	.....	.....
jūjjai ..	yunakti ..	.....	.....	.....	.....
jūjjhai ..	yudhyatē ..	yudhyatē ..	yudhyatē ..	yudhyatē ..	yudhyatē	
jūnjai ..	yunakti ..	.....	.....	.....	.....
jūnani ..	.....	.....	.....	.....	.....
jūppai ..	yunakti ..	.....	.....	.....	jīṇam	
jūrai ..	krudhyati, khi- dyatē *	krudhyati ..	.....	.....	krudhyati	Cf. jvarai.
jūravai ..	vañcati *	.....	.....	.....	.....
jēūna ..	jitvā ..	.....	.....	.....	.....
jēmai ..	bhūktē ..	.....	.....	.....	.....
jōvai ..	.....	.....	.....	.....	.....	Cf. jīmai.
jvarai (? jūrai)	.....	.....	krandati ..	.....	paśyati	Cf. jūrai.
			jh.			
jhaṅkhai ..	upālabhatē, niḥśvasiti, vi- lapati, sam- tapyatē *	.....	.....	.....	.....
jhaijai ..	śiyatē *	.....	.....	.....	.....
jhañtai ..	bhramati ..	.....	.....	.....	.....
jhañpai ..	bhramati *	.....	.....	.....	.....
jhañpai ..	.....	.....	.....	.....	.....
					ākramayati. chādayati.	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
harai ..	kṣarati, smara- ti.*	.....	.....	.....	kṣarati ..	Cf. jhūrai.
jhāai ..	dhyāyati ..	dhyāyati ..	[dhyāyati] ..	.....	dhyāyati ..	
jhāau ..	.....	dhyāyatu ..	.....	.....	.....
jhāanti ..	.....	dhyāyanti ..	.....	.....	.....
jhāanti ..	.....	.....	dhyāyanti ..	.....	.....
jhāhii ..	.....	dhyāsyati ..	.....	.....	.....
jhāaē ..	.....	.....	.....	dhyāyati ..	.....
jhāi ..	dhyāyati ..	dhyāyati ..	[dhyāyati] ..	dhyāyati ..	dhyāyati ..	
jhāu ..	.....	dhyāyatu ..	.....	dhyāyatu ..	.....
jhāhii ..	.....	dhyāsyati ..	.....	dhyāsyati ..	.....
jhijjai ..	kṣayati ..	kṣayati ..	.....	.....	kṣayati ..	DNM. iv, 40. = kṣiyatē.
jhijjai ..	.....	.....	kṣayati ..	kṣayati ..	.....
jhūnai ..	jugupsatē *	.....	.....	.....	.....
jhūrai ..	smarati *	.....	.....	.....	.....	Cf. jharai.
jhōsiam ..	kṣiptam ..	.....	.....	.....	.....
t.						
tiriṭillai ..	bhramati *	.....	.....	.....	.....	DNM. iv, 3. = bhrāmyati.
tiviḍikkai ..	maṇḍayati *	.....	.....	.....	.....
th.						
thavai ..	.....	.....	.....	.....	sthāpayati ..	
thavai ..	.....	.....	.....	.....	sthāpayati ..	Apabhraṁśa.
thāai ..	tiṣṭhāti ..	tiṣṭhāti ..	tiṣṭhāti ..	.....	.....
thāau ..	.....	tiṣṭhātu ..	.....	.....	.....
thāamti ..	.....	tiṣṭhanti ..	.....	.....	.....
thāanti ..	.....	.....	tiṣṭhanti ..	tiṣṭhanti ..	.....
thāahii ..	.....	sthāsyati ..	.....	.....	.....
thāi ..	tiṣṭhāti ..	tiṣṭhāti ..	tiṣṭhāti ..	tiṣṭhāti ..	.....
thāu ..	.....	tiṣṭhātu ..	.....	tiṣṭhātu ..	.....
thāhii ..	.....	sthāsyati ..	.....	sthāsyati ..	.....
thāvai ..	.....	.....	.....	.....	sthāpayati ..	
d.						
ḍakkam ..	.....	.....	.....	.....	daṣṭam ..	DNM. iv, 6, danta- grhītam.
ḍajjhai ..	dahyatē ..	.....	.....	.....	.....
ḍarai ..	trasyati *	.....	.....	.....	.....
ḍallai ..	pibati *	.....	.....	.....	.....
ḍahai ..	dahati ..	.....	.....	.....	.....
ḍimbbhai ..	sramsate *	.....	.....	.....	.....
ḍei ..	.....	.....	.....	ḍayatē ..	.....
ḍh.						
ḍhamsai ..	vivartatē *	.....	.....	.....	.....
ḍhakkai ..	chādayati *	.....	.....	.....	sthagati ..	
ḍhamḍhallai ..	bhramati *	.....	.....	.....	.....	Cf. ḍhumḍhullai.
ḍhamḍhōlai ..	gavāśayati *	.....	.....	.....	.....	Cf. ḍhumḍhullai.
ḍhavai ..	.....	.....	.....	ārabhatē ..	.....	Cf. āḍhavai

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
ḍhikkai ..	vṛṣabhō garja- ti.*	.....	.....	.....	.....
ḍhukkai ..	.....	.....	.....	.....	praviśati	
ḍhumḍhullai ..	bhramati. ga- vēśayati.*	.....	.....	.....	.....	Cf. ḍhamḍhallai
ḍhundhullai ..	.....	.....	.....	.....	bhramati	Cf. ḍhamḍhallai.
ḍhumai ..	bhramati *	.....	.....	.....	.....
ḍhusai ..	bhramati *	.....	.....	.....	.....
१, १.						
naccai ..	.....	nṛtyati	nṛtyati	nṛtyati	nṛtyati	
naccai ..	nṛtyati	.....	.....	.....	.....
najjai ..	jñāyatē *	.....	jñāyatē	jñāyatē	jñāyatē	
najjai ..	.....	.....	jñāyatē	.....	.....
naṭṭai ..	.....	.....	.....	.....	naṭati	
naṭṭai ..	naṭati	.....	.....	.....	.....
naḍai ..	gupyati *	.....	.....	.....	naṭati	
navai ..	namati, bhārā- krāntō nama- ti.	.....	.....	.....	.....
navarijjai ..	.....	.....	.....	.....	kathyatē	Cf. nivarijjai.
navvai ..	jñāyatē *	.....	jñāyatē	jñāyatē	jñāyatē	
navvai ..	.....	.....	jñāyatē	.....	.....
nassai ..	naśyati	.....	.....	.....	.....
nājjai ..	jñāyatē	.....	.....	.....	.....
nāsai ..	naśyati, nāśa- yati.	.....	.....	.....	.....
nāsavai ..	nāśayati	.....	.....	.....	.....
nai ..	paśyati *	.....	.....	.....	.....
niakkai ..	.....	.....	(?) paśyati	.....	.....	D. niacchai.
niacchai ..	.....	.....	(?) paśyati	.....	.....	Cf. niakkai.
niacchai ..	paśyati *	.....	.....	.....	.....
niārai ..	kānēksitam ka- rōti.*	.....	.....	.....	.....
niunjai ..	.....	.....	.....	.....	.....
niudḍai ..	majjati *	.....	.....	.....	.....
nicchallai ..	chinatti *	.....	.....	.....	.....
nicchūḍham ..	uddhṛtam	.....	.....	.....	.....
nijjai ..	.....	.....	.....	.....	.....
nijjharai ..	kṣayati *	.....	.....	.....	.....
nijjbāai ..	nij- nidhyāyati	.....	.....	.....	.....
nijjhāi ..	.....	.....	.....	.....	.....
nijjhōḍai ..	chinatti *	.....	.....	.....	.....
nittuhai ..	vigalati *	.....	.....	.....	.....
nittuhai ..	niṣṭambham karōti.*	.....	.....	.....	.....
niddai ..	kṣarati *	.....	.....	.....	.....
ninhavai ..	nihnute	.....	.....	.....	.....
niddai ..	nidrāti	.....	.....	.....	.....
nippajjai ..	niṣpadyatē	.....	.....	.....	.....
nibbalai ..	.....	.....	.....	.....	.....
nimai ..	nyasyati *	.....	.....	.....	.....
nimajjai ..	.....	.....	.....	.....	.....
nimiam ..	sthāpitam	.....	.....	.....	.....
				niṣidati	.....	Cf. nivvalai.
				.....	.....	Cf. nimajjai.

Ādeśa.	SANSKRIT EQUIVALENT. ACCORDING TO :—				
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.
nimillai	.....	.....	.....	.....	nimilati
nimillai	nimilati	.....	.....	.....	.....
nimilai	.....	.....	.....	.....	nimilati
nimilai	nimilati	.....	.....	.....	.....
nimeī	.....	.....	.....	.....	niyunakti
niṃmai	.....	.....	.....	.....	nirmimīte
niṃmavai	.....	.....	.....	.....	nirmimīte
niṃmavai	nirmimīte *	.....	.....	.....	.....
niṃmahai	gacchati *	.....	.....	.....	.....
niṃmāi	.....	.....	.....	.....	nirmimīte
niṃmānai	.....	nirmimīte	nirmimīte	nirmimīte	nirmimīte
niṃmānai	nirmimīte *	.....	.....	.....	.....
niraṇāsai	naśyati	.....	.....	.....	.....
nirappai	tiṣṭhati *	.....	.....	.....	.....
nirigghai	niliyatē *	.....	.....	.....	.....
nirinajjai	pinasṭi *	.....	.....	.....	.....
nirinaśai	gacchati. pi- naṣṭi.*	.....	.....	.....	.....
nirundhai.	ni-.....	.....	.....	niruṇaddhi	.....
rumbhai.	.....	.....	.....	.....	.....
niruvārai	grhṇāti *	.....	.....	.....	.....
nilijjai	niliyatē	.....	.....	.....	.....
niḷai	niliyatē	.....	.....	.....	.....
niḷukkai	tuḍati, niliya- tē.*	.....	.....	.....	.....
niḷlasai	ullasati *	.....	.....	.....	.....
niḷluṅchai	muṅcati *	.....	.....	.....	.....
niḷūrai	chinatti	.....	.....	.....	.....
niḷarijjai	.....	.....	.....	kathyatē	.....
niḷahai	gacchati, na- śyati, pinas- ṭi.*	.....	.....	.....	.....
niḷārēi	niḷārayati	.....	.....	.....	.....
niḷvaḍai	prthag bhavati, spasṭō bhava- ti.*	.....	.....	.....	.....
niḷvarai	chinatti. duḥ- khaṃ katha- yati *	.....	.....	.....	.....
niḷvalai	kṣarati *	.....	.....	.....	.....
niḷvalai	niṣpadyatē	.....	.....	.....	.....
niḷvalēi	duḥkhaṃ muṅ- cati.*	.....	.....	.....	.....
niḷvasai	.....	.....	.....	niṣpadyatē	.....
niḷvāi	viśrāmyati *	.....	.....	.....	.....
niḷvōlai	manyunā oṣ- ṭhaṃ mali- naṃ karōti.*	.....	.....	.....	.....
niṣahai	.....	.....	.....	.....	niṣahatē
niṣirai	niṣrjati	.....	.....	.....	.....

SANSKRIT EQUIVALENT, ACCORDING TO :—						
Ādeśa.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	REMARKS.
nisuddhō	nipātitaḥ	....	....	....	....	Cf. DNM. iv. 36, nisuddham, pā- titam.
niṣḍhai	bhārākrāntō namati *	....	....	niṣahatē	niṣahatē	
nisehai	niṣēdhati	....	....	....	....
nihammai	nihammati	....	....	....	....
nihavai	hnutē	....	....	....	....
nihuvai	kāmayatē *	....	....	....	....
nihōḍai	nivārayati, pā- tayati *	....	....	....	....
nīi	gacchati *	....	....	....	....
nīnai	gacchati *	....	....	....	....
nīranūjai	bhanakti *	....	....	....	....
nīravai	ākṣipati, bu- bhukṣatē *	....	....	....	....
nīlai	niḥsarati	....	....	....	....
nīlukkai	gacchati *	....	....	....	....
nīluinchai	niṣpatati, āc- chōṭayati *	....	....	....	....
nīsarai	ramatē	....	....	....	....
nīsarai	niḥsarati	....	....	....	....
nīsasai	niḥśvasiti	....	....	....	....
nīhammai	nirhammati	....	....	....	....
nīharai	ākrandati, niḥ- sarati *	....	....	....	....
nūmai	chādayati, nya- syati *	....	....	....	....	Cf. nūmai.
nūmajjai	niṣīdati	....	niṣīdati	....	śētē	Cf. nūmajjai.
nūllai	ksipati	....	....	....	....	Cf. nūllai.
nūvvai	prakāśayati *	....	....	....	....
nūmai	chādayati *	....	....	....	....	Cf. nūmai.
nūmai	chādayati	....	....	....	chādayati	
nūmaē	....	....	....	chādayati	....
nēi	....	....	....	nayati	nayati	
nēi	uayati	....	....	....	....
nūnūjai	....	....	nudati	....	....
nūllai	ksipati *	nudati	....	nudati	nudati	Cf. nūllai.
nūhāi	snāti	....	....	....	....
<i>l.</i>						
takkhai	takṣati	....	....	....	....
tacchai	takṣati *	....	....	....	....
taḍai	tanōti *	....	....	....	....
taḍḍai	tanōti *	....	....	....	....
taḍḍavai	tanōti *	....	....	tādayati	....	Cf. tāḍei, tālei.
taḍai	tanōti	....	....	....	....
tamai	....	....	....	....	....
tamāḍai	bhramayati	....	....	....	tāmyati	
tamūnai	....	....	....	....	....
tambai	....	....	(D. tāmyati)	....	tāmyati	Cf. the next.
tarai	tarati, śaknō- ti *	śaknōti	tāmyati	śaknōti	śaknōti	Cf. the preceding.
tarijjai	tiryatē	....	....	....	....	DNM. v. 5, om. tarati.
talaamitai	bhramati *	....	....	....	tiryatē	Cf. tāliamitai.

Ādēśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍēya.	
tavai	.....	.....	.....	.....	stauti	
tasai	trasyati	.....	.....	.....	trasyati	
tāḍai	tāḍayati	.....	.....	.....	.....	Cf. taḍḍai, tāḍi.
tāliantai	bhramayati *	.....	.....	.....	.....	DNM. v, II, = bhramati. Cf. talaantai.
tālei	.....	.....	.....	.....	tāḍayati	Cf. taḍḍai, tāḍi.
tiai	.....	.....	.....	.....	timyati	Apabhraṁśa.
tikkhālai	.....	.....	.....	tējayati	tējayati	
tiḍḍavai	.....	.....	.....	.....	tāḍayati	
tiṇḍai	.....	.....	.....	timyati	.....	Cf. the next.
tiṇṇai	.....	.....	.....	.....	timyati	Cf. the preceding.
tiṇṇāai	.....	.....	.....	.....	timyati	
timmai	.....	.....	.....	.....	timyati	
timmai	.....	.....	.....	.....	timyati	Apabhraṁśa.
tillāsai	.....	.....	.....	timyati	.....
tirai	tīryatē, tīraya- ti, śaknōti.	śaknōti	śaknōti	.....	tīryatē, śaknō- ti, śakyatē.	
tīraē	.....	.....	.....	śaknōti	.....
(?) tuai	.....	.....	.....	śaknōti	.....	Cf. caai.
tuṭṭai	truṭyati, tuḍa- ti.	.....	truṭyati	truṭyati	tuḍati	
tuḍai	tuḍati	.....	.....	truṭyati	tuḍati	
tuppan̄	mraṅsitam	.....	.....	.....	mraṅsitam	
turai	.....	.....	.....	.....	tvaratē	
turian̄	.....	tvaritam	.....	tvaritam	tvaritam	
turiō	tvaritah	.....	.....	.....	.....
tulai	tōlayati	.....	.....	.....	.....
tuvarai	tvaratē	tvaratē	tvaratē	tvaratē	tvaratē	
tūrai	tvaratē	.....	.....	.....	tvaratē	
tūsai	tuṣyati	tuṣyati	tuṣyati	tuṣyati	tuṣyati	
tēavai	pradīpyatē	.....	.....	.....	.....
tējai	.....	.....	.....	.....	tējayati	
tēmai	.....	.....	.....	.....	timyati	
tōḍai	tuḍati	.....	.....	truṭyati	tuḍati	
<i>th.</i>						
thai, thaēi	.....	.....	.....	.....	sthagati	
thakkai	tiṣṭhati, phak- kati.*	.....	.....	.....	tiṣṭhati	
thakkai	.....	.....	.....	.....	tiṣṭhati	Apabhraṁśa.
thakkavai	.....	.....	.....	.....	sthāpayati	Apabhraṁśa.
thāṅgai	.....	.....	.....	.....	unnāmayati (sic).	
thaiṅillai	.....	.....	.....	.....	cōrayati	Cf. phaṅillai.
tham̄ti	tiṣṭhanti	.....	.....	.....	.....	Apabhraṁśa.
thippai	tṛpyati, vigala- ti.*	.....	tṛpyati	tṛpyati	tṛpyati	Cf. theppai.
thimpai	.....	tṛpyati	.....	.....	.....
thim̄mai	.....	.....	.....	.....	timyati	Apabhraṁśa.
thuai	.....	.....	.....	.....	stauti	
thun̄ai	stauti	.....	.....	stauti	.....
thun̄adi	.....	.....	.....	.....	stauti	Śauraseni.
thun̄ijjai	stūyate	.....	.....	.....	.....
thuvai	.....	.....	.....	stauti	stauti	

SANSKRIT EQUIVALENT, ACCORDING TO:—

Ādeśa.	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	REMARKS
thuvvai theppai	stūyatē	.....	.....	.....	.....	Cf. thippai.
<i>d.</i>						
daia	.....	.....	.....	.....	dattvā	Śaurasēni.
daissadi	.....	dāsyati	.....	.....	dāsyati	Śaurasēni.
daṁśai	darśayati *	.....	.....	.....	.....	.....
daṁśāvēi	.....	.....	.....	.....	darśayati	.....
daṁśēi	.....	.....	.....	darśayati	darśayati	.....
dakkhavai	darśayati *	.....	.....	.....	.....	Cf. dākkhavai.
daṭṭhavai	draṣṭavyam	.....	.....	.....	.....	.....
daṭṭhu	draṣṭum	.....	.....	.....	.....	.....
daṭṭhūna	dr̥ṣṭvā	.....	.....	.....	.....	.....
daḍḍham	.....	dagdham	.....	.....	.....	.....
darasēdi	.....	.....	.....	.....	darśayati	Āvanti.
darisai	darśayati	.....	.....	.....	.....	.....
darisāvēi	.....	.....	.....	.....	darśayati	.....
darisēi	.....	.....	.....	darśayati	darśayati	.....
darisēdi	.....	.....	.....	.....	darśayati	Āvanti.
dalai	dalati	.....	.....	.....	.....	.....
dahijjai	dahyatē	.....	.....	.....	.....	[dakkhavai
dakkhavai	.....	.....	.....	.....	darśayati	Apabhraṁśa. Cf
dāvai	darśayati *	.....	.....	.....	.....	.....
dāvēi	.....	.....	.....	darśayati	.....	.....
dijjai	.....	.....	.....	.....	.....	.....
dinnam	dattam	dattam	dattam	dattam	diyatē	.....
diadi	.....	.....	.....	.....	dattam	.....
disai	dr̥ṣyatē	.....	.....	.....	diyatē	.....
disāē	.....	.....	.....	.....	dr̥ṣyatē	.....
duucchai, umchai.	du-jugupsatē *	.....	.....	.....	.....	.....
dugucchai, gumchai.	du-jugupsatē *	.....	.....	.....	.....	.....
ducchai	.....	.....	.....	.....	.....	.....
dujjhai	.....	.....	duhyatē	.....	.....	Not in D. See dubbhai.
duppahavai	.....	.....	.....	duśprabhavati	.....	.....
dubbhai	duhyatē	.....	duhyatē	duhyatē	duhyatē	D. dujjhai.
dubbham	.....	.....	.....	.....	dugdham	.....
dubbhadi	.....	.....	.....	.....	duhyatē	.....
dumai	dhavalayati *	.....	.....	.....	.....	Āvanti.
dummai	.....	.....	.....	.....	.....	Cf. dūmiani.
duvvai	.....	.....	dūyatē	dūyatē	.....	.....
duhāvai	.....	.....	.....	.....	(?) dūyatē	Āvanti.
duhijjai	chinatti *	.....	.....	.....	.....	.....
duhiai	duhyatē	.....	.....	.....	duhyatē	.....
duhiadi	.....	.....	.....	.....	duhyatē	.....
dūmai	.....	.....	.....	.....	duhyatē	.....
dūmiam	paritāpayati *	dūyate	.....	dūyate	dūyate	.....
dūmēi	dhavalitam	.....	.....	.....	.....	.....
dūsai	dāvayati	.....	.....	.....	.....	.....
dekkhai	duṣyati	.....	duṣyati	duṣyati	duṣyati	.....
dekkhai	paśyati *	.....	.....	.....	.....	.....
dei	.....	.....	.....	.....	.....	.....
dēdi	dadāti	.....	.....	dadāti	paśyati	Apabhraṁśa.
dolei	dōlayati	dadāti	.....	.....	dadāti	.....
.....	.....	.....	.....	.....	dadāti	Śauraseni.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-sarman (Tarkavāgiśa)	Mārkaṇḍeya.	
	<i>dh.</i>					
dhamsāḍai ..	muñcati ..	....	....	....	....	Cf. DNM. v. 51 dhamsāḍis
dhamai ..	....	....	....	dhamati ..	....
dhamijjai ..	....	....	....	....	dhmāyatē	
dharaī ..	dharaī ..	....	....	....	....
dhavai, (?) dhuvai.	....	....	....	dhāvati ..	....	Cf. dhuvai.
dhavalai ..	dhavalayati ..	....	....	....	....
dhāi ..	dadhāti ..	....	....	....	dhāvati	
dhāi ..	dadhāti, dhāvati.	dhāvati ..	....	dhāvati ..	dhāvati	
dhāu ..	....	dhāvatu ..	....	....	....
dhāḍai ..	nihsarati *	....	....	....	....
dhāvai ..	dhāvati ..	....	....	....	....
dhāhi ..	....	dhāviṣyati ..	....	....	....
dhippai ..	....	....	....	....	dīpyatē	Cf. dhupai.
dhuai ..	....	....	....	dhunōti ..	dhunōti	
dhuaṁ ..	....	....	....	dhūtam ..	....
dhuaḍi ..	....	....	....	....	dhunōti ..	Śaurasēni.
dhuaṅti ..	....	....	....	dhunvatī ..	....	Cf. dhuvanti.
dhuaṅtō ..	....	....	....	dhūtavān ..	....
dhukkai ..	....	....	....	kṣudhyati ..	kṣudhyati	
dhunai ..	dhunōti ..	dhunōti ..	dhunōti ..	dhunōti ..	dhunōti	
dhunāḍi ..	....	....	....	....	dhunōti ..	Śaurasēni.
dhunijjai ..	dhūyatē ..	dhūyatē ..	[dhūyatē] ..	[dhūyatē] ..	[dhūyatē]	
dhuddhuai ..	śabdāyatē ..	....	....	....	....
dhupai ..	....	....	....	....	dīpyatē ..	Cf. dhippai
dhuvai ..	dhunōti, dhāvati.	....	dhāvati ..	dhunōti ..	dhunōti	Cf. dhavai, dhūai, dhōai.
dhuvanti ..	....	....	....	dhunvatī ..	....	Cf. dhuvanti.
dhuvvai ..	dhūyatē ..	dhūyatē ..	dhāvati, [dhūyatē].	dhūyatē ..	dhūyatē	
dhūai ..	....	....	....	dhāvati ..	....	Cf. dhuvai, dhōai.
dhūmāi, dhūmāi.	....	....	....	....	dhūmāyati	
dhēi ..	....	....	....	dadhāti ..	....
dhōai ..	....	....	....	dhāvati ..	dhāvati ..	Cf. dhuvai, dhūai.
dhōaē ..	....	....	....	dhāvati ..	....
dhōvai ..	....	....	dhāvati ..	....	....

n, see n.

p.

payai ..	pacati ..	....	....	....	....
payarai ..	smarati *	....	....	....	....
paallai ..	....	....	....	prasarati ..	prasarati	
payallai ..	prasarati, śithi- libhavati. lam- batē.*	....	....	....	....
payāsei ..	prakāśayati ..	....	....	....	....
paisai ..	....	....	....	....	praviśati	
paisai ..	....	....	....	....	praviśati	
pauñjai ..	....	....	....	....	prayunakti	Apabhraṅśa.

Ādeśa	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Markaṇḍeya.	
pauttham ..	.....	.....	.....	.....	prōṣitam ..	Cf. DNM. vi, 66.
paulai ..	pacati *	.....	.....	.....	.....
pakkhōḍai ..	vikōśayati, śī- yatē.*	.....	.....	.....	.....
pamgai ..	gṛhṇāti *	.....	.....	.....	.....
paccaḍai ..	kṣarati *	.....	.....	.....	.....
paccaḍḍai ..	gacchati *	.....	.....	.....	.....
paccāgacchai ..	pratyāgacchati	.....	.....	.....	.....
paccārai ..	upālabhatē *	.....	.....	.....	.....
paccamḍai ..	gacchati *	.....	.....	.....	.....
pajjarai ..	kathayati *	.....	.....	.....	.....	Cf. bajjarai.
pajjharai ..	kṣarati ..	.....	.....	.....	prakṣarati	
pattai ..	pibati *	.....	.....	.....	.....
paṭṭhāvai, paṭ- ṭhāvai.	prasthāpayati	.....	.....	.....	.....
paḍai ..	patati ..	patati ..	patati ..	patati ..	patati ..	
padiaggai ..	anuvrajati ..	.....	.....	.....	.....
paḍikkhai ..	pratikṣatē ..	.....	.....	.....	.....
paḍicchai ..	praticchati ..	.....	.....	.....	.....
paḍivālcī ..	.....	.....	.....	.....	pratipālayati	
paḍisāi ..	naśyati, śā- myati.*	.....	.....	.....	.....
paḍḍuhai ..	kṣubhyati *	.....	.....	.....	.....
paḍhai ..	.....	.....	paṭṭhati ..	.....	.....
paṇāmai ..	arpayati *	.....	.....	.....	.....
paṇāmcī ..	.....	.....	.....	.....	upanamayati	
paṇollai ..	.....	praṇudati ..	.....	.....	.....
paṇṇāḍai ..	.....	.....	.....	.....	vilulati ..	Cf. paṇṇāḍai.
pattīāi ..	.....	.....	.....	.....	pratyēti	
padaai ..	gacchati *	.....	.....	.....	.....
paṇṇāḍai ..	mṛdnāti *	.....	.....	.....	.....	Cf. paṇṇāḍai. DNM. vi, 29, paṇ- ṇāḍai.
pappuṭṭai ..	.....	.....	.....	.....	prasphuṭati	
papphōḍai ..	.....	.....	.....	.....	prasphuṭati	
papphōḍāc ..	.....	.....	.....	prasphuṭati ..	.....
pabbālai ..	chādayati, plā- vayati.*	.....	.....	.....	.....
pabhavai ..	prabhavati ..	prabhavati ..	.....	prabhavati ..	.....	Cf. paha vai.
pabhavēi ..	prabhavati ..	.....	.....	.....	.....
pamillai ..	pramīlati ..	pramīlati ..	pramīlati ..	pramīlati ..	pramīlati ..	
pamīlai ..	pramīlati ..	pramīlati ..	pramīlati ..	pramīlati ..	pramīlati ..	
pammeai ..	.....	.....	.....	.....	prasmarati	
pamhuṭṭho ..	pramuṣītaḥ, pramuṣṭaḥ.	.....	.....	.....	.....
pamhusai ..	pramuṣṇāti, pramīśati, vi- smarati.*	.....	.....	.....	.....
pamhuhai ..	smarati *	.....	.....	.....	.....
parai ..	bhramati *	.....	.....	.....	.....
pariaṇjai ..	.....	.....	.....	paribhanakti	.....	Cf. pariraṇjai, pa- viraṇjai.
pariattai ..	paryatati ..	.....	.....	.....	.....
pariamtai ..	śliṣyati *	.....	.....	.....	.....
parialai ..	gacchati *	.....	.....	.....	.....
pariallai ..	gacchati *	.....	.....	.....	.....

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Markaṇḍeya.	
pariālei ..	veṣṭayati *	.....	.....	.....	.....	DNM. vi, 35, pari- vālai.
parittāi ..	.....	.....	.....	.....	paritrāyatē	
paribbhamai, paribhamai.	.....	.....	.....	.....	paribhramati	
paribhavai ..	paribhavati ..	paribhavati ..	.....	.....	.....	Cf. parihavai.
parinañjai ..	.....	.....	parimārṣṭi ..	.....	.....
parirañjai ..	.....	.....	.....	.....	bhanakti ..	Cf. pariañjai, pa- viramñjai.
parilhasai ..	parisramsātē	.....	.....	.....	.....
parivāḍai ..	ghaṭayati *	.....	.....	.....	.....	DNM. vi, 35, pari- vāḍai.
parivālai ..	.....	.....	.....	.....	.....	See pariālei.
pariviālai ..	.....	.....	.....	pariviśati ..	pariviśati	
parivisai ..	.....	.....	.....	.....	pariviśati	
parisāmai ..	śāmyati *	.....	.....	.....	.....
parihaṭṭai ..	mṛdnāti *	.....	.....	vilulati ..	vilulati	
parihavai ..	.....	.....	.....	paribhavati ..	paribhavati	Cf. paribhavai.
parihūo ..	.....	.....	.....	.....	paribhūtaḥ	
parī ..	kṣipati, bhra- mati.*	.....	.....	.....	.....
palāvai ..	nāśayati *	.....	.....	.....	.....
palivai ..	pradīpyatē ..	.....	.....	.....	.....
palotṭai ..	paryasyati, pratyāgaccha- ti, pralōṭati.*	.....	.....	.....	.....	DNM. vi, 73, om. pralōṭati.
palotṭam ..	paryastam ..	.....	.....	.....	.....
pallatṭai ..	paryasyati* ..	.....	.....	.....	paryasyati	
pallatthai ..	.....	.....	.....	paryasyati ..	paryasyati	
pallassai ..	.....	.....	.....	.....	paryasyati	
palhatthai ..	paryasyati, vi- rēcayati.*	.....	.....	.....	.....
palhattham ..	paryastam ..	.....	.....	.....	.....
pavasiam ..	.....	.....	.....	.....	prōṣitam	
pavāai ..	.....	.....	.....	.....	pramlāyati ..	Cf. pavvāai.
paviranñjai ..	bhanakti ..	.....	.....	.....	.....	Cf. pariañjai, pari- rañjai.
pavisai ..	praviśati ..	.....	.....	.....	.....
pavvāai ..	.....	.....	.....	.....	pramlāyati ..	Cf. pavvāai.
pavvāyai ..	mlāyati *	.....	.....	.....	.....	Cf. pavvāai, pavvā- ai.
pasarai ..	prasarati ..	.....	.....	.....	prasarati	
pasavai ..	prasūtē ..	.....	.....	.....	.....
pasavai ..	.....	.....	.....	.....	praviśati ..	Apabhraṁśa.
passai ..	.....	.....	.....	.....	paśyati ..	Cf. pāsai.
pahammai ..	prahammati ..	.....	.....	.....	.....
paharai ..	praharati ..	.....	.....	.....	.....
pahallai ..	ghūrnatē *	.....	.....	.....	.....
pahavai ..	.....	.....	prabhavati ..	prabhavati ..	prabhavati ..	Cf. pabhavai.
pahavai ..	.....	.....	.....	.....	prabhavati ..	Vrācaḍa Apa- bhraṁśa.
pahuccai ..	prabhavati, paryāpnōti.	.....	.....	.....	.....	Apabhraṁśa.
pahuppai ..	prabhavati ..	.....	.....	.....	prabhavati	
pahūo, -am	prabhūtam ..	.....	.....	prabhūtaḥ	prabhūtam	
pahōḍai ..	.....	.....	.....	vilulati ..	.....

SANSKRIT EQUIVALENT, ACCORDING TO :—

Ādeśa.	Hemacandra.	Vararuci.	Kramadiśvara	Rāma-śarman (Tarkavāgīśa).	Markaṇḍeya.	REMARKS.
pāi, pāi	pāti	jighrati	.....	.....	pāti	.....
pādei	pāyati	.....	.....	.....	.....	.....
pāhai	.....	.....	.....	.....	pāṭhayati	.....
pādubbhavai	.....	.....	.....	.....	prādurbhavati	.....
pādubbhūo	.....	.....	.....	prādurbhūtaḥ	prādurbhūtaḥ	.....
pārai	pārayati, śak- nōti.*	.....	.....	.....	.....	DNM. vi, 41, om. pārayati.
pālei	.....	padyatē	.....	.....	.....	.....
pāvai	prāpnōti	.....	.....	.....	.....	.....
pāvēi	plāvayati	.....	.....	.....	.....	.....
pāsai	paśyati*	.....	.....	.....	.....	Cf. passai.
pāi	pibati	.....	.....	.....	pibati	Cf. pivai.
piarañjai	.....	.....	.....	.....	bhanakti	.....
piarañjac	.....	.....	.....	pibhanakti	.....	.....
pijjai	pibati*	.....	.....	.....	pīyate	.....
pivai	.....	.....	.....	pibati	.....	Cf. piāi.
piṣṇai	kathayati*	.....	.....	.....	.....	.....
pilai	.....	.....	.....	pīḍayati	.....	.....
pīśai	pinasṭi	.....	.....	.....	.....	.....
piṁśai	mārṣṭi*	.....	.....	.....	.....	Cf. pusai.
pucchai	prcchati	.....	prcchati	.....	prcchati	.....
puñchai	mārṣṭi*	.....	.....	.....	.....	.....
puñchai	.....	.....	.....	prōnchati	prōnchati	.....
puñjai	puñjayati	.....	.....	.....	.....	.....
puṭṭai	.....	.....	.....	.....	prōnchati	.....
puṇai	.....	.....	(D.) paśyati	paśyati	.....	Cf. pulāai.
puṇijjai	puṇāti	.....	.....	.....	.....	.....
pummai	pūyate	.....	.....	.....	.....	.....
pulaai	paśyati*	.....	.....	.....	paśyati	Apabhraṁśa.
pulaāai	ullasati	.....	paśyati	.....	paśyati	Cf. puṇai, pulōai.
pulai	.....	.....	.....	.....	.....	.....
pulaēi	paśyati	.....	.....	.....	paśyati	Cf. pulāai.
[pulijjai]	.....	.....	.....	.....	[dṛśyate]	.....
pulīai	.....	.....	.....	.....	dṛśyate	.....
pulōai	.....	.....	.....	.....	paśyati	Cf. pulāai.
pulōēi	paśyati*	.....	.....	.....	.....	Cf. pulāai. DNM. vi, 53, pulōi.
puvvai	pūyate	.....	.....	.....	.....	.....
pusai	mārṣṭi*	.....	.....	.....	.....	.....
pusai	.....	.....	.....	puśyati, prōn- chati.	mārṣṭi	Cf. puṁśai, pūśai.
pusai	pūrayati	.....	.....	mārṣṭi	.....	.....
pusai	puśyati	.....	.....	.....	.....	.....
pusai	.....	.....	.....	puśyati, (?) la- sati.	puśyati ¹	Cf. pusai, pōśai.
pekkhai	.....	.....	.....	.....	.....	.....
pekkhadi	.....	.....	paśyati	.....	.....	.....
pecchai	.....	.....	.....	.....	prekṣate	Śaurasēni.
pecchadi	paśyati*	.....	paśyati	.....	.....	[Āvanti.
peṁḍavai	prasthāpayati*	.....	.....	.....	paśyati	Śaurasēni and
pellai	ksipati*	.....	.....	.....	.....	.....
peskadi	prekṣate	.....	.....	īrayati	prērayati	.....
pokkai	vyāharati*	.....	.....	.....	.....	Māgadhi.
pōśai	.....	.....	.....	.....	.....	.....
prassadi	.....	.....	.....	puśyati	.....	Cf. pusai, pūśai.
prassadi	paśyati	.....	.....	.....	.....	Apabhraṁśa.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa)	Markaṇḍeya.	
				<i>ph.</i>		
phaṁśai	visainvadati, sprśati.*	.....	.....	.....	.....	.....
phaṁśaē	.....	.....	.....	.....	.....	.....
phañillai	.....	.....	.....	.....	.....	Cf. thañillai.
phañḍai	spandatē	.....	.....	.....	.....	.....
pharisai	sprśati	.....	.....	.....	.....	.....
phalai	.....	.....	.....	.....	.....	.....
phaliām	.....	paṭitam	paṭati	.....	.....	Cf. phālai. See Vr. viii, 9.
phālai	.....	.....	.....	.....	pāṭayati	Cf. phalai
phālei	.....	.....	.....	.....	pāṭayati	.....
phāsai	sprśati	.....	.....	.....	.....	.....
phittai	bhraśyati *	.....	.....	.....	.....	bhraśyati
phiḍai	bhraśyati *	.....	.....	.....	.....	.....
phumśadi	.....	.....	.....	.....	.....	mārṣṭi
phuṭṭai	bhraśyati, sphuṭati.*	sphuṭati	sphuṭati	sphuṭati	sphuṭati	sphuṭati
phuḍai	bhraśyati, sphuṭati.*	sphuṭati	sphuṭati	sphuṭati	sphuṭati	sphuṭati
phuḍaii	spāṣṭam	.....	.....	.....	.....	.....
phumai	bhramati	.....	.....	.....	.....	.....
phurai	.....	.....	.....	.....	.....	.....
phullai	.....	.....	.....	.....	kramatē	sphurati
phusai	bhramati, mārṣṭi.*	.....	.....	.....	.....	.....
phellusai	patati *	.....	.....	.....	.....	.....
				<i>b.</i>		
bajjai	trasyati	.....	.....	.....	.....	.....
bajjarai	kathayati *	.....	.....	.....	.....	.....
bajjhai	badhyatē	.....	.....	.....	.....	.....
baḍabaḍai	.....	.....	.....	.....	.....	.....
banohiiiai	badhyatē	.....	.....	.....	.....	.....
balai	ārōpayati *	.....	.....	.....	.....	.....
bahibbhavai	.....	.....	.....	.....	.....	bahirbhavati
babibbhūo	.....	.....	.....	.....	.....	bahirbhūtaḥ
bāhai	.....	.....	.....	.....	.....	bibhēti
biḥēi	bibhēti	.....	.....	.....	.....	bibhēti
bīhai	bibhēti *	.....	bibhēti	bibhēti	.....	.....
bīhēi	.....	.....	.....	bibhēti	.....	.....
bukkai	garjati *	.....	.....	.....	.....	.....
bujjai (?buḍḍai)	.....	.....	.....	.....	.....	.....
bujjhai	budhyatē	.....	budhyatē	budhyatē	budhyatē	budhyatē
buḍḍai	majjati *	.....	majjati	(?) majjati	majjati	majjati
buḍḍadi	.....	.....	.....	.....	.....	majjati
buddham	.....	.....	.....	.....	.....	buddham
buhukkhai	bubhuksatē	.....	.....	.....	.....	.....
bēmi	vēdmi	.....	.....	.....	.....	.....
bojjai	trasyati *	.....	.....	.....	.....	.....
bollai	kathayati *	.....	.....	.....	vakti	.....
bollai	.....	.....	.....	.....	.....	vadati
						Apabhraṁśa.

Only in DNM. vi.
86.

Cf. bojjai, vajjai.
Only in DNM. vi.
92. Cf. pajjarai.

See vadavaḍai

DNM. vii, 86.
valai.

Cf. vihai.

Cf. buḍḍai.
Cf. vujjhai.
Cf. vuṭṭai.
Śaurasēni.

Cf. bajjai. DNM.
vii 96, vajjai.

SANSKRIT EQUIVALENT, ACCORDING TO :—

Ādeśa.	Hemacandra	Vararuci.	Kramadīvara.	Rāma-śarmaṇ (Tarkavāgiśa).	Mārkaṇḍeya.	REMARKS.
bruvai brōdi	bravīti				bravīti	Apabhraṅśa. Vṛacada bhraṅśa. Apa-
			<i>bh.</i>			
bhaṁsai	bhraśyati					Cf. bhassai.
bhaṁjai	bhanakti					
bhañjai					bhanakti	
bhañjai	bhanati					
bhañjjaē	bhañyate					
bhañnai				bhañati		
bhañnaē	bhañyate					
bhañnaē					bhañyate	Āvanti.
bhamai	bhramati	bhramati			bhramati	
bhamāḍai	bhramati *					
bhamāḍai	bhramati *					
bhamāḍēi	bhramayati					
bhamāvēi	bhramayati					
bhammai					bhramati	
bhammaḍai	bhramati *					
bharai	smarati *	smarati	smarati	bharati, sma- rati.	smarati	
bhalai	smarati *					
bhavai	bhavati					
bbavadi	bhavati					Śaurasēni
bhavia						Śaurasēni.
bhavissadi					bhūtva	Śaurasēni.
bhasai	bhaśati				bhaviṣyati	Śaurasēni.
bhassai						
bhāai					bhraśyati	Cf. bhaṁsai.
bbāadi					bhāyayati	
bhāāvēi					bhāti	Śaurasēni.
bhāi	bibhēti *	bibhēti	bibhēti	bibhēti	bhāyayati	
bhāēi					bibhēti	
bbādi					bhāyayati	
bhāmai	bhrāmuyati				bibhēti	Śaurasēni.
bhāsai	bhāsatē					
bhāsāvēi					bhīṣayate	
bhinmāi					bhīṣayate	
bhindai	bhinatti	bhinatti	bhinatti	bhinatti	bhinnam	
bhisai	bhāsatē				bhinatti	
					plōṣati	plōṣati, bhīṣa- yate.
bhisāvēi						bhīṣayate
bhisēi						bhīṣayate
bhisai						bhīṣayate
bhisēi					bhīṣayate	
bhisāvēi						bhīṣayate
bhukkai	bhaśati *				bhīṣayate	Cf. bhisāvēi.
bhujjai	bhujyate					
bhumjai	bhunkte					
bhuñjai						
bhuñijjai					bhuinkte	
bhumai	bhujyate					
bhulai	bhramati *					
bhuvadi	bhraśyati *					
bhūdam	bhavati	bhavati				Śaurasēni. Śaurasēni.
					bhūtam	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
bhūvai ..	.....	.....	.....	bhavati ..	.....
bhēsai ..	.....	.....	.....	bhīṣayatē ..	.....
bhēsāvēi ..	.....	.....	.....	bhīṣayatē ..	.....
bhēsēi ..	.....	.....	.....	.....	bhēṣayati ..	
bhottavvai ..	bhōktavyam ..	bhōktavyam ..	bhōktavyam ..	bhōktavyam ..	bhōktavyam ..	
bhottunī ..	bhōktum ..	bhōktum ..	.....	bhōktum ..	bhōktum ..	
bhottūna ..	bhuktvā ..	bhuktvā ..	.....	.....	bhuktvā ..	
bhottūnaṁ ..	.....	.....	.....	bhuktvā ..	.....
bhōavvai ..	.....	.....	.....	bhōktavyam ..	.....
bhōum ..	.....	.....	bhōktum ..	bhōktum ..	.....
bhōūna ..	.....	.....	bhuktvā ..	.....	.....
bhōūnaṁ ..	.....	.....	.....	bhuktvā ..	.....
bhōdi ..	bhavati ..	.....	.....	.....	bhavati ..	Śaurasēni.
bhōdi ..	bhavati ..	.....	.....	.....	.....	Māgadhī.
bhōdi ..	.....	.....	.....	.....	bhavati ..	Vrācaḍa Apā- bhraṁśa.
<i>m</i>						
makkhai ..	mraṣṭati ..	.....	.....	.....	.....
maggai ..	maṅgati ..	.....	.....	.....	.....
maccai ..	mādyati ..	.....	.....	.....	.....
majjai ..	majjati, mārṣṭi ..	.....	.....	.....	mārṣṭi ..	
majjadi ..	.....	.....	.....	.....	majjati ..	Śaurasēni.
maḍḍai ..	mṛdnāti * ..	.....	.....	.....	mṛdnāti ..	
maḍḍhai ..	mṛdnāti * ..	.....	.....	.....	.....
maṇai ..	manyatē ..	.....	.....	.....	.....
maṇḍai ..	maṇḍayati ..	.....	.....	.....	.....
maṁthai ..	mathnāti ..	.....	.....	.....	.....
mamūrai ..	.....	.....	.....	cūrṇayati ..	.....	Cf. mummurai, mu- sumūrai.
marai ..	mriyatē ..	mriyatē ..	.....	.....	.....
marisai ..	mṛṣyati ..	mṛṣyati ..	mṛṣyati ..	mṛṣyati ..	mṛṣyati ..	
malai ..	mṛḍnāti * ..	mṛḍnāti ..	mṛḍnāti ..	.....	mṛḍnāti ..	
malei ..	.....	.....	.....	mṛḍnāti ..	.....
mahai ..	kāṅksati * ..	.....	.....	icchati ..	.....
mahamahai ..	gandhaḥ prasa- rati.	.....	.....	.....	.....
māai, māi ..	.....	.....	.....	.....	māti ..	
milāai ..	mlāyati ..	.....	.....	.....	mlāyati ..	Śaurasēni.
milāadi ..	.....	.....	.....	.....	mlāyati ..	
milāi ..	mlāyati ..	.....	.....	.....	.....
missai ..	miśrayati ..	.....	.....	.....	.....
milai ..	mīlati ..	.....	.....	.....	mīlati ..	
muai ..	muñcati ..	.....	.....	.....	muñcati ..	Cf. mōai.
muai ..	.....	.....	.....	.....	muñcati ..	Apabhraṁśa.
mukkai ..	.....	.....	.....	.....	muñcati ..	Apabhraṁśa.
mukkam ..	.....	.....	.....	muktam ..	muktam ..	
(?) muggāhai ..	.....	.....	.....	prasarati ..	.....	Cf. moggāhai.
mujjhai ..	muhyati ..	.....	.....	.....	.....
muñcai ..	.....	.....	.....	.....	muñcati ..	
muñcai ..	.....	.....	.....	.....	muñcati ..	Apabhraṁśa.
muṇai ..	jānāti * ..	jānāti ..	.....	.....	jānāti ..	
muṇijjai ..	jñāyatē ..	.....	.....	.....	.....
muṇiai ..	.....	.....	.....	.....	jñāyatē ..	
mummurai ..	.....	.....	.....	.....	cūrṇayati ..	Cf. mamūrai, mu- sumūrai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci	Kramadīśvara.	Rāma-śarman (Tarkavāgīśa)	Mārkaṇḍeya.	
murai	hāśena sphu- ṭati.*	.....	.....	.....	laḍati	[mellai.
mullai	.....	.....	.....	.....	muñcati	Apabhraṁśa. Cf.
musai	muṣṇāti	.....	.....	.....	.....	Cf. mūsai.
musumūrai	bhanakti *	.....	.....	.....	.....	Cf. mamūrai, mum- murai.
mūrai	bhanakti *	.....	.....	.....	.....	.....
mūsai	.....	.....	musṇāti	.....	muṣṇāti	Cf. musai.
mellai	muñcati *	.....	.....	.....	.....	Cf. mullai.
mēlavai	niśrayati	.....	.....	.....	.....	.....
(?) moggāhai	.....	.....	.....	prasarati	.....	Cf. muggāhai.
moṭṭāyai	ramatē *	.....	.....	.....	.....	.....
mottavvai	mōktavyam	.....	.....	[mōktavyam]	mōktavyam	.....
mottūni	mōktum	.....	.....	[mōktum]	mōktum	.....
mottūpa	muktvā	.....	.....	.....	muktvā	.....
mottūpani	.....	.....	.....	[muktvā]	.....	.....
mōai	.....	.....	.....	.....	muñcati	Cf. muai.
mōai	.....	.....	.....	.....	muñcati	Apabhraṁśa.
mhasai	.....	.....	.....	.....	bhraśyati	.....
r.						
raai	racayati	.....	.....	.....	.....	.....
raikhōlai	dōlayati *	.....	.....	.....	.....	.....
raijēi	rañjayati	.....	.....	.....	.....	.....
rattai	.....	raktam	.....	.....	.....	.....
randhai	.....	.....	.....	rādhnōti	rādhayati	.....
rappai	.....	.....	(D) takṣati	.....	.....	Cf. rampai.
ramai	ramatē	.....	.....	.....	ramatē	.....
ramijjai	.....	ramyatē	.....	.....	[ramyatē]	.....
ramiai	.....	.....	.....	.....	[ramyatē]	.....
ramiadi	.....	.....	.....	.....	ramyatē	.....
rampai	takṣati *	.....	.....	.....	.....	Śaurasēni.
rampai	.....	.....	.....	.....	.....	Cf. rappai.
raiphai	takṣati *	.....	.....	.....	takṣati	Cf. rappai.
rambhai	gacchati *	.....	.....	.....	.....	.....
rambhai	.....	.....	.....	takṣati	takṣati	.....
rammai	.....	ramyatē	.....	.....	ramyatē	.....
ravai	rauti	.....	.....	.....	.....	.....
rāni	.....	.....	.....	.....	.....	.....
rāvai	rājate	.....	.....	.....	rāti, rājate	Rāti only in P.
rādi	.....	.....	.....	.....	.....	.....
rāi	.....	.....	.....	.....	rājate	.....
(?) rānai, (?) vā-	.....	.....	.....	.....	rati	.....
nai	.....	.....	.....	vinamati	.....	Only P.
rāvei	.....	.....	.....	.....	.....	.....
riai	rañjayati	.....	.....	.....	.....	.....
riai	praviśati *	.....	.....	.....	.....	.....
riḍai	mañḍayati	.....	.....	.....	.....	.....
riṛai	rājate	.....	.....	.....	.....	.....
ruai	.....	.....	.....	.....	.....	.....
rujjhai	runaddhi	.....	rōditi	rōditi	rōditi	Cf. rōai
rujjai	rauti *	.....	.....	.....	.....	.....
ruṅṅai	rauti, (?) bhra- mati.*	.....	.....	.....	.....	.....
ruṅṅai	.....	.....	.....	.....	.....	.....

bhramati is added
by DNM. vii. 14.
Cf. v. 1. to jhraiṅa
in Hc. iv. 161.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS
	Hēmacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
ruṇṇai	.....	ruditam	ruditam	ruditam	ruditam	
ruṇḍhai	ruṇaddhi	.....	.....	.....	.....
rundhai	.....	ruṇaddhi	ruṇaddhi	ruṇaddhi	ruṇaddhi	
ruṇḍhijjai	rudhyatē	.....	.....	.....	.....
rubhai	rudhyatē	.....	.....	.....	.....
ruṇḍhai	ruṇaddhi	.....	.....	.....	.....
rumbhai	.....	ruṇaddhi	ruṇaddhi	ruṇaddhi	ruṇaddhi	
ruvai	rōditi, rauti	rōditi	rōditi	rōditi	rōditi	Cf. rovai
ruvijjai	rudyatē	.....	.....	.....	.....
ruvvai	rudyatē	.....	rōditi	.....	rōditi	
rūsai	ruṣyati	ruṣyati	ruṣyati	ruṣyati	ruṣyati	
rēavai	muñcati	.....	.....	.....	.....
rēhai	rājatē	.....	.....	.....	rājatē	
rēhaē	.....	.....	.....	rājatē	.....
roṇcai	pināṣṭi *	.....	.....	.....	.....
rottavvai	rōditavyam	rōditavyam	.....	[rōditavyam]	rōditavyam	
rottum	rōditum	rōditum	.....	[rōditum]	rōditum	
rottūna	ruditvā	ruditvā	.....	.....	ruditvā	
rottūnai	.....	.....	.....	[ruditvā]	.....
rōai	.....	.....	rōditi	.....	rōditi	Cf. ruai.
rōi	.....	.....	.....	.....	rōditi	
rōṇ	.....	.....	(D) rōditum	.....	.....
rōdadi	.....	.....	.....	.....	rōditi	Śaurasēni.
rōmanṭhai	rōmanṭhayati	.....	.....	.....	.....
rōvai	rōditi	.....	rōditi	rōditi	rōditi	Cf. ruvai
rōvadi	.....	.....	.....	.....	(?) ruṇaddhi	Śaurasēni.
(?) rōsai	.....	.....	.....	(?) ruṣyati	.....
rōsūnai	mārṣṭi *	.....	.....	.....	mārṣṭi	

l.

laggai	lagati	lagati	lagati	lagati	lagati	
lajjai	lajjatē	.....	.....	.....	.....
ladhai	smarati *	.....	.....	.....	.....
labhai	labhyatē	.....	.....	.....	.....
lalai	.....	.....	.....	.....	ladati	
laviavvai	.....	.....	.....	lavitavyam	.....
lavium	.....	.....	.....	lavitum	.....
laviūnai	.....	.....	.....	lūtva	.....
lasai	.....	.....	.....	.....	lasati	Cf. lhasai.
lahijjai	labhyatē	.....	.....	.....	[labhyatē]	
lahai	.....	.....	.....	.....	[labhyatē]	
lālappai, lālam- pai, lālam- bhai.	.....	.....	.....	vilapati	vilapati	
lālabbhai	.....	.....	.....	.....	vilapati	
lālamhai	.....	.....	.....	vilapati	.....
liai	.....	.....	.....	.....	limpati	
liam	.....	.....	.....	.....	liptam	
likkai	niliyatē *	.....	.....	.....	.....	Cf. likkai
lijjai	.....	.....	.....	.....	liyatē	Āvanti.
lijjai	.....	.....	.....	.....	liyatē	Cf. libbha
lijjhai	.....	lihyatē	(D) lihyatē	.....	.....
littam	.....	.....	.....	.....	liptam	
libbhai	lihyatē	.....	lihyatē	lihyatē	[lihyatē]	Cf. lijjai.
limpai	limpati	.....	.....	.....	limpati	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
lisai	svapiti *	.....	.....	.....	.....
lihai	.....	.....	.....	.....	likhati	
lihijjai	lihyatē	.....	.....	.....	lihyatē	
lihai	.....	.....	.....	.....	[lihyatē]	
lihiadi	.....	.....	.....	.....	lihyatē	.. Śaurasēni.
luai	.....	.....	.....	.....	lumpati	
luaii	lūnam *	.....	.....	lūnam	luptam	
luantō	.....	.....	.....	lūnavān	.....
lukkai	tuḍati, nili- yatē	.....	.....	.....	.....
luggō	rugnaḥ	.....	.....	.....	.....
luṅchai	mārṣṭi *	.....	.....	.....	.....
luṅchai	.....	.....	.....	prōṅchati	prōṅchati	
luḍai	.....	.....	(D.) mārṣṭi	.....	.....	Cf. lubhai.
lunai	lunāti	lunāti	lunāti	lunāti	lunāti	
lunadi	.....	.....	.....	.....	lunāti	.. Śaurasēni.
luṅijjai	lūyatē	lūyatē	lūyatē	[lūyatē]	[lūyatē]	
luttaii	.....	.....	.....	.....	luptam	
lubbhai	lubhyati	.....	.....	.....	.....
lubhai	.....	mārṣṭi	mārṣṭi	.....	.....	Cf. luḍai.
lumpai	.....	.....	.....	.....	lumpati	
lulai	.....	.....	.....	[lunāti]	.....
lurvai	lūyatē	lūyatē	lūyatē	lūyatē	lūyatē	
luhai	mārṣṭi *	.....	.....	mārṣṭi	mārṣṭi	
lūrai	chinatti *	.....	.....	.....	.....
lei	lāti	.....	.....	.....	.....
lehai	.....	.....	.....	.....	.....
lotṭai	svapiti *	.....	.....	.....	likhati	
lhasai	sraṁsate *	.....	.....	.....	luṭḥati	
lhikkai	niliyatē *	.....	.....	.....	lasati	.. Cf. lasai.
lhikkō	naṣṭaḥ	.....	.....	.....	.....	Cf. lhikkai.
			v			
vaai	.....	.....	.....	.....	.....	See caai.
vaggolai	.....	.....	.....	.....	.....
vaccai	rōmanthayati * kāṅksati, vra- jati.*	vrajati	vrajati	vrajati	vrajati	.. DNM. vii, 41, om vrajati.
vacchai	.....	.....	.....	.....	.....
vajjai	paśyati	trasyati	udyatē, vapati trasyati	.....	trasyati	.. Cf. bajjai. DNM. vii, 41, trasyati, not paśyati.
vajjae	.....	.....	.....	trasyati	.....
vajjarai	kathayati	.....	.....	.....	.....
vajjhai	.....	.....	(D.) uhyatē	.....	.....	Cf. vabbhai.
vañcai	vañcati	.....	.....	.....	.....
vañcai	.....	.....	.....	.....	.....
(?) vañjai. (?) vuñjai.	.....	.....	.....	unnamayati	vrajati	.. Apabhramśa.
vaññadi	vrajati	.....	.....	.....	.....
vaḍavaḍai	vilapati *	.....	.....	.....	.....	Māgadhi. DNM vi, 92, ba- ḍavaḍai.
vaḍḍhai	vardhate	vardhate	vardhatē	vardhatē	vardhatē	
vappai	.....	.....	.....	(?) tvacati	.....
vabbhai	.....	.....	.....	uhyatē	.....
vamālai	puñjayati *	.....	.....	.....	.....	Cf. vajjhai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
vamphai ..	kāṅksati, va- lati.*	.....	.....	.....	.....
varai ..	vṛṇōti ..	vṛṇōti ..	.....	vṛṇōti ..	.....
varahāḍai ..	nihsarati *	.....	.....	.....	.....
varisai ..	varṣati ..	varṣati ..	varṣati ..	varṣati ..	varṣati ..	
valai ..	grhṇāti, valati *	.....	.....	valati ..	.....	See balai. DNM. vii, 86, grhṇāti. ārōpayati, and om. valati.
valaggai ..	ārōhati *	.....	.....	ārōhati ..	ārōhati ..	
vallai ..	.....	.....	.....	valati ..	.....
vasuāai ..	.....	.....	.....	.....	śuśyati ..	
vasuāai ..	.....	.....	.....	.....	śuśkam ..	
vasuāi ..	udvāti *	.....	.....	.....	.....
vahadi ..	.....	.....	.....	.....	varṣati ..	Vrācaḍa Apa- bhraṇīśa.
vabiam ..	.....	.....	.....	ūḍham ..	.....
vahiavvam ..	.....	.....	.....	vōḍhavyam ..	.....
vahiui ..	.....	.....	.....	vōḍhum ..	.....
vahijjai ..	uhyatē ..	.....	.....	.....	[uhyatē] ..	
vahiāi ..	.....	.....	.....	.....	[uhyatē] ..	
vahīadi ..	.....	.....	.....	.....	uhyatē ..	Śaurasēu.
vāai ..	.....	mlāyati ..	mlāyati ..	.....	mlāyati ..	
vāi ..	mlāyati *	mlāyati ..	mlāyati ..	.....	mlāyati ..	
(?) vānai, (?) rā- nai.	.....	.....	.....	vinamati ..	.....
vāvamphai ..	śramam karōti*	.....	* ..	.....	.....
vāvareī ..	vyāpriyatē ..	.....	.....	.....	.....
(?) vāvāai ..	.....	.....	.....	(?) avakāsatē ..	.....
vāvei ..	vyāpnōti ..	.....	.....	.....	.....
vāharai ..	vyāharati ..	.....	.....	.....	.....
vāharijjai ..	vyāhriyatē ..	.....	.....	.....	.....
vāhūppai ..	vyāhriyatē *	.....	.....	.....	.....
viatṭai ..	viśamvadati *	.....	.....	.....	.....
viambhai ..	vijrmbhatē ..	.....	.....	.....	.....
viambhai ..	.....	.....	.....	.....	vijrmbhatē ..	
viambhantō ..	.....	.....	.....	vijrmbhamānah ..	.....
viaiai ..	.....	.....	(D.) bhujati ..	.....	.....	Only in D. RLM. corrupt. The Sanskrit root is given as bhujō (kauṭilyē).
viasai ..	vikasati ..	.....	.....	.....	vikasati ..	
viārei ..	.....	.....	.....	.....	vicārayati ..	
viuḍai ..	nāśayati *	.....	.....	.....	.....
vikiṇai ..	vikrīṇite ..	.....	.....	.....	.....
vikośai ..	vikośayati ..	.....	.....	.....	.....
vikkīnai ..	.....	vikrīṇite ..	vikrīṇite ..	vikrīṇite ..	vikrīṇite ..	
vikkēai ..	vikrīṇite ..	.....	.....	vikrīṇite ..	.....
vikkēi ..	vikrīṇite ..	vikrīṇite ..	vikrīṇite ..	.....	vikrīṇite ..	
vigalai ..	vigalati ..	.....	.....	.....	.....
vicchōlai ..	kampayati *	.....	.....	.....	.....
vijjai ..	.....	.....	kṣipati ..	.....	.....
vijjhai ..	.....	.....	.....	vighatate ..	.....
viñcheī ..	.....	.....	.....	.....	vighatātē ..	
viḍaviḍai ..	racayati *	.....	.....	.....	.....

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
vidhattam	arjitam					
vidhappai	arjyate				vyutpadyate	
vidhavai	arjati *					
vidhavijjai	arjyate					
viṇabhai				khedayati		Cf. viṇabhai.
viṇavai	vijñāpayati					
vittharai					vistrṇōti	
viddhai				vidhyati		
vippagālai	nāśayati *					
viṇharai	smarati, vis- marati.*				vismarati	
virai	gupyati, bha- nakti					
virāci	viracayati					
viramānai				pratipālayati		Cf. ciramālai.
viramālai	pratikṣate *					
virallai	tanōti					
virāi	vilīyate *					
virillai					vistrṇōti	
virihai				pratipālayati	pratipālayati	
virēai	virēcayati					
virōlai	mathnāti *					
vilaggai				vilagati		
vilabhēi					khedayati	Cf. viṇabhai.
vilavai	vilapati				vilapati	
vilijjai	vilīyate					
vilumpai	kāṅksati					
vilottai	visamvadati *					
vivaṭṭai	vivartate					
visai, (?) ghisai		grasate				See ghisai.
visamvayai	visamvadati					
visattai	dalati *			vikāsayati	vikasati	Cf. vosattai.
visattam					vikasitam	
visarai					vismarati	Cf. vissarai, visa- rai.
visumaradi						Śaurasēni.
visurai					vismarati	
visūrai	khidyate *	khidyate	khidyate	khidyate	khidyate	
vissarai				vismarati		Cf. visarai, visarai.
vihaḍēi					vighaṭate	
vihallai				(?) virauti, vis- trṇōti.		
vihasai					vikasati	
vihivillai					viracayati	
vihirai	pratikṣate *					
vihōḍai	tāḍayati *					
vijai	vijayati					
viṇai						
viṇēi				vicārayati		
visamai	visrūmyati				vicārayati	
visarai	vismarati *			vismarati	vismarati	Cf. visarai, vissa- rai.
visālai	miśrayati *					
viḥai		bibhēti				Cf. bihai.
vuccai	ucyate					
vuccadi				braviti, vakti	braviti	Śaurasēni.

SANSKRIT EQUIVALENT, ACCORDING TO:—

Ādeśa.	Hemacandra.	Vararuci.	Ḳramadiśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	REMARKS.
vujjhai ..	.....	budhyatē ..	.....	.....	.....	Cf. bujjhai
vuñhai ..	vrajati ..	.....	.....	.....	.....	Apabhraṁśa
(?) vuñjai, (?) vañjai.	.....	.....	.....	unnamayati ..	.....
vuṭṭai ..	.....	majjati ..	.....	.....	.....	Cf. budḍai
vuttai ..	.....	.....	(D.) majjati ..	.....	.....
vubbhai ..	uhyatē ..	.....	.....	.....	uhyatē	
vettavvañ ..	.....	vēditavyam ..	.....	.....	.....
vettum ..	.....	vēditum ..	.....	.....	.....
vettūṇa ..	.....	viditvā ..	.....	.....	.....
vellai ..	ramatē *	.....	.....	.....	.....
vēdai ..	khacati *	.....	.....	.....	.....
vēḍhai ..	vēṣṭatē ..	vēṣṭatē ..	vēṣṭatē ..	vēṣṭayati ..	vēṣṭatē	
vēḍhijjai ..	vēṣṭayate ..	.....	.....	.....	.....
vēḍhī ..	vēṣṭayati ..	.....	.....	.....	.....
vemayai ..	bhanakti *	.....	.....	.....	.....	DNM. vii, 79, vē- maai.
vemai ..	.....	.....	.....	.....	bhanakti	
vēmi ..	vēdmi ..	.....	.....	.....	.....
vēlavai ..	upālabhatē, vañcati.*	.....	.....	.....	.....
vēvai ..	vēpatē ..	.....	.....	.....	.....
vēhavai ..	vañcati *	.....	.....	.....	.....
vokkai ..	vijñapayati ..	.....	.....	.....	unnaṭati, un- nadati.	Cf. avukkai.
vokkhai ..	.....	.....	.....	unnadati ..	.....
voccai ..	.....	.....	.....	vadati ..	.....	Cf. vōcai.
vojjai ..	vijayati, tra- syati.*	.....	.....	.....	.....	Cf. bojjai.
vottavvañ ..	vaktavyam ..	.....	.....	.....	vaktavyam	
vottum ..	vaktum ..	.....	.....	.....	vaktum	
vottūṇa ..	uktvā ..	.....	.....	.....	uktvā	
vollai ..	.....	.....	.....	ākramatē ..	.....	Cf. vōlai.
vōcai ..	.....	.....	.....	vadati ..	.....	Cf. voccai.
vōḍhañ ..	.....	.....	.....	ūḍham ..	.....
vōḍhavvañ ..	.....	.....	.....	vōḍhavyam ..	.....
vōḍhum ..	.....	.....	.....	vōḍhum ..	.....
vōlai ..	gacchati *	.....	.....	.....	kramatē ..	Cf. vollai.
vōlinañ ..	.....	.....	.....	.....	krāntam	
vōlinō ..	atikrāntaḥ ..	.....	.....	.....	.....
vōsaṭṭai ..	vikasati ..	.....	.....	vikāśayati ..	vikasati ..	Cf. viṣaṭṭai.
vōsaṭṭañ ..	bhṛtōlluthi- tam.*	.....	.....	.....	vikasitam ..	In Hc., only ^m DNM vii, 81.
vōsaṭṭō ..	vikasitaḥ ..	.....	.....	.....	.....
vōsirai ..	avasṛjati ..	.....	.....	.....	.....
sciṇṭadi ..	.....	.....	.....	.....	tiṣṭhati ..	Māgadhī.
saai ..	.....	.....	.....	.....	svadatē	
sañrujjhai ..	sañrudhyat ..	.....	.....	.....	.....
sañrudhijjai ..	sañrudhyatē ..	.....	.....	.....	.....
sañvarai ..	sañvrñōti ..	.....	.....	.....	.....

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hēmacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Parkavāgiśa).	Mārkaṇḍeya.	
saṁvellai ..	saṁvēṣṭatē ..	saṁvēṣṭatē ..	saṁvēṣṭatē ..	saṁvēṣṭatē ..	saṁvēṣṭatē ..	
saṁsai ..	sraṁsātē ..	.....	.....	.....	.....
sakkai ..	śakuōti ..	śaknōti ..	śaknōti ..	śaknōti, sar- pati.	śaknōti, śakya- tē, sarpati.	
sakkadi ..	.....	.....	.....	.....	śaknōti ..	Śaurasēni.
sakkīadi ..	.....	.....	.....	.....	śaknōti ..	Śaurasēni.
sakkunadi ..	.....	.....	.....	.....	śaknōti ..	Śaurasēni.
sakkunīadi ..	.....	.....	.....	.....	śaknōti ..	Śaurasēni.
saṁkhāi ..	saṁstyāyatē *	.....	.....	.....	.....
saṁkhuḍḍai ..	ramatē ..	.....	.....	.....	.....
saṁgacchāi ..	saṁgacchatē ..	.....	.....	.....	.....
saṁgalai ..	saṁghaṭatē *	.....	.....	.....	.....
saṁgōvai ..	.....	.....	.....	.....	saṁgōpāyati	
saṁghai ..	kathayati ..	.....	.....	.....	.....
saṁghadai ..	saṁghaṭatē ..	.....	.....	.....	.....
saccavai ..	paśyati ..	.....	.....	.....	.....
saṁjavai ..	.....	.....	.....	.....	saṁgōpāyati	
saḍai ..	sīdati ..	śīyate ..	(D. śīyatē)	sīdati ..	śīyate	
saḍḍhai ..	.....	.....	(?) śīyatē ..	.....	.....	Cf. saḍai.
saṁṇāmai ..	.....	.....	.....	.....	.....	See saṁṇāmai.
saddahai ..	śraddadhāti ..	śraddadhāti ..	śraddadhāti ..	śraddadhāti ..	śraddadhāti ..	
saddahāni ..	.....	.....	.....	.....	.....
saṁtappai ..	saṁtapyatē ..	.....	.....	.....	.....
saṁdānai ..	avaṣṭambhāṁ karōti.*	.....	.....	.....	.....
saṁdisai ..	saṁdiśati ..	.....	.....	.....	.....
saṁdumai ..	pradīpyatē *	.....	.....	.....	.....
saṁdhukkai ..	pradīpyatē *	.....	.....	.....	.....
saṁṇāmei ..	ādrīyatē *	.....	.....	.....	.....	DNM. viii, 19, saṁ- ṇāmai.
saṁṇumai ..	chādayati ..	.....	.....	.....	.....
sappai ..	.....	.....	.....	.....	.....
samai ..	śāmyati ..	.....	.....	sarpati ..	sarpati ..	
saṁṇai ..	bhūṅktē, sa- māpnōti.*	.....	.....	.....	.....	Cf. saṁmai.
saṁṇaravai, sa mārai.	saṁṇaracayati ..	.....	.....	.....	.....
saṁṇāveī ..	saṁṇāpnōti ..	.....	.....	.....	.....
saṁṇapajjai ..	saṁṇapadyatē ..	.....	.....	.....	.....
saṁbhavai ..	saṁbhavati ..	saṁbhavati ..	.....	saṁbhavati ..	.....
saṁbhāvai ..	lubhyati, saṁ- bhāvayati.*	.....	.....	.....	.....	DNM. viii, 19, om. saṁbhāvayati.
saṁbhūo ..	.....	.....	.....	saṁbhūtaḥ ..	saṁbhūtaḥ ..	
saṁmai ..	.....	.....	.....	śāmyati ..	.....	Cf. saṁmai.
saṁmillai ..	.....	.....	.....	saṁmīlati ..	.....
saṁmilai ..	saṁmīlati ..	.....	.....	saṁmīlati ..	.....
sarai ..	saṁmīlati ..	.....	.....	saṁmīlati ..	.....
salahai ..	sarati ..	sarati ..	.....	sarati ..	sarati ..	
savai ..	ślāghatē ..	.....	.....	.....	.....
sahai ..	sūtē ..	.....	.....	.....	.....
sahāi ..	rājatē *	.....	.....	.....	.....
sahāni ..	.....	.....	.....	.....	.....
sahāvvanī ..	.....	.....	.....	ājānāti ..	.....
sahāni ..	.....	.....	.....	sōdham ..	.....
sahāni ..	.....	.....	.....	sōdhavyam ..	.....
saḍḍhai ..	.....	.....	.....	sōdham ..	.....
saṁmayai ..	karṣati ..	.....	.....	.....	.....
.....	pratikṣatē ..	.....	.....	.....	.....

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Parkavāgiśa).	Mārkaṇḍeya.	
sāmaggai	śliṣyati	.....	.....	.....	.....
sārai	praharati *	.....	.....	.....	.....
sāravai	samāracayati	.....	.....	.....	.....
sāsai	.....	.....	.....	.....	kathyatē	
sāhai	kathayati *	.....	.....	kathayati	.....	Cf. sāhēi, abisāhai.
sāhattai	sauhvṛṇōti	.....	.....	.....	.....
sāharai	sauhvṛṇōti	.....	.....	.....	.....
sāhīai	.....	.....	.....	.....	kathyatē	
sāhēi	.....	.....	.....	.....	kathayati	Cf. sāhai.
sijjhai	sidhyati	.....	.....	sidhyati	sidhyati	
siñcai	siñcati	.....	.....	.....	.....
sippai	sicyatē. sni- hyatē.	.....	.....	.....	.....
siñpai	siñcati *	.....	.....	.....	.....
silēsai	śliṣyati	.....	.....	.....	.....
sivvai	sivyati	.....	.....	.....	.....
sihai	kāñksati. spr- hayati.*	.....	.....	.....	.....	DNM. viii, 32, om. kāñksati.
sīsai	kathayati. śi- nasti.*	.....	.....	.....	.....	DNM. viii, 34, om. śinasti.
suai	svapiti	.....	.....	svapiti	svapiti	Cf. suvai, sōai, sō- vai.
suaii	.....	.....	.....	śrutam	.....
suadi	.....	.....	.....	śrutavān	svapiti	Śaurasēni.
suantō	.....	.....	.....	.....	śetē	Śaurasēni.
suādi	.....	.....	.....	.....	.....
sukkaii	.....	.....	.....	śuṣkam	.....
(?)soggāhai	.....	.....	.....	prasarati	.....	Cf. soggāhai.
sujjhai	.....	.....	.....	śudhyati	śudhyati	
sudhai	.....	.....	.....	.....	sinarati	
supai	śṛṇōti	śṛṇōti	śṛṇōti	śṛṇōti	śṛṇōti	
sunadi	.....	.....	.....	.....	śṛṇōti	Śaurasēni.
sunūna	śrutvā	.....	.....	.....	.....
sunijjai	śrūyatē	śrūyatē	[śrūyatē]	.....	śrūyatē	
sunīadi	.....	.....	.....	.....	śrūyatē	Śaurasēni.
supai	.....	mārṣṭi	mārṣṭi	.....	.....
sumarai	smarati	smarati	smarati	smarati	smarati	
sumaradi	.....	smarati	.....	.....	smarati	Śaurasēni.
suvai	.....	.....	.....	.....	svapiti	Cf. suai, sōai, sō- vai.
suvidaii	.....	.....	.....	.....	suptam	Śaurasēni.
suvidavvai	.....	.....	.....	.....	svaptavyam	Śaurasēni.
suvidum	.....	.....	.....	.....	svaptum	Śaurasēni.
suviśadi	.....	.....	.....	.....	svapsyati	Śaurasēni.
suvvai	śrūyatē	śrūyatē	[śrūyatē]	.....	śrūyatē	
suvvai	.....	.....	.....	.....	śrūyatē	Āvanti.
sudai	bhanakti *	.....	.....	.....	.....
sūrai	bhanakti *	.....	.....	.....	.....
sūsai	śuṣyati	śuṣyati	.....	.....	śuṣyati	
sēai	siñcati	.....	.....	.....	.....
sēhai	naśyati *	.....	.....	.....	.....
(?)soggāhai	.....	.....	.....	prasarati	.....	Cf. soggāhai
sottavvai	.....	.....	.....	.....	svaptavyam	
sottūii	.....	.....	.....	.....	svaptum	
sottūna	.....	.....	.....	.....	suptvā	
sollai	kṣipati. pacati	.....	.....	irayati	samīrayati	

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO :—					REMARKS.
	Hemacandra.	Vararuci.	Kramadiśvara.	Rāma-śarman (Tarkavāgīśa).	Mārkaṇḍeya.	
sōai	svapiti ..	svapiti ..	Cf. suai, suvai, sōi, sōvai.
sōavvai	śrōtavyam	Cf. sōai.
sōi ..	.....	.....	.....	svapiti ..	.....
sōuñ ..	.....	.....	.....	śrōtum ..	.....
sōūna ..	śrutvā ..	.....	.....	.....	.....
sōūnai ..	.....	.....	.....	śrutvā ..	.....
sōḍham ..	.....	.....	.....	sōḍham ..	.....
sōḍhavvai ..	.....	.....	.....	sōḍhavyam ..	.....
sōḍhum	sōḍhum	Cf. suai, suvai, sōai.
sōvai ..	.....	.....	.....	.....	svapiti ..
<i>h.</i>						
haō ..	hatah	DNM. viii, 64, hak- khupai, and so a v. l. to Hc. iv, 114.
hakkai ..	niśēdhati *	.....	.....	.....	.....
hakkhuvai ..	utkṣipati *	.....	.....	.....	.....
hanai ..	śṛṇōti *	hanti	Śaurasēni.
hanadi ..	.....	.....	.....	.....	hanti
hanijjai ..	hanyatē	DNM. viii, 62, om. harati.
hanitavvai ..	hantavyam ..	.....	.....	.....	.....
hamtūna ..	hatvā ..	.....	.....	.....	.....
hanmai ..	hanti, hanyatē, hammati.	hanti ..	hanti ..	.....	hanti
harai ..	gr̥hṇāti, harati *	.....	.....	.....	.....
harijjai ..	hriyatē ..	.....	.....	hriyatē ..	hriyatē
harisai ..	harṣati ..	harṣati ..	harṣati ..	.....	harṣati
harīai ..	.....	.....	.....	hriyatē ..	.....
havai ..	bhavati, (?) ju- hōti.	.....	.....	.....	.....
havadi ..	bhavati ..	.....	.....	.....	.....
hasai ..	hasati	hasati ..	hasati	Śaurasēni.
hasijjai ..	hasyatē ..	hasyatē ..	.....	.....	.....
hassai ..	hasyatē ..	hasyatē ..	.....	hasati ..	.....
hāravai ..	nāśayati ..	.....	.....	.....	.....
hiṇṇai ..	.....	.....	.....	gr̥hṇāti ..	.....
hīttham ..	.....	trastam ..	.....	.....	.....
hindai ..	.....	.....	.....	.....	gr̥hṇāti
hindūna ..	.....	.....	.....	.....	gr̥hītvā
hindijjai ..	.....	.....	.....	.....	.....
hindiai ..	.....	.....	.....	gr̥hyatē ..	.....
hivai ..	(?) juhōti ..	.....	.....	.....	gr̥hyatē
hirai ..	hriyatē ..	hriyatē ..	hriyatē ..	hriyatē ..	hriyatē	
hirijjai ..	.....	hriyatē ..	.....	.....	.....
hirīai, hirīi ..	.....	hriyatē ..	.....	.....	.....
hisamanai ..	heṣitam	Cf. DNM. viii, 68, heṣāravah. Cf. huvai.
huai ..	.....	.....	.....	.....	juhōti ..
huai ..	.....	.....	.....	.....	.....
huai (?) hūai ..	.....	blūtam ..	.....	hutam ..	.....
huantō ..	.....	.....	.....	.....	.....
huṇai ..	juhōti ..	juhōti ..	juhōti ..	hutavān .. juhōti ..	juhōti ..	Cf. hūai.

Ādeśa.	SANSKRIT EQUIVALENT, ACCORDING TO:—					REMARKS.
	Hemacandra.	Vararuci.	Kramadīśvara.	Rāma-śarman (Tarkavāgiśa).	Mārkaṇḍeya.	
hunadi ..	.....	.....	.....	.....	juhōti ..	Śaurasēnī.
huñijjai ..	hūyatē ..	hūyatē ..	[hūyatē] ..	[hūyatē] ..	hūyatē ..	Śaurasēnī.
huñiadi ..	.....	.....	.....	.....	hūyatē ..	Śaurasēnī.
hulai ..	kṣipati, mārṣṭi	.....	.....	.....	.....	.....
huvai ..	bhavati ..	bhavati ..	bhavati ..	bhavati ..	bhavati, juhōti	Cf. huai.
huvadi ..	bhavati ..	.....	.....	.....	.....	Śaurasēnī.
huvanti ..	.....	bhavanti ..	.....	.....	.....	.....
huvvai ..	hūyatē ..	hūyatē ..	[hūyatē] ..	[hūyatē] ..	hūyatē ..	.....
hūam̄ ..	bhūtam ..	(?) bhūtām ..	bhūtam ..	.....	.....	Cf. huam̄.
hūō ..	.....	.....	.....	bhūtaḥ ..	bhūtaḥ ..	.....
(?) hūmai ..	.....	.....	.....	(?) satrayatē, (?) trasyati.	.....	.....
hoṃti ..	.....	bhavanti ..	.....	.....	.....	.....
hōi ..	bhavati ..	bhavati ..	bhavati ..	bhavati ..	bhavati ..	.....
hōi ..	.....	.....	.....	.....	bhavati ..	Āvantī.
hōdi ..	bhavati ..	.....	.....	.....	bhavati ..	Śaurasēnī.

APPENDIX.

PRĀKRṬA-KALPATARU, I, viii.

The following is an attempted restoration of the eighth Stabaka, dealing with Dhātv-ādēśas, of the first Śākhā of Rāma-śarman's *Prākṛta-kalpataru*. The text is in verse, and each verse is accompanied by a prose commentary. As previously explained, the one manuscript known to exist of this work is most corrupt. Not only is the writing difficult to read with certainty, but the scribe, who was evidently ignorant of the elements of Prakrit, seems to have had before him an original the writing of which was equally doubtful. The whole MS., therefore, as we have it is full of blunders. Fortunately, each Prakrit ādēśa given in the text is repeated in the commentary, and, owing to this fact, together with the aid of the metre of the text, it has generally been possible to restore the ādēśa to its original form with some certainty.

The case is different with regard to the numerous Prakrit verses and short sentences quoted in the commentary. Most of these are plainly invented by the author as *ad hoc* examples,¹ so that it is impossible to correct them by reference to the works of other Prakrit authors, even if their sources could be traced. Unlike the ādēśas, these are written each only once, and, owing to the shortness of many of the sentences, it is not often that the metre, if such exists, can be identified. For these reasons, I have found it impossible to correct the Prakrit of many of these examples, even when the writing is clear. I have, therefore, in such cases written down just what I found in the manuscript, marking with queries those words about the reading of which I was not certain. Even this certainty was a subjective matter, and I do not doubt that many people would read some of the passages in ways other than those shown by me. In several places these examples, as printed, are sheer nonsense, but this was inevitable under the conditions of the work. It is true that I might have emended the passages out of my inner consciousness, or that I might have omitted them altogether, but neither of these alternatives commended itself to me, and I have accordingly left the passages as they seem to me to stand. Fortunately, these examples are of small importance. The main thing was to ascertain Rāma-śarman's list of Dhātv-ādēśas, and this I hope I may claim to have done with some accuracy. A few of his ādēśas are doubtful, and attention has been drawn to each of these in the footnotes. In these footnotes, I have also noted all the more important emendations made by me, but I have not wasted space on the hundreds of manifestly certain corrections of simple scribal errors.

¹ So Hemacandra concocted his own very insipid examples in the *Dēśināmamālā*.

In the margin, I have given references to the corresponding passages in the works of Vararuci and Mārkaṇḍeya. Unless otherwise stated, the references are to the sūtras in the eighth paricchēda of the *Prākṛta-prakāśa*, and in the seventh pāda of the *Prākṛta-sarvasva*.

Metre, Upajāti, √ - √ - √, √ √ - √ - √

1. bhuvā tu lādau klalu hō-huvau staḥ,¹ Vr. 1; Mk. 1, 2.
 prādēr bhavō, duppahavō ca, hū ktē; Vr. 3, 2; Mk. 2, 3.
 na prādur-āviḥ-sam-udaḥ parasya. Mk: 4.
 tvarēs tu nityam tuvaras, turah ktē. Vr. 4, 5; Mk. 6, 7.

Comm. bhuvā iti.—*Rāhī pasannā jai hōi, Kaṇha, tumam juā hōsi a, hōmi dūi.*

ēvam huvai. prādēs tu, pabhavai iti, sambhavai, ahibhavai, ubbhavai. Tathā duppahavai, pahavai, (?) alatti māhavō mam parihavai sahī nā majjhē; ktē tu bhuvah hūḥ; hūō, hūā, hūam, pahūō ityādi. pādubbhūō, avibbhūō, sambhūō, ubbhūō.

tvarēs tu tuvarāc. Śākalya-matē tuvarah [? tūrah]. turiam mā gaccha, ehijja sō [Cf. Hāla, 17].

2. ghūrñēs tu ghōṇah,² prabhavēc ca ghummō; Vr. 6; Mk. 9.
 nudēs tu ṇollam samudirayanti; Vr. 7; Mk. 8.
 pātes tu phālas ca; vṛṣer ṛtō riḥ, Vr. 10; Mk. 11, 53.
 kṛṣer mṛṣēs cātra hṛṣer api syāt. Vr. 11; Mk. 54.

Comm. ghūrñēr iti.—*cittam ghōṇai, ṇaṇam ghummai mahurā-rāsassa. ṇollai, phālai, phālēi. vṛṣāder ṛtō riḥ. varisai, karisai, marisai, harisai.*

3. a-sōpasarga-smarater vidhēyō
 bharaḥ sudhibhiḥ sumaras tathā dvau, Vr. 18; Mk. 14.
 vē vīssarō, vīsara ēva kaścit. Mk. 16.
 ṛtas tv ṛd-antasya bhavēt sadā 'rah. Mk. 54.

Comm. asōpasargasyēti.—*Kaṇham bharanti bhārai, sumaranti sumarai. sōpasargasya tu aṇusarai (?) visahai arah. vēs tu vīssarai, vīsarai kaścit. ṛd-antasya ṛtō ara; karai, sarai, varai, bhārai, ityādi.*

4. kṛñāḥ kuṇō vātha, sadā bhavēt kā Vr. 13, 17; Mk. 112--4.
 tavayā-tu[mañ]-ktvāsv api bhūta-bhavye,³ Vr. 17; Mk. 113--4.
 kte kō; graher dvau khalu geṇha-hiṇṇau,⁴ Vr. 1, 27; Mk. 1, 36; Vr.
 15; Mk. 96.
 ghē tavya-tum-ktvasu vibhāṣitō 'yam. Vr. 16; Mk. 97.

Comm. kṛñā iti.—*sā pasāam kuṇanti. pakṣe karai (?) kaṣasarōam vaccha-thalammi, Kaṇha.*

kāavvam, kāum, kāūnam, kāhā, kāhī. kte kaam.

geṇha iti.—[tavya-tum-ktva]sv i[ti] eṣu ghē vibhāṣitaḥ, ghetlavvam⁵ gheum,

¹ MS. *ptam*, but *pta* is frequently written for *sta*.

² MS. *rōṇah* or *ōṇah*. Comm. has *ghōṇai*.

³ MS. *mahoya*.

⁴ So MS. I am unable to emend. Perhaps what was intended was *ṛ'rah* or something of that sort.

⁵ MS. *bhūtaṅtasya*, which I have emended as above. Something of this sort is certainly required.

⁶ Mk. *hinda*.

⁷ MS. *sō*.

⁸ So MS. I can make nothing of it.

⁹ Mk. *ghevam*. Hc. iv, 210 *ghettavvam*.

ghettūna. pakṣē geṇhiavvam, geṇhiim, geṇhiūna. kēcit tu gēhiavvam ityādi ūhaniyam.

5. jambhāu uktaḥ khalu jmbhatēḥ syāt, Vr. 14; Mk. 32.
 Kātyāyanēnōṣita ēva jambhā;
 prādēr imau dvau na vadanti sarvē
 maṇiṣiṇaḥ prākṛta-sāsanēṣu. Mk. 33.

Comm. jambhāa iti.—jambhāai pasañña-mmi gōsē jambhāantam Māhavam bhavēmi. Kātyāyana-matē Kaṇhō jambhāi. Prādēr jambhāu jambhā dvau prākṛta-sāsanēṣu na pradīṣṭau, sō viambhanta (?) nōttā.

6. vyadhēs tu viddhō¹; niṣadēr nimajjō²;
 jñō jāna āṇas ca aṇas³ ca kaścit; Vr. 23; Mk. 13.
 uddhmas tu nityam tata uddhamā⁴ 'tra; Vr. 32; Mk. 41—2.
 grasēr ghisah syāc ca; ciṇas ciṇōtēr. Vr. 29; Mk. 42, 35.

Comm. vyādhēs tv iti.—viddhattō, viddhai; nimajjai; āṇai; kēcit tu aṇai puṇanti⁵; uddhamai,⁶ dhamai; ghisai; ciṇai, ciṇanti.

7. bliyas tu bhā bhū imau pradīṣṭau, Vr. 17; Mk. 29.
 tasyāiva bhāsō ṇici bhēsa-bhīsau;
 syāc chraddadhātēr dāha ēva vācyah; Vr. 33; Mk. 37.
 (?) satrēs⁷ tu (?) hūmō⁸; 'tha tṛpēs ca thiṭṭah. Vr. 22, thimpa-; Mk. 12.

Comm. bliya iti.—bhāi, sā bhīhī, bhīhai. ṇici, bhāsai, bhāsāvēi, bhēsai, bhēsāvēi, bhīsai, bhīsāvēi. mam Māhavō na saddahai kaḥam piām pi (?)bhrūsai. thiṭṭai Māhavam.

8. avāt tu gāhēḥ pravadanti vāham, Vr. 34; Mk. 49.
 kāsēs⁹ tu vāsam yadi 'śabda-kutsā,¹⁰ Vr. 35; Mk. 49.
 kēsām ca¹¹ vāvāa, imāv ila staḥ;
 krīṇah kiṇō, vēs tu vikalpitaḥ kkē. Vr. 30—1; Mk. 38—9.

Comm. avāt iti.—ōvāham, avavāhai; vōvāsai. avavāsai¹²; jaha diṇammi vōvāsai (?) haḥ{t}aphērē iti; kēcit tu vōvāsēi iti; vāvāai¹³; kiṇai; vēs tu vikkēai, vikkiṇai¹⁴; Kaṇhō vikkēai pasūṇam bahūṇam.

¹ So the Sētubandha throughout. Hāla has vijjha-. See the indexes to these two works. The word is not given either by Hc. or Mk.

² Hc. iv, 123, numajjai = niṣidati. Mk. vii, 138, numajjai = sētē.

³ āṇa- and aṇa- are not given by Hc. or Mk. Perhaps we should read muṇas for aṇas.

⁴ We should probably read uddhuma 'tra.

⁵ Probably read aṇanti (? muṇai muṇanti).

⁶ Hc. and Mk. uddhumai.

⁷ So MS., which is here quite clear. The Dhatupaṭha gives a root sattra-, samtānakriyāyām. Satrēs might be explained as a scribal error for trasēs, were not tras- provided for subsequently in verse 22. Cf. also sattrāyatē, he sacrifices.

⁸ Or dru^sō or bhrū^sō. The Comm. gives a form which is most like bhrūsō.

⁹ MS. kās-. So Vr. and Mk; but Hc. and KI. hās-. Cf. the next note.

¹⁰ Cf. Dhatupaṭha, kāsṛ, śabdakutsāyām.

¹¹ MS. kēsām ca. Emendation conjectural.

¹² MS. vavavāsai.

¹³ MS. vāvāai, but this would spoil the metre in the verse.

¹⁴ MS. vikkēai, vidhiṇai; Kaṇhō vikkēai, etc.

Metre, Śālinī, — — — —, — — — — —

9. ṣṭhā-dhyā-gānām *ṭhāa-jhāau* ca *gāaṣ*, Vr. 25.
ṭhā-jhā-gāṣ cēty atra nityam tv¹ amīśām, Vr. 26.
 syur vidhy-ādaṁ vartamānē ca bhavyē
 cēd ēkatvē yady apīha pradiṣṭāḥ.

Comm. ṣṭhā-dhyā-gānām iti.—*ṭhāanti sā jhāaē, gāaē tam; ṭhāu, jhāu, gāu,*
 vartamānē *ṭhāi, jhāi, gāi*; bhavyē, *ṭhāhii, jhāhii, gāhii.*

Metre, Upajāti, as before.

10. uktē[ṣu] *khā-dhā* khalu khādi-dhāvyor Vr. 27; Mk. 59, 100.
 ac chiṣyatē luk tu halō niruktāḥ;
 mānō nirō *mānam* udāharanti;
 niraḥ padēr atra *vasaḥ*² pradiṣṭāḥ Vr. 36; Mk. 26, 27.
 Mk. 25.

Comm. uktēṣv³ iti.—*aṇnam khāi, gotṭhammi dhāi, (?) khāantō⁴ me; dhōaē⁵*
gotṭha-majjhē ityādi hal lupyatē 'c chiṣyatē. *ṇimmānai; ṇivasai.²*

11. rudē *ruvaḥ* kvāpi *ruaṣ* ca *rōvaḥ*; Vr. 42; Mk. 80.
 kṣiyas⁶ tu *jhijjhaḥ*; pibatēḥ *pivaṣ* [ca]; Vr. 37; Mk. 115.
 ghaṭēs tu *ghaṭṭō*, 'tra tathā *gaḍhaḥ* syād; Cf. Hc. iv, 112.
 iṣēr⁷ *mahō*; 'thārabhatēr *dhavaṣ* ca. Hc. iv, 192, 155.

Comm. rudēr iti.—*ruvai, kvāpi ruai, rōvai, ca; jhijjhai⁸; sā jhijjhaē⁹ tujjha (?)*
vandē vīṭē; pivai; ghaṭṭai, gaḍhai ca; iṣēr mahai; ārabhatēr dhavai.

Metre, Bhujāṅgaprayāta, — — — — —, — — — — —

12. adēḥ syāc [ca] *cakkhō*; rudhē¹⁰ *rundha-rumbhau*; Vr. 49; Mk. 152, 69.
 'ninādē 'bhidhēyē' kaṇēr *okkhaṇaḥ*¹¹ syāt; Cf. Mk. 133.
 tathāivātra nityam sudhirā vadanti

ruṣēs tuṣyatēḥ puṣ-ḍuṣōr dirghatās ca. Vr. 46; Mk. 83.

Comm. adēr iti.—*cakkhai; rundhai; ṇirundhēi¹² mam sō, ṇirumbhāmi 'ham pi*
rāsa-ppabandhē; okkhanai kuṇṇaiṭō (?) thōruṇa; rūsai, tūsai, ciltṇa pūsai, dūsai.

Metre, Upajāti, as before.

13. dā-dhā-niyam kartari ḍina ētvam; Mk. 102; Hc. 237.
 jalpēr la-kārasya ma-kāram āhuḥ; Vr. 24; Mk. 19.
 antyasya kāryam patatēḥ¹³ sadēr¹⁴ ḍaḥ; Vr. 51; Mk. 74.
 kvathas tu dhō, vēṣṭayatēr api syāt. Vr. 39, 40; Mk. 70, 71.

Comm. dā-dhā-niyam iti.—*dēi, dhēi, nēi, ḍēi; jampai.* antyasyēty adhikaraḥ.
puḍai, sadai, kadhai, vēḍhai.

¹ MS. *nīvō.*

² Not in Vr., Mk. and Hc. (iv, 128). Both have *ṇivālai*, not *ṇivasai*.

³ So MS., but the verse has *uktēṣṭhadhā*, which I have emended to agree with the Comm.

⁴ MS. *khāāpīō.*

⁵ So Mk. 100.

⁶ MS. *kṣīpas.*

⁷ Cf. verse 41.

⁸ MS. *sijjhai.*

⁹ MS. *sijjhaē.*

¹⁰ MS. *rudē.*

¹¹ Mk. *oigāṇai:=kvaṇai.*

¹² MS. *ṇirundhai*, which I have emended as above for the sake of metre (Bhujāṅgaprayāta). A long syllable wanting before *pi*.

¹³ MS. *patatēḥ.*

¹⁴ Vr. Mk. *sad.*, but Hc. iv, 219, *sad.*

14. kathēr ' ha-kārō ; 'tha bhidi-cchidōr ndō Vr. 38 ; Mk. 66.
 'bhēdē' ca Śākalya-matē tayōḥ syāt ;
 dvitvē śakādēs ca ; vṛdhēr ḍḍha-kārō ; Vr. 52, 44 ; Mk. 84, 75.
 vēṣṭēr lla-kāraḥ sam-udaḥ parasya. Vr. 41 ; Mk. 72.

Comm. kathēr iti.—*kahai ; bhindai, chindai ; sakkai, laggai ; vadḍhai ; samvellai, uvvellai.*

15. nṛtēr vrajēr ccō ; 'tha budhēr yudhēr jjaḥ, Vr. 47, 48 ; Mk. 79, 77.
 śudhēr ḡrdhēs cātra, tathā sidhēs ca ;
 dvitvaṃ vibhāṣā-vihitaṃ gamādēr
 gamiḥ śamis cāpi bhaṇa²-sphuṭādyāḥ.

Comm. nṛtēr vrajēr iti.—*ṇaccai, vaccai ; bujjhai, jujjhai, sujjjhai, giijjai, sijjjhai ; gammai, sammai, bhaṇ[ṇ]ai ityādi ; phuttai, phuḍai, callai, calai ityādi.*

16. prādēs tu milēḥ kathitaṃ sudhībhir, Vr. 56 ; Mk. 87.
 hasēḥ,² khanēr maś ca, valēr,⁴ vacēr laḥ, Mk. 90, 93.
 vadēs tu cō, 'tas tu vacēr vadēr ḍt ; Mk. 92.
 ktvā-tavya-tumy (?) anv api lug bhujādēḥ. Mk. 91, 89.

Comm. prādēs tv iti.—*ṇamillai, ṇamīlai ; sammillai sammīlai ; ummillai, ummīlai ityādi ; hassai, hasai ; khammai, khamai (? khaṇai) ; vallai, valai ; vacēs tu bollai, bōlai ; evaṃ vadēr voccai, vōcai, ata ḍt. uktau 'gamādih', 'antyasyē 'ti vartētē.*

ktvādiṣu bhujādēr antya-luk ; *bhōūṇam, bhōavvam, bhōum.*⁵ evaṃ *rucanucōr* api.

17. syād dvitvam ottvam khalu " puṣkarādi "—
 " sēvādi " pāthād⁶ iha vā bhujādēḥ ; Vr. 55 ; Mk. 102.
 bhujē rudēs cātra mucēr ud ḍt syāt,⁷
 tathā ca *ma-mmāv* api dūña ētau.⁸ Vr. 8 ; Mk. 10.

Comm. syād iti.—*bhottūṇam, bhottavvam, bhottum ; dummai, dūmai.*⁹

18. ṇō 'ntē ji-lū-hu-śru-dhuvāṃ ca hrasvō ; Vr. 56 ; Mk. 87.
 jēr vā *jaam* cāha, *dhuam dhuvaṃ* ca¹⁰ Mk. 90, 93.
 dhūñas, tathēṣṭaṃ tu *luvaṃ* lunātēr, Mk. 92.
 ktvādau *lavam* syād, iha sō śṛṇōtēr. Mk. 91, 89.

¹ Not given by Vr. or Mk., as the change of *th* to *h* falls under general rules. Cf. Hc. iv. 2.

² MS. has *śamirambhāṇaca*, which I have conjecturally emended as above. What is wanted a reference to *bhaṇ-* Elsewhere (Vr. 58 ; Mk. 173) *gammai* is treated as a passive. *Sammāi* and (apparently not given above) *bhammai* (Mk. 85) are active. For *sphu-* and *cal-* see Vr. 53 ; Mk. 85. The Comm. gives little help here.

³ Passive in Vr. 58. Mk. does not mention this word in this connexion. Vr. is silent about *kha-*, *vac-*, and *vad-* here, but cf. *voccam* = *vakyāmi*. vii, 16. Mk. silent about *vac-* and *vad-* here, but in xvii. 63 gives *bollai* = *vadati* for *Apabhraṃsa*, and (ix, 113) *vuccadi* = *braviti* for Śaurasēni.

⁴ MS. *vatēr*, which I have emended to agree with the Commentary. Cf. Dhatupāṭha, *val-*, *vall-*, *saṃvaraṇē*

⁵ These are not given by Vr., Mk., or Hc. But see the next verse, where the subject is continued.

⁶ The *puṣkarādi* are given in i, 12 of this work. (Cf. Vr. i, 20 ; Mk. i, 24.) They are words in which *u* becomes *o*, The *sēvādi* are dealt with in iv. 1 of this work. (Cf. Vr. iii 58 ; Mk. iii, 75.) They are words in which consonants are optionally doubled.

⁷ This line is conjecturally emended. MS. has *bhujīuciścātramucikhāyāṣyāt*, which has one syllable too many.

⁸ So emended from MS., which has *tathōmmāvapi*⁹, in which two syllables are wanting.

⁹ Mk. only *dūmai*.

¹⁰ MS. *dhuvas* *lah*.

Comm. *ṇō* 'nta iti.—*jiṇai*, *luṇai* hrasvaḥ, *huṇai*, *suṇai*, *dhuṇai*; *jēs* tu *jaā-*'dēśe *jaai*; *dhūṇas* tu *dhuā-dhuwā-*'dēśe *dhuai*, *dhuantī*, *dhuvai*, *dhuvantī*; *tatpūrvā-*lunātēr *luvā-*'dēśa *ulluvāmi*; *ktvāḍau lavā-*'dēśe *laviūṇa*, *laviavvam*, *laviūm*; śrñōtēr *sōr ādēśe sōūṇa*, *sōuvvam*, *sōum*.

19. *bhāvē* ca *karmaṇy* *adhikāra iṣṭō*
vā-'dir *bhavēt*, *ṇō* 'py *uditō vibhāśā.*¹ Vr. 57; Mk. 95.
niṣṭhā-padeṣu na *vadanti dhīrā*, Mk. 94.
hrasvō bhavēc cā, 'tra ca *jēs* tu *jippah.*²

Comm. *bhāva* iti.—*ataḥ param bhāva-karmaṇōr ēva. jivvai*, *luvvai*,³ *dhuvvai* ityādi. 'niṣṭhā' kta-ktavatu [Pāṇini I, i, 26]; *tayōḥ*, *jiām*, *jiantō*; *luām*, *luantō*; *huām*, *huantō*; *suām*, *suantō*; *dhuām*, *dhuantō*. *jēs* tu *jippai*; (?) *jahā kasō jippai samarammi Māhavēṇa* ityādi.

20. *duhēs* tu *dubham*, *vahatēs* tu *vabham*⁴ Mk. 177.
lihēs tu *libham*⁵ *khalu vā vadanti,*⁶ Vr. 95⁶; Mk. 177.
kṛṇās tu *kīram*, *haratēs* tu *hīram*; Vr. 60; Mk. 174.
jñō ṇavva-ṇajjau ca *budhā vadanti* Mk. 181.

Comm. *duhēr* iti.—*bahūi* (?) *ki lumbhai*⁷ (?) *dubhai*, *Kaṇha*, *pemmaṇ ṇō* (?) *ōṇajāi tuha vabhai ṇō* (?) *ha bhārō ṇō* (?) *ōṇajāi tuha libhai* (?) *dēhamōdvā*⁸ *paksē duhīai*, *duhijjai*; *lihīai*, *lihijjai*; *ṇa jāi*, *sahi*, *kīraē paṇa-a-kēli-bhaṅgō*; (?) *lavara hīrai* (?) *vīa* (?) *piāi Dāmōarō*⁹; *paksē karīai*, *karijjai*; *harīai*, *harijjai*; *ṇavvai*, *ṇajjai sō vi*.

21. *grahēs* tu *gheppah* *khalu ghejja-gejjau*¹⁰ Mk. 178.
diṇṇādayaḥ *ktēna nipātaniyāḥ*, Mk. 183.
dāṇās tu *diṇṇam*, [*rudira*]s tu *ruṇṇam*, Vr. 62; Mk. 183.
śuśēs tu [*su*] *kkaṁ*¹¹ ca, *mucēs* tu *mukkaṁ*. Mk. 183.

Comm. *grahēr* iti.—*gheppai jō* (?) *ḥulihim ḥārāṇō*; *ghejjai*, *gejjai* ca; *paksē geṇhijjai*, *geṇhīai*, *hindijjai* [Mk. 179] *iti* ca.

diṇṇam ḥaṇṇam tai Ruppīṇīc bhāsāi Kaṇham vaṇṇam pi; *sukkaṁ*, *ēvam*, *mukkaṁ* *iti*.

22. *takṣēs* tu *lādēśa uśanti rambham*; Mk. 48.
krudhēs tu *jūram* *khalu kōvidās* ca; Vr. 64; Mk. 130.
khidēr visūram, *viṇabham*¹² *ṇicārthē*; Mk. 126, 63.
trasēs tu *vajjam*; *tva[ca]tēs*¹³ tu *vappam*. Mk. 157.

¹ MS. *śādurbhavētōpādītōvabhāsa*, which I have emended to agree with Comm. and with Mk. 94, 95.

² So clearly in the MS. It is not given by Vr., Mk. or Hc.

³ So MS. here and in Comm. Mk. and Hc. iv. 215 have *vubham*.

⁴ MS. *vihēs*, *vibham*, but corrected in Comm.

⁵ MS. *vacanti*.

⁶ Cowell, *tijjai*.

⁷ MS. *lumbhai*, but *dubhai* is probably intended.

⁸ I can make nothing of this corrupt passage. Almost every word is a matter of doubt.

⁹ This also is unintelligible. The word written *vīa* is almost illegible. The MS. apparently has *lavaraharivī abī ai Dāmōarō*.

¹⁰ Mk. *gheppa-*, *ghejja-*, *gejjha-*.

¹¹ This is doubtful. MS. has *śūrestukkaṁ*, and gives *sukkaṁ* (?) *sukkaṁ* in Comm.

¹² Mk. *vilabha-*. Here, and in Comm., MS. has clearly *viṇabha-*.

¹³ MS. *trates*, *vētēs*, or *vētēs*, which neither scan nor give any sense. Cf. *Dhatupāṭha trac-*, *sambavan-* Hc. iv. 176

Comm. takṣēr iti.—(?) *kaṃō* (?) *puḡō rambhai mē sarivam, cittam pi rambhijjai* *ajja lēna*; kartari, karmaṇi, bhāvē ca. *jūrai mē*. (?) *kuḍaṅgē vilaasē ajja vi kīsa* *gōri*; tuha (?) *vippai visūraē* (?) *pasya bha^vēnu^v aṇō^v*¹; *gōraṅgaṇānām virahō vinabhēi* *Kaṇham*; *na vajjaē, vappai sō vi* (?) *hatthim*.

23. *luham pusam cātra mṛjēr imau dvau*; Vr. 67; Mk. 56.
masjēr² punar dvāv iha bujja³ khuppau; Vr. 68; Mk. 98.
dṛśēr avakkham, puṇaam, niaccham, Vr. 69; Mk. 105.
ghaṇam, niam⁴ cātra vadanti pañca.

Comm. *luham* iti.—*luhanti susaē* [?] *pusaē*] *varāham*.

ṇēhammi sō bujjai tujjha Rāhī
khuppasē pemmāṇa rasē tumam kim?
sā tujjha Rāhī (?) *kalumhēmagayā*.⁵
avakkha Kaṇham, puṇa appa (?) *tumam*;
niaccha Kāmam, puṇa mam (?) *ḍaabbham*.⁶

24. *bhāvē ca karmaṇy a[pi] tasya dīsō,* Mk. 178.
ṇicy atra¹ damsō darisaś ca vācyau, Mk. 106.
āvē ca dāvō⁸ bhavatiha tasya. Hc. iv, 32.
ādīsyatē⁷ trān bahulam svarāṇām Mk. 102.

Comm. *bhāva* iti.—*na dīsaē āli* (?) *kastumludandō*; *ṇici, Kaṇham damsēi, dui* *darisēi kuṅja* [?] *kuṅjē*]; *siṇṇham dāvēi vaanēṇa tīē*.

ādīsyatē⁷ tra bahulam (?) *dhalav-aṇa-svarāṇām⁹*; *dhāvē sutau* [?] *gatiśuddhyōh*] *dhūai, dhavai* [?] *dhuvai*], *dhōai* [verse 10] *syāt*; *naśyatē* [?] *bhavati*] *kvacid bhūvai, hōi* [verse 1] [i]tīdṛśēṣu; *ḍvāhaē* [verse 8] *ca avavāhai vēdṛśēṣu*; *rōhai* [?] *rōsai*, cf. verse 12], *pōsai, pusai, jusai* [?] *pūsai*, verse 12] *ityādi*.

25. *śakēs tuas¹⁰ tīra-tarā imē syur*; Vr. 70; Mk. 55.
mṛdēr¹¹ malam cātra samīrayanti; Vr. 50; Mk. 73.
puṣēr¹² bhisah khuppa udiritau dvau; Mk. 46.
chattas tyajēs chakka imāv ilha staḥ¹³ Mk. 104

Comm. *śakēr* iti.—(?) *sāśvantī* (?) *sāsantī*) *na tarai Hari-vāam laṅghium*; *tīraē vā*; *āliṅgantī mē malēi vaccham*; (?) *rōs¹⁴ agginā bhisai jō bhavaṇam riūṇam, tam khuppai* (?)

gives *vaiṃphai* < *valati*, which has the same meaning. Hence my conjectural emendation. In the text we may, of course, also read *vappai*.

¹ I can make nothing of this example.

² MS. *majjēr*. ³ Mk. *buḍḍa*-, Vr. *vuṭṭa*-.

⁴ Vr. gives *pulaa*-, *niaccha*-, and *avakkha*-. Mk. gives *pula*-, *nia*-, *niaccha*-, *jōva*-, *avakkha*-, *pulōa*-, and *pulaa*-. In the MS. the *ni* of *niam* is missing, and is supplied from Mk.

⁵ This is part of an Upajati verse. I cannot emend the end of the third line.

⁶ Also part of an Upajati verse, but *tumam* of the first line breaks the metre.

⁷ MS. *appa*. ⁸ MS. *āvēvadādā* corrected from Comm.

⁹ We should probably read *dhāvēdiṣṣo aṇa-svarāṇām*.

¹⁰ So MS. We should probably read *śakēs caas*, with Vr., Mk. and Hc.

¹¹ MS. *ṇudēr*. ¹² MS. *puṣēr*.

¹³ MS. *chakkavāḍvāmahākah*, which I have conjecturally emended as above. *Chattas* is quite clear in the MS. We should expect *chadḍas*.

¹⁴ MS. *rōpaggina*.

*kaṇṇa-ḍahanō, iṇam accharīam*¹; *chattāmi pemnum iṇam Harissa, chattai kim Hari mam*; *chakkāmi nāham siviṇē vi Kaṇham.*

26. *asti-kṣudhēr dvau kramatō 'ccha*²*-dhukkau*; Mk. 116, 22.
dvau sappā-sakkāv uditau tu sarpēḥ; Mk. 47.
*dvau khumma-khundau kathitau kṣudēs*³ *tu*; Mk. 52.
*truṭēs tu tōḍas tuḍa-tuṭṭa-khodḍāh.*⁴ Mk. 64.

Comm. astīti.—[Gāthā] *kamala-ṇaṇṇō acchaē majjha tti tē dhukkai ēsa Kaṇhō.*
 [Vasantatilakā] *sā Kaṇha sakkai kuḍaṅga-varam tumam kim.*

ittham na sappasi pasīa vi (?) puñca-kōvam.

*khummantō Kēḍhavam khundai (?) ṇavvamaham. tōḍai, tuḍai, tuṭṭai, khōḍai.*⁴

27. *rājēs tu rēhō*; 'tra *kṛṣēs tu kaḍḍhō*⁵; Mk. 103, 76.
rādhēs tu randhaḥ kathitah sudhibhiḥ; Mk. 99.
*kriḍēs tu kilah*⁶; *khaurah khacēs*⁷ ca; Mk. 127.
*skhalēḥ khudḍah*⁸ *khunda imau pradistau.*

Comm. rājēr iti.—*kamala-ṇaṇṇō rēhaē rāsa-majjhē*; *kaḍḍhai*; *randhai*; *Kaṇhō kīlāē gōviāhim*; (?) *khaurihō*⁹ *isihōham vaṇē riū*; *khudai*,⁸ *khundai.*

28. *ghrō jīṅgha*¹⁰; *irēḥ khalu solla-pellau*¹⁰ Mk. 43, 58.
svapēḥ suaḥ sō; 'tra *tathāiva*¹¹ *sōah*; Mk. 50.
tavyē tumi ktē 'tra *sahēs tu sōḍhō*,
*vahēs tu vōḍhah kathitō vibhāṣā.*¹²

Comm. ghra iti.—*kamala-ṇaṇṇō jīṅghaē nīva-puppham*; *iriś curādi, sollai*,¹⁰ *pellai*; *suaī, sōī, sōai*; *sōḍhavam, sōḍhum, sōḍham*; *pakṣē sahiavvam, sahium, sahiam*; *vōḍhavam, vōḍhum, vōḍham*; *pakṣē vahavvam, vahium, vahiam* iti.

29. *ālukkha-phamsau spr̥satēr imau dvau*, Mk. 144.
parēs chivah syāc, chua ēvam anyah, Mk. 169.
bhāvē ca karmaṇy api tasya chip̥pō, Mk. 176.
vā chikka-chitta-cchiva ēva ca ktē. Mk. 183.

Comm. ālukkha iti.—*kēḍavam tam ālukkanti hanta phamsēmi bahum paricchivai*
 (?) *poḥkāmīlīm*; *anyas tu chuai*; *bhāva-karmaṇōḥ, jvalēṇa chip̥pai Harī chalēṇa sō*;
ktē, chikkīam, chittīam, chivīam iti ca.

¹ This is a Gāthā verse, but there is one matrā too many in the second line.

² Vr. xii 19, confines *accha-* to Śaurasēni. He does not mention *dhukka-*.

³ MS. *kṣudhēs*, and so the printed edition of Mk. But my MSS. of the latter, and also the printed edition of ix 118, show that the root is *kṣud-*. See also the first line of this verse.

⁴ Mk. *khutta*. The Comm. here has *khōḍai*. MS. has *putēs* for *truṭēs*, and *tucē* for *tuḍa*. The latter I have emended to agree with Comm.

⁵ MS. *hājō*, which I have corrected to agree with the Comm.

⁶ Not in Vr. or Mk.

⁷ Mk. = Sanskrit *khav-*, *khav-* and *khac-* are two variant readings in the Dhātupāṭha for the same verb.

⁸ So MS. The Comm. has *khudai*. Neither of these words occurs elsewhere in this sense.

⁹ Mk. *ijīha, oḥimbha*.

¹⁰ MS. *ṇollapedvau*, Comm. *pollai, pellai*. *solla* is certainly right. According to Vr. 7, Mk. 8, and verse 2 above *ṇollai* = *nudati*. *pellai* is, of course, the right reading, as in the Comm.

¹¹ Conjecturally emended from MS. *ladāva*.

¹² Not given elsewhere.

30. stautēs *thuṇaḥ*¹ syāc ca tathā *thuvaś* cā- Mk. 65.
 'tha *phulla-cappāv*² api ca kramēr dvau, Mk. 135.
 āñō 'ñca-vollau ca tathā bhavētām Mk. 134.
 samō³ milēs cātra *galah*⁴ pradiṣṭaḥ.

Comm. [stautēr iti].—*thuṇai*, *thuvai*; *Kaṇham thuṇanta vivivāi* (?) ^v_vigē'ō ;
phullai, *cappai*; āñas tu *āñcai* [sic],⁵ *vollai*; *saimilēh*⁶ *galai*.

31. *vijjhō*⁷ ghaṭēr vēr, ṇici tūda *oggha*; Mk. 109, 110.
 āññāḥ *sahā* syād *ahisāha* ēvañ⁸ ;
 āñō ruhēḥ syuś ca *valagga-cummau*⁹ Mk. 136.
 (?) *bhūpa*¹⁰ athō vēr namatēs ca *vāṇaḥ*.¹¹

Comm. [vijjha iti.—]vighaṭatēr *vijjha*, *vijjhai*; *udaḥ* parasya *ghaṭēr* ṇici *oggha*; *ogghaḥ*; āñ-pūrva-ruhēr (?) *ōḍa* *ādēsāḥ*, *māñiñi* ṇa *vandasi* [? *valaggasi*] *kīsa* *Kaṇham*; *na cummasi* (?) *maam* *cīa* (?) *rañi* *dāsi* (?) *ḍallai* (?) *kkhu* *palaē* ṇa *tumam* *virittē* *ēsō*; *vēr* *namatēr* *vāṇaḥ*; *kaha* ṇa *vāṇasi* *Kaṇha* *sīsam* *ēsē* (?) *vuñjasi*¹² *mañasi* *kīsa* *ajja*.

32. *ullāla-vuñjau* ṇici tasya *gūlas*.¹³ Mk. 156.
 cō 'tthaṅga *ētē* syur *udaḥ* parasya ;
 arañja-vēmau viditau *py-abhibhyām* Mk. 142.
 bhañjēr, *parēs* cā 'ñja *iha* pradiṣṭaḥ.¹⁴

Comm. *ullālēti*.—*tasya* ut-pūrvasya *namatēr* ṇici *vaṇaḥ*¹² [? *ullāla-vuñja-gūlāḥ*]; *ullālasī*¹⁴ (?) *honñāñasi* *Kaṇha* *masi* *ēsē* a *vuñjasi*¹² *mañamsiñi* *kīsa* *ajjai*; *kvāpi* *utthaṅghai*; *bhanaktēr*, *Kaṇhō* *piarañjaē* (?) *hasam*; *ahivēmaē* (?) *vaṇa-laim* *phalillaam*; *pariañjai* *viviṇam* *mañkaō*.

33. *ukkōsa* *utkōsayatēr* *iha* syāt ;
 tillāsa-tiṇḍāv api *timyatēr* dvau¹⁶ ; Mk. 148.

¹ Mk. *tava*, *thua*, *thuva*; Hc. 241 *thuṇa*.

² MS. *thuvascāthāphullacappāvapicakramēṇadvā*. The emendation to *kramēr* is certain, as shown by the next line, but neither of the *ādēsas* is given by other authors. According to Mk. 135, *cappai* = *ākramatē*, and according to 151, = *carcayalē*.

³ MS. *samō*.

⁴ Hc. iv, 406, *galanti* = *galanti*.

⁵ According to the text of the verse, we should have here *āñcai*. Mk. 134 has *āñcai*.

⁶ MS. *sīmīlēh*.

⁷ Mk. *viñcha*.

⁸ These two *ādēsas* are not given elsewhere. They are fairly clear in the MS., but the Comm. omits reference to them.

⁹ Mk. *campa* or *cumpa*, according to reading.

¹⁰ I can make nothing of this word. It does not scan.

¹¹ Not given elsewhere, but quite clear both here and in Comm. The word, of course, may also be read *vaṇaḥ* in both places.

¹² *vuñja* and *gūla* are doubtful. MS. has *vuñja* and *gūla* in the verse, but *vañja* and (?) *vaṇa* in the Comm. We have also *vuñjasi* in the Comm. of verse 31, and there the MS. has *vañjasi*. Mk. gives *uññāmōi*, *uññālāi*, *guluṅṅchai*, and *thaṅgai*. Hc. iv, 36, *utthaṅghai*, *ullālai*, *gulaṅṅchai*, *uppēlai* and *unnāmai*.

¹³ The forms are therefore, *piarañjai*, *ahivēmai*, and *pariañjai*. Mk. gives *piarañjai*, *vēmai*, *parirañjai*, *bhañjai*, all as equivalent to *bhanakti*.

¹⁴ MS. *hallālasī*.

¹⁵ The whole of this line is conjectural. For *timyatēr*, MS. has *tiṣyatē*. The *ādēsas* *tillāsa* and *tiṇḍa* are fairly clear, but, for the latter, Comm. has *tiṇḍāsai*, which would not scan, and which is a clear instance of dittography for *tiṇḍai*. For *timvatī*, Mk. gives *tiññai*, *tiññāi*, and *timmai*. The first may be compared with *tiñḍai*, above, but there is nothing to correspond to *tillāsai*, unless this word is a mistake for *tiñḍai*.

syur uñchatēḥ prāt *pusa-luñcha-puñchā*¹ Mk. 62.

ḍalla uktō 'tra vṛtēr avāt² syāt, Mk. 119.

Comm. ukkōsa iti.—[*ukkkōsai*]; *tillāsai*, *tiṇḍai*³; prōñchatēs traya ādēśah; *pūsai*, *luñchai* *puñchai*; (?) *puṇṇā khaṇē pūsai ṇakkha* [*ṇa kkhū*] *vaam*; avavṛtēr⁴ *ḍallah*, *ḍallai kkhū hariṇō* (?) *cariē ṇa rukkhō*.

34. *udō laḍam*⁵ tasya vadanti nityam, Mk. 120.

*ḍvaṭṭam*⁶ atrāpi parēr vibhāśā, Mk. 119.

ḥallattha-khujjāv iha paryasēḥ stō; Mk. 121.

'thō 'jjattha⁷ āhamma ihāgamēr dvau. Mk. 140.

Comm. uda iti.—*ulladdāi*⁸; *ḍvaṭṭai*; parēr vibhāśā pakṣē pūrva ēva; *ḥallatthai*,⁹ *khujjai*¹⁰; āgamēr *ajjattha āhamma* imau dvau; *ajjatthantam sacchādō pecca eam ālinganti kuñja-gēhamini Rāhi*.

35. *otthah* sthagēs; chādayatēs tu *nūmah*; Mk. 45, 141.

ḥapphōḍa ēva sphuṭatēr bhavēt prāt; Mk. 147.

lālamḥa-lālapḥa imau lapēr¹⁰ vēr
lālabbha-lālabha imau ca tadvat. Mk. 129.

Comm. ottha iti.—*sumuhi otthasi* (?) *vasattam Damōaram* (?) *ṇiambarassē* [? *ṇiaa gharammi*] *Rāhi*; *nūmaē*; *jō mahattam ḥapphō[ḍa]ē*; [*lālamḥai*], *lālapḥai*, *lālabbhai*, *lālabhai* *catvāri rūpāni*.¹¹

36. *strīnas*¹² tv ath' *otthalla-vad ottharah* syād Mk. 163.

udā,¹³ *vinā* tasya bhavēd *vihallah*¹⁴; Mk. 165.

cūrṇēr mamūrah,¹⁵ kvacid atra *cūrō*; Mk. 159.

lagēr vi-pūrvasya bhavēd *vilaggah*. Cf. Mk. 84.

Comm. strīna iti.—*udā saha*¹⁶ *strīna otthallai*, *ottharai*; *vinā saha vihallai*; *mumūrai*, *cūrāi* ca; vi-pūrva-lagēḥ *vilaggai*.¹⁷

37. *cureḥ ḥhaṇillō*,¹⁸ 'tha parēr imau dvau Mk. 122.

*cala-cchulau*¹⁹ stō; *viravēr vihallah*,²⁰

¹ Mk. 56 equates *pūsai* with *māṣṭi*, which has the same meaning. The MS. here has *svasa* for *pusa*, which is corrected in the Comm.

² According to Mk. *ḍallai* = *aparvartatē*.

³ See note 15 on the preceding page.

⁴ MS. *avasthetē*, which I have emended to agree with the text.

⁵ Mk. *ullatṭai*.

⁶ Mk. equates *ḍvaṭṭai* (corrected here from *ḍaṭṭai*, to agree with Comm.) with *aparvartatē*, not *parivartatē*.

⁷ Mk. *ajjatthai*.

⁸ MS. *ḥallatṭai*.

⁹ There are here some words which I cannot read.

¹⁰ MS. *lalapēr*.

¹¹ I have emended the Comm. to agree with the text, which, so far as the Prakrit words go, is quite clear. Though the Comm. says there are four words, it gives only three, *lalappai*, *lālabbhai*, and *lālamḥai*. Mk. has *lālapḥai*, *lālamḥai*, *lālabbhai*, *lālabhai* and *vilavai*.

¹² Dhātupāṭha, *strī*.

¹³ MS. *cadā*.

¹⁴ Mk. *virilla*. *vihallah*, though in both text and Comm. is probably wrong, for the word is repeated in the next verse with another meaning.

¹⁵ Mk. *mumūra*.

¹⁶ MS. *udō saha*.

¹⁷ MS. *villagai*.

¹⁸ Mk. *thaṇilla*.

¹⁹ These two are not given by other authorities.

given by other authorities.

visatta-vōsatta imau vikāsēh¹ ;

Mk. 170.

parēr višēr atra *viālam*² āhuḥ.

Mk. 150.

Comm. curēr iti.—*phañillai, chulai, calai* ; vikāsēr *visattai, vōsattai* ; pari-pūrva-
višēr *pariviālai*.

38. udō nadēr *vokkham*³ ; upagrahasyā⁴

Mk. 143, 145.

'*vasāam* āhuś ca, lasēs tu (?) *pūsam*⁵ ;

pahōḍa-guñcella imau lulēr⁶ vēr

Mk. 125.

vadanti santah *parihattam* ēva,

Mk. 125.

Comm. uda iti.—ut-pūrva-[nadēr *vokkhai* ; upa-pūrva-] *grahēh, Kanham niṇṇa-
gōri avasāaē* ; (?) *pūsāē* ; lulaḥ sautraḥ ; pi [? vi]-pūrva-lulēḥ pakṣē, [*pahō*]ḍai, *guñ-
cellai, parihattai, trīni rūpaṇi*.

39. Metre, Anuṣṭubh.

kathēḥ sāhō, yakā sārddham *ṇivarijjas*,⁷ tathâparaḥ Mk. 131.

syād imē dvē⁸ *pusas* cātha ; *tikkhālas* tu tijēr iha. Mk. 160.

Comm. kathēr iti.—kathēr ṇij-antatvam āhuḥ, *sāhai*, yakā saha *ṇivarijjai* (?)
*simēra*⁹ *pusai* dvē rūpē ; tijēḥ, *tikkhālai maggaṇāi kammārō*.

40. Metre, Upajāti, as before.

cudēs *cudah*¹⁰ ; prāt saratēr¹⁰ *paalla-*

Mk. 168.

^s*oggāha-* ^m*uggāham*¹¹ uśanti santah ;

tādēs tu *taddam*¹² ; ṇici vēś carēs ca

Mk. 171.

*viṇam*¹³ ; sahēr nēr *nisudham*¹⁴ tv amuṣmin.

Mk. III, 118.

Comm. cudēr⁹ iti.—*cudai* ; pra-pūrva-saratēr¹⁰ *paallai*, ^s*oggāhai*, [^m*uggāhai*],
trīni rūpaṇi ; tādēr, *taddai* ; vi-pūrva-carēr ṇici *viṇam*, *kim viṇasi Kaṇha saṃgamē
Rāhim* ; ni-pūrvasya *sahēḥ nisudai*¹⁴ (sic).

¹ Mk. and Hc. iv, 195, *vikas-*.

² So also Mk. MS. here *viānam*, but corrected in Comm.

³ Mk. *vokha*.

⁴ Mk. *upagūha* (sic), with *āvaāsa* for the *ādēsa*.

⁵ MS. *krū^sam*, with *prū^sāē* in Comm. Mk. 117 gives *thasa* as the *ādēsa* for *las*, but this will not scan here.

⁶ MS. *lunēr*. Mk. gives *pañṇāḍai, guñjollai*, and *parihattai* as equivalents of *vilulati*. Hc. gives *pañṇāḍai* and *parihattai* as equivalents of *mydnāti* (which we shall see closely agrees with the meaning of *lul-* here) and *gumjollai* as equivalent of *ullasati*. The Dhātupāṭha gives (i, 336 ; vi, 113) a *√-lu-* (*luḍ-, lul-*), *vilōḍanē*. But there is also a sautra *√lul-, vimardanē*, which is that referred to here. For this latter root, see Jñānendra Mōhau Dāsa, *Bāṅgālā Bhāṣār Abhidhāna*, p. 1506. For sautra roots cf. *Kāśikā*, III, i, 82. The MS. *lunēr* is therefore an error for *lunēr*, i.e. *lulēr* ; as, in this MS., both *n* and *l* are represented by the same Bengali character (৩).

⁷ Mk. *navarijjai* and *sāsai*.

⁸ So emended from MS. *imēva*. The Comm. has *simēra pusai*. Mk.'s *ādēsa* for *kathyatō* is *sāsai*. *pusai* also = *prōchati* (verse 33 ; cf. also verse 24).

⁹ This is not mentioned elsewhere. The forms are doubtful. MS. has *cudēs cudah* in Text and *cudēr iti, cudai* in Comm. There does not seem to be any Sanskrit *√cud-*.

¹⁰ MS. *saraō*, Comm. *stharatēh*.

¹¹ ^s*oggāha* and ^m*uggāha* do not occur elsewhere. They are clear in MS. Mk. gives *paallai, pasarai*. According to Mk. 123, *oggāhai* or *uggāhai* = *udgrāhayati*, but the MS. of the Comm. here shows distinctly that the words begin with *s* or *m*.

¹² Mk. *tālēi, tiḍḍavai*.

¹³ MS. *viṇam*, corrected to *viṇam* in Comm.

¹⁴ MS. corrupt here. In Text *sahēṇṇapudham*, Comm. *sahēḥ nisudai*. I have emended to agree with Mk. 118 and also with the metre.

41. atha pratēḥ pālayatēḥ, *virīham*, Mk. 158.
 tatrāiva dhīrāḥ *viramāṇam*¹ āhuḥ; Mk. 158.
*pīlō*² mataḥ piḍayatēr; *asāa*³
 iṣēr, pratēr *oggaham* ēva vaṣṭi. Mk. 132.

Comm. athēti.—pratēḥ pālayatēr *virīhai*, *viramāṇai*; piḍayatēḥ, *pīlai*; iṣēr *asāai*, pratēs tu *oggahai*.⁴

42. dhātu-svarūpāṇy aparāṇi pakṣē
 Śākalyam anyac⁵ ca matānugāmi,
 Kātyāyananasyāpi matē tathāiva
 jñēyāni⁶ lakṣyānubhava-kramēṇa.

Iti Prākṛta-kalpatarau dvācatvāriṃśat-kusumair lādi-stabakaḥ.

¹ Mk. *cīramālai*.

² Not in Mk. or Hc.

³ Not given elsewhere. The form is doubtful, for the equivalent of √iṣ- is already given in verse 11.

⁴ MS. *pratēstulēōggai*.

⁵ MS. *Sākalyamantacca*. ? Should we read *anyac ca Śākalya-matānugāmi* ?

⁶ MS. *jñēvānu*.

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PLANT AND ANIMAL DESIGNS IN THE MURAL
DECORATION OF AN URIYA VILLAGE.

A WORKING MODEL OF THE ORIGIN OF THE
GANGES IN A TEMPLE IN GANJAM.

BY

N. ANNANDALE, D.Sc., F.A.S.B., F.R.S., C.I.E.



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PLANT AND ANIMAL DESIGNS IN THE MURAL DECORATION OF AN URIYA VILLAGE.

By N. ANNANDALE, *D.Sc., F.R.S., F.A.S.B., C.I.E.*

The object of this paper is to put on record some examples of a primitive but none the less effective form of art which seems to be rapidly disappearing. Within the last ten years it has almost gone in several villages on the shores of the Chilka Lake in which it formerly flourished, but it still flourishes on the large island or peninsula of Samal, remote from direct intercourse with the outer world though actually within half a mile of the main railway-line between Calcutta and Madras. All my illustrations are drawn from the village on this island and were obtained in the year 1922.

I must express my great indebtedness to Babu D. N. Bagchi, one of the artists of the Zoological Survey of India, for his assistance in not only taking the beautiful photographs and making the accurate sketches with which this paper is illustrated, but also for acting as interpreter and for obtaining much interesting information. His knowledge of the Uriya language and his status as a Brahmin enabled him to gain the confidence of the people and to enter their houses freely in a way which would have been impossible for myself.

Samal island is situated on the northern shore of the Chilka Lake in the north-east corner of the Ganjam district of the Madras Presidency. When the water is very low in the dry season it ceases to be an island and is joined to the adjacent shore by a narrow sand-spit.

The people of Samal are Uryias in so far that they speak the Uryia language, but physically they are of very mixed type. The curly hair, flat noses, short sturdy figures and other primitive characters of many of them proclaim aboriginal blood, while to others their prominent cheek-bones, square faces and somewhat yellowish complexion give a Mongoloid appearance by no means uncommon in Orissa. In a third type the legs are long and the body is very slender, while the features are those common among Uryias in districts where the race is apparently purer.

The culture of these people seems to be primitive, but ignorance of their language has prevented my obtaining satisfactory information about their social system. Nominally, at any rate, they are Vishnuvite Hindus and mostly of the Goala or cowherd caste.

This village consists of about thirty houses arranged in a single long street, which has its back on one side to the lake. The road between the houses is broad and fairly smooth and the whole village has an air of neatness somewhat unusual in India.

Some of the houses are composite and shelter several families under a single

roof. A plan of such a house prepared by Babu D. N. Bagchi and Mr. R. Hodgart of the Zoological Survey of India is given in text-figure I. As will be seen from this plan, however, there was no communication between the quarters of the three families which occupied the particular house on which the plan was based, and each family had its own front door.

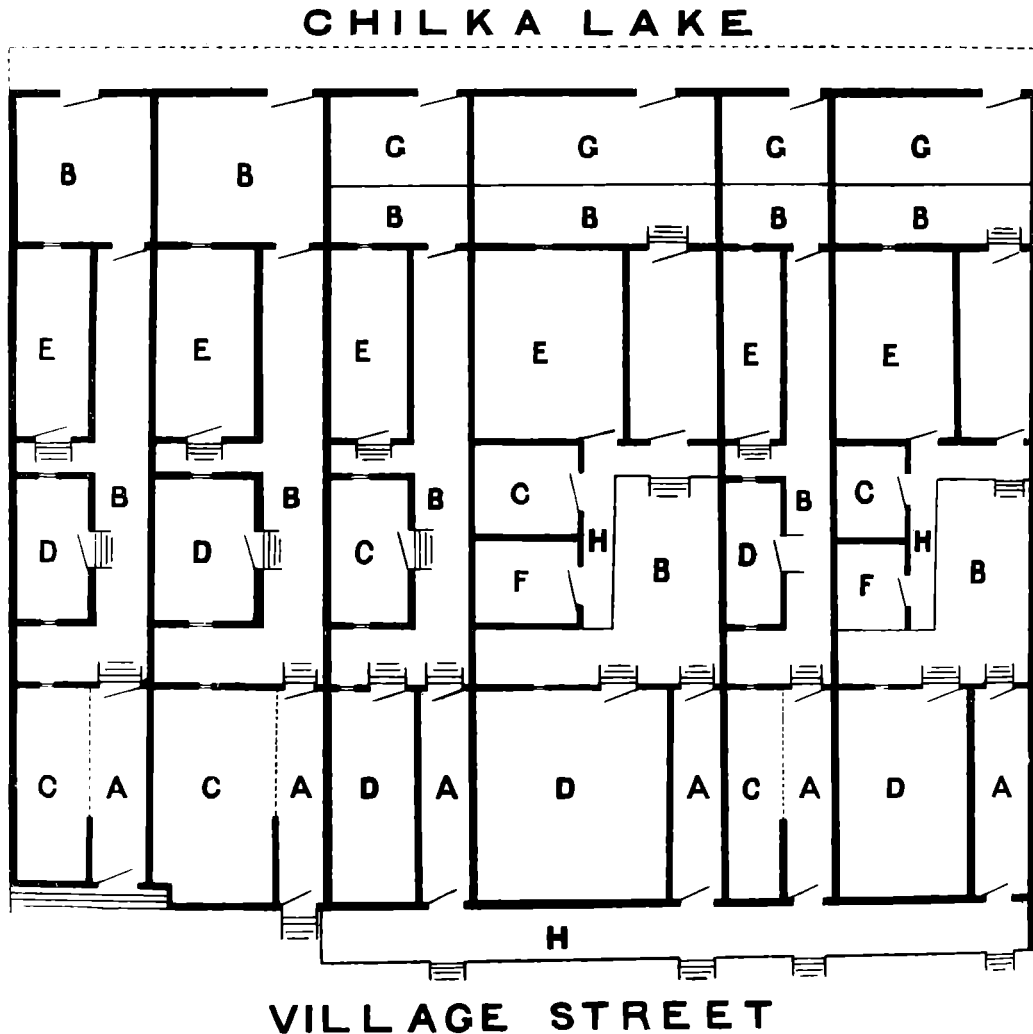


FIG. 1.

Plan of composite house on Samal Island. A = covered passage. B = open space. C = kitchen. D = bedroom. E = store-room. F = sitting-room. G = cow-byre. H = open verandah. The series of fine transverse lines represent steps.

The houses are built mainly of clay from the bed of the lake, but the inner partitions are strengthened inside by hurdles of bamboos and thin sticks. They have sloping roofs, the rafters of which are made of sticks or bamboos, and are thatched with rice-straw. There are as a rule no windows outside, but there is often a small platform (fig. 1—) under the eaves of the house. This is sometimes made of

rough stones but more commonly of clay. In some houses a part or the whole of the platform is enclosed with a low clay wall to form a small box-like verandah in which the men play cards, mend their fishing-nets or otherwise occupy themselves in the evening.

Rice and millet, of which a large amount is grown on Samal, are spread out to dry on mats in the village street, while the large baskets in which grain is transported on bullock-carts are kept under the eaves of the houses (plate I, fig. 1).

Down the middle of the street, or rather in front of different houses to one side, there is a series of cones or pillars on the top of which a bush of *tulsi* (*Ocimum sanctum* Linn.) is planted for religious purposes. Some of these cones are quite plain and are constructed merely of clay, others are much more elaborate and are built of carved stone-work (plate IV, fig. 3).

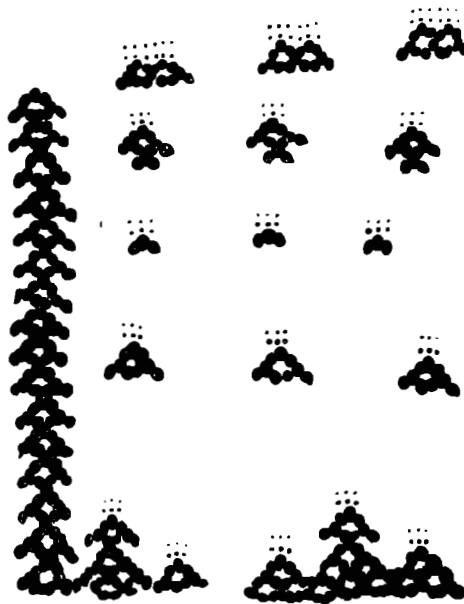


FIG. 2.

"Three-finger" pattern on outer wall of house, reproduced in negative.

The walls of the houses, both external and internal, are neatly smoothed and uniformly covered with a wash of red earth, which is brought from a quarry some miles away. This forms the background for the decorations I will now describe.

At seasons when neither fisheries nor agriculture are exacting both the men and the women of the village spend a considerable part of their leisure in painting their houses and in decorating the clay *tulsi* pillars to which I have already referred. The simplest form of decoration of both (plate I, fig. 3) consists of what is called the "three-finger" pattern. This is produced by dipping the three middle fingers into a mixture of chalk and water and applying them in different ways to the red earth on the walls or pillars. The plate to which I have alluded gives a good example of the manner in which small and large dots thus produced can be combined to form a pattern. Text-figure 2 is from a sketch by Babu D. N. Bagchi of a panel

on a wall of a house: the white dots, for purposes of reproduction, are represented black. In other villages near Samal the groups of three white dots are often placed at the end of long streaks made by drawing a single finger down the wall, and then have much the appearance of conventional figures of either flowers or fireworks; but I have no information that the imitation is conscious. It is otherwise with the patterns now to be considered.

Figure 1, plate II gives a good idea of the two commonest of these patterns on the outer side of the house-walls. Variations of these two main types far outnumber all others. They are lettered A and B on the figure. The name given me for pattern A is *janar*, the name of a kind of maize or Indian corn (*Zea mays* Linn.). The general form of the pattern is that of a plant of this

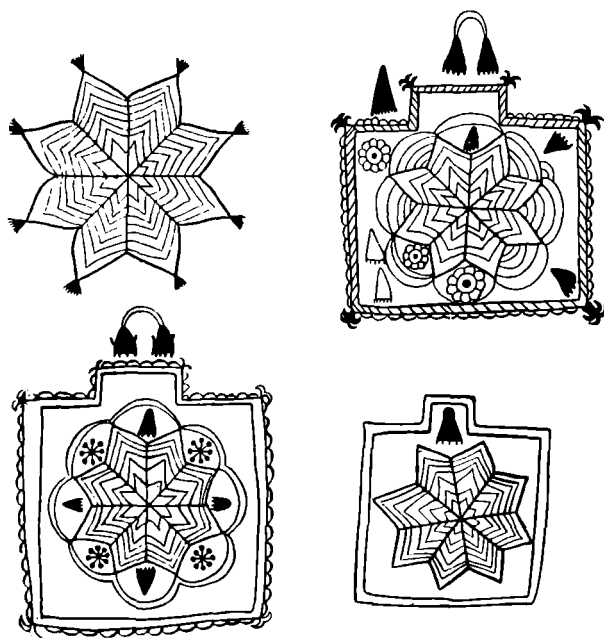


FIG. 3.

Designs painted in white on the ground in front of houses, reproduced in negative.

cereal growing up from an ornamental base. The tips of the leaves or blades may be either turned down in the natural position or turned upwards, and various other leaves, said to be those of the *pipal* tree (*Ficus religiosa*), are added between those of the plant itself. It will be noted in all the figures that at any rate some of the maize leaves end in a comblike figure. This has often the appearance of a hand, but I believe it represents rather a human foot-print. Text-figure 3 shows a series of designs drawn in chalk on the ground in Samal village on the occasion of a visit of the local zemindar. These designs were made in front of different houses and on each, in accordance with a well-known Bengali and Uryia custom, a decorated pot of water supporting a cocoanut was placed to bring good luck. Here the foot-prints are much clearer and all doubt is removed when they are compared with

the conscious figures of Krishna's foot-prints commonly painted by women on the doorsteps of houses, especially on Thursdays and on certain festivals, in many parts of Bengal, Orissa and Madras.

The origin of the other of the two commonest patterns (plate II, fig. 1B) is less obvious at first sight but my informants agree that it represents a bunch of coconuts. The pattern is called *punjha pareda*, which means "four coconuts." The outlines of only three of the coconuts can as a rule be distinguished in each repetition of the figure, which is usually arranged in vertical pairs or series. As a rule there is a small ornamental base and leaves of the *pipal* are variously introduced.

Patterns like those I have called A and B are as a rule executed by men. They are painted direct on the red walls by means of a wisp of coconut-fibre dipped in a mixture of chalk and water. As will be seen from fig. 1, plate I they are arranged in a series of horizontal panels framed in a pattern of horizontal and vertical lines and each occupying the greater part of the depth of the available wall-space.

On some houses, however, the decoration is of a much more elaborate kind, though executed in the same way but I believe by women. In 1922 I offered a small prize for the best decorated house in the village and awarded it to the house from which the photographs on plate III were drawn. Text figure 4 is also from the same house. The patterns in their reduced size are of course much less effective than they were in the originals *in situ*.

On the walls of this house each vertical panel was divided into two and the framework was of a very elaborate nature, comprising not only straight lines in various combinations but also plant and animal designs. I will describe first the central part of the lower division of each panel; the upper division of all contained the conventional maize figure referred to above as A. This figure is also represented on the lower part of the panel reproduced in fig. 1 of plate III. Only the central blade bears the foot-print at its top, the others terminating in what may be meant either for young coconuts or pipal leaves. The whole is outlined with a series of dots and the base is filled in with crossed lines.

In another panel (pl. III. fig. 2) the centre is occupied by a conventional representation of the *gua* or betel pepper (*Piper bettle* Linn.) surrounded by flowers of the *kadamba* tree (*Nauclea Kadamba*). The former is very rarely represented but the latter is not uncommon, especially in the decoration of the inner walls of the houses. A more elaborate pattern in which it takes the chief place will be discussed later (pl. IV, fig. 1).

A third panel (pl. III. fig. 3) is said to represent various parts of the lotus plant (*Nelumbum speciosum*), including the young shoots under water and the flowers, with three *kadamba* flowers above. In a fourth (pl. III. fig. 4) the central figure is a lotus flower, with two ducks above, while the four sprays of foliage are those of the *sola* plant (*Aeschynomene aspera* Linn.). Representations of this latter water-plant are not uncommon.

The framework of these panels is, as I have said, elaborate. Its details will be

best understood by a reference to the figures, but I may note that they are to some extent appropriate to the central design of each panel. In the first panel the swimming ducks above and below the maize plant have no particular connection with it, but the highly conventionalized peacocks below the upper division of the panel are perhaps more appropriate. In the second panel, with the betel vine in the centre, the figures at the side represent a clever adaptation of the same plant terminating in the lucky foot-prints and with the swimming ducks again above and below. In the third, with the lotus plant, the sides are occupied by vertical series of double fishes, a very common symbol in India and other eastern countries, used by Buddhists and even Mahommedans as well as Hindus. This figure appears

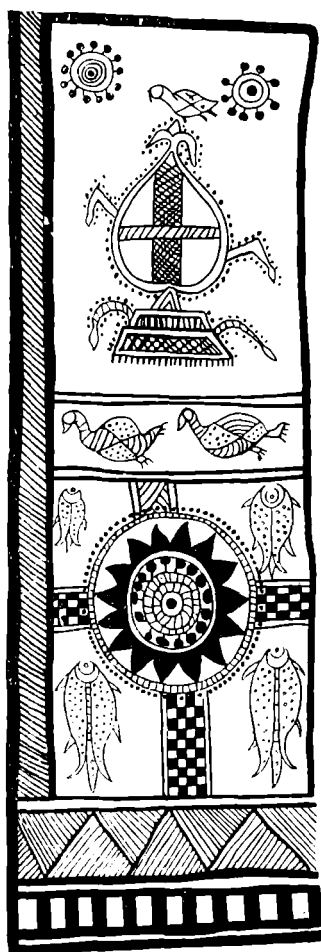


FIG. 4.
Panel on outer wall of house.
reproduced in negative.

frequently on the houses of Samal. Above and below the lotus plant are designs representing lotus flowers floating on the water, which is represented by wavy lines. The same design appears above and below the other figures of water-plants on the fourth panel.

In the paintings on some houses or some panels purely conventional designs play a larger part than in the panels I have already discussed. Text-figure 4 represents the outline of part of the panel on a narrow strip of wall beside the door of the same house as that on which the four panels just described were drawn. The upper design represents a decorated cocoanut on a jar of water displayed for good luck as already explained. Above it are duck and two (?) *kadamba* flowers. Below there are two ducks and below them again a somewhat elaborate design with a conventional lotus and four double fishes. In the figure white marks are again reproduced black.

Figure 3, pl. II represents a set of still more elaborate panels on the outside of a verandah. Unlike the others yet discussed it was painted specially for my edification and the artist, a woman, has attempted to introduce numerous different designs, thus producing a crowded and unsatisfactory whole. In addition to the designs already mentioned, *viz.*, those of the maize plant, the bunch of cocoanuts, the lotus, the *sola* plant, the swimming duck, the peacock and the double fish, figures of parrots and standing geese may be noted.

These designs, of which a few additional variations perhaps appear occasionally, exhaust the number of those ordinarily painted on the outside of the houses of Samal. I must now consider those on the inner walls and particularly those on the covered passage-way that leads into the houses from the door (fig. 1 A, p. 242).

Most of these interior decorations are painted in several colours, often on a background of white chalk laid on mixed with water by means of a piece of cloth. This is not always the case, however, and I will first describe two designs in or practically in monochrome painted direct on the red wall.

The first of these (pl. IV, fig. 2) has very little to do with plant or animal designs, but appears to represent *tulsi* pillars interspersed with purely geometrical figures. My figure is from a very accurate sketch by Babu D. N. Bagchi.

The second panel (pl. IV, fig. 1) is more germane to our subject, for it represents the *kadamba* tree in full flower, with a frieze of swimming ducks below. Although mostly in white chalk, the design is enlivened by touches of bright red on the stalks of the flowers, the bodies of the ducks and the triangles of the upper line of the frame. It may be noted how very skilfully the artist has adapted his design to the space to be filled and it should be remarked that the *kadamba* is a tree and not a creeper as he has made it appear to be.

The colours used in the more elaborate interior panels are few and simple. The pigments are mostly bought in a powdered state in the bazaar at Rambha, the nearest large village, and mixed with water in a half-cocoonut shell. The colours purchased are white chalk, an Indian red, a chrome yellow and a vermillion. In addition, charcoal and a bluish green pigment, said to be made locally from bean leaves, are used. They are mixed in the same way. The brush is a whisk of cocoonut fibre like that used in the simpler designs.

The unfinished design reproduced in fig. 4, pl. IV is interesting as showing the technique employed in painting in colour direct on the red wall. It represents three parrots sitting on *pipal* leaves rising from an imaginary erection of bowls or pillars. The artist had not been able to attain complete symmetry in his design and had apparently abandoned it in despair. It remained unfinished for at least a year. It will be noted that the figures have first been outlined in chalk, which was laid on with a brush. The lower pillars are black below, with a yellow centre and a red upper part; the uppermost pillar is black both above and below, but the side-pillars on which the two parrots are sitting are green above. The *pipal* leaves are red, the parrots green with yellow breasts outlined in white and black wings. Their heads were still in outline.

The photograph reproduced in pl. II, fig. 3 represents a painting actually on the outer wall of a house but executed specially for me and of a type usually reserved for interior decoration. It was in colours on a white background. Most of the designs already discussed are represented on it. In one panel the central figure is a decorated cocoonut and water-pot, in the other a lotus plant.

The paintings on the internal passages of the houses are often of a somewhat different character from those I have figured. Sometimes they are mythological, consisting of figures of Hanuman and the like, sometimes would-be naturalistic with human figures, elephants, etc., often purely geometrical; but none of these types of paintings have the interest of those I have illustrated.

The latter are, so far as my experience goes, unique in their skilful adaptation

of plant and animal forms in recurring designs of the nature of patterns. They differ greatly from the diagrams and signs commonly painted on the walls of houses in Bengal on special festivals. These have been figured by Dr. Abanindra Nath Tagore in a Bengali work current in Calcutta,¹ but, so far as can be judged from this work, have not the purely decorative effect of the paintings on Samal island and seem to have more of a direct symbolic significance.

In this connection a word should be said as to the object of the Uriya decorations. They include certain lucky signs, such as the double fish and the foot-prints; but, so far as I can ascertain, their main object is purely æsthetic. Whether they are beautiful or not may be a matter of dispute, but that they are striking and effective is proved by the photos reproduced, particularly by the views of the village given on plate I. The only explanation I could get of them from the people was that they were painted to give people pleasure and especially to please any great man who might pass through the village.

¹ "Banglar Brata" (বাংলার ব্রত): Calcutta.

DESCRIPTION OF PLATE I.

FIG. 1.—The village street on Samal Island, Chilka Lake, showing painted houses, etc.

Note the millet and rice spread out to dry on mats, the large basket used for transport of grain by bullock-cart, the stone platform and pillar supporting a sacred *tulsi* plant and the bamboo mast carrying a lamp in a perforated earthen pot. These masts with lights are erected in the month of *Kartik* (September-October).

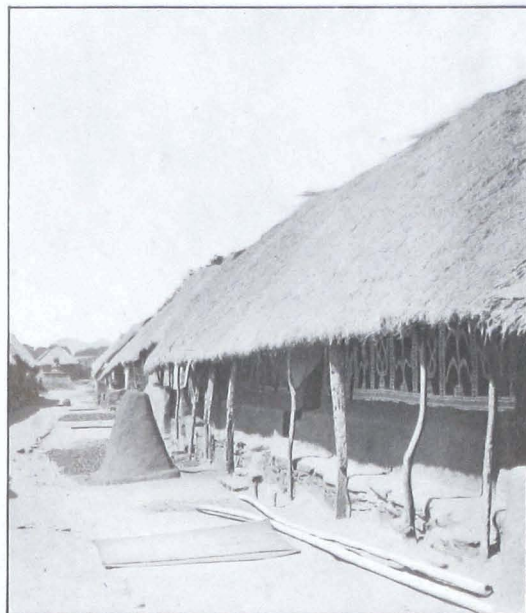
„ 2.—Another view of the same street, showing a plain clay *tulsi* pillar.

„ 3.—A nearer view of the same pillar after decoration with white chalk on a background of red earth. The pattern is the “three-finger” pattern.

Note the offering of flowers and rice-grains at the base of the pillar and also the irregular white vertical lines due to a libation of milk.



3.



2.



1.

N. A. Photo.

URYIA HOUSE - PAINTING

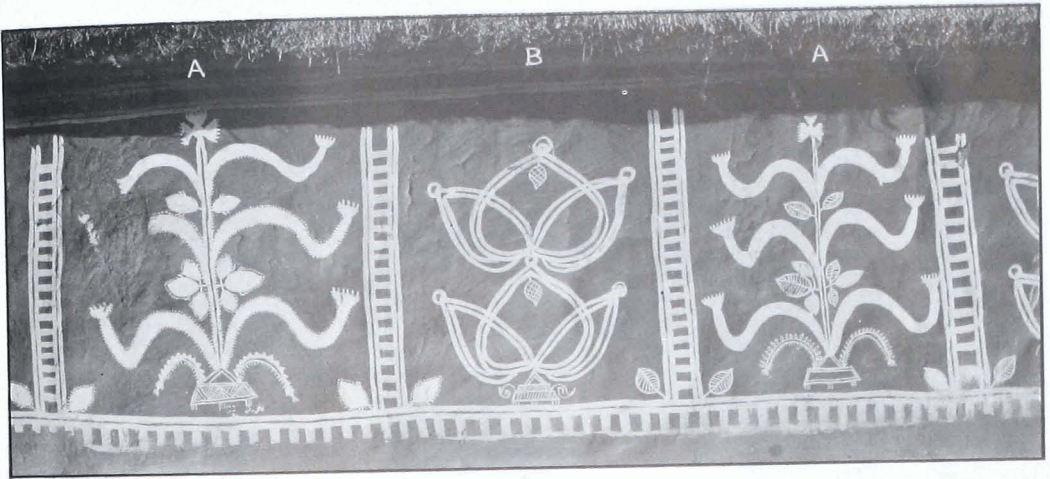
DESCRIPTION OF PLATE II.

FIG. 1.—Painted outer wall of house with the two commonest patterns, the “maize” pattern (on each side) and the “four-cocoanuts” pattern in the middle. White chalk on a background of red earth.

„ 2.—Another outer wall with more elaborate patterns, painted for a competition.

„ 3.—The outer wall of a verandah specially decorated in colours on a background of white chalk.

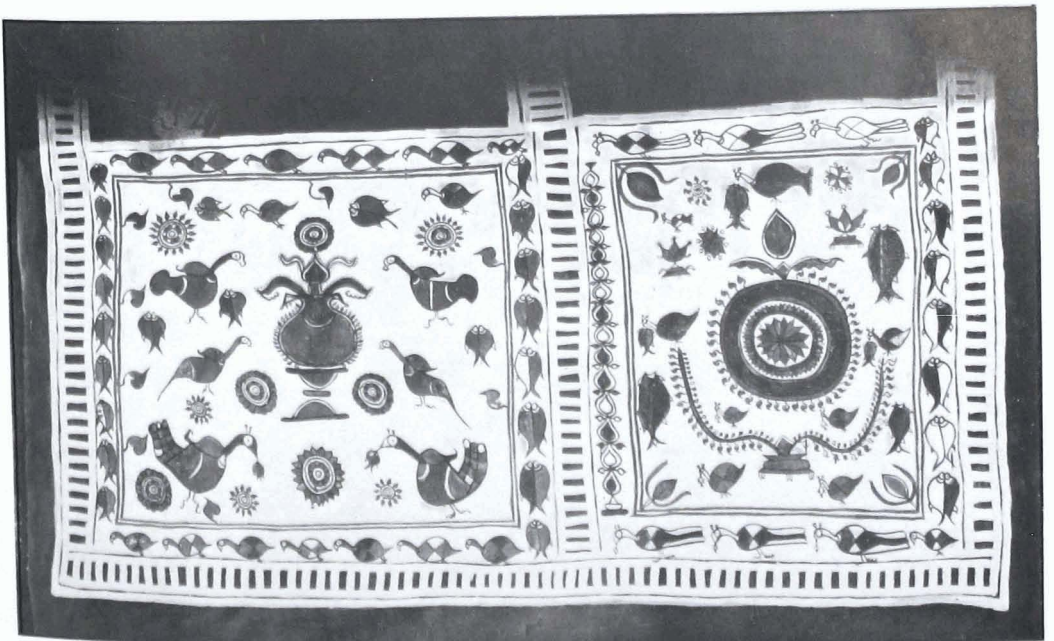
Note the house-number above the left panel of the painting, a touch of modern officialdom.



1.



2.



3.

DESCRIPTION OF PLATE III.

- FIG. 1.—Panel in white chalk on a background of red earth from the outer wall of a house. The maize pattern in the middle with peacocks above and swimming ducks below.
- „ 2.—Another panel from the same wall. Betel-vine and *kadamba* flowers in the middle, with other betel-vines at each side and swimming ducks above and below.
- „ 3.—Another panel from the same wall. Lotus plant and flowers in the middle with double fishes on each side and lotus flowers floating on water above and below.
- „ 4.—Another pattern from the same wall. Lotus flowers in the centre with two ducks and four *sola* plants. Peacocks above and floating lotus flowers: the same pattern below.



1.



2.



3.



4.

D. Bagchi Photo.

URYIA HOUSE-PAINTING

DESCRIPTION OF PLATE IV.

FIG. 1.—Panel on wall of inner passage of house in white chalk with touches of Indian red on background of red earth. *Kadamba* tree with ducks below.

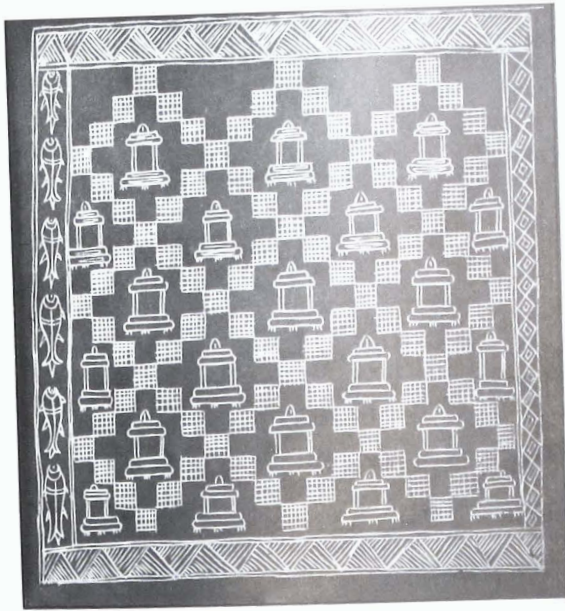
„ 2.—Panel in white chalk on wall of inner passage of another house. Geometrical designs with *tulsi*-pillars and (on one side) double fishes.

„ 3.—The main (stone) *tulsi*-pillar in the village with its platform, for comparison with the design reproduced in fig. 2.

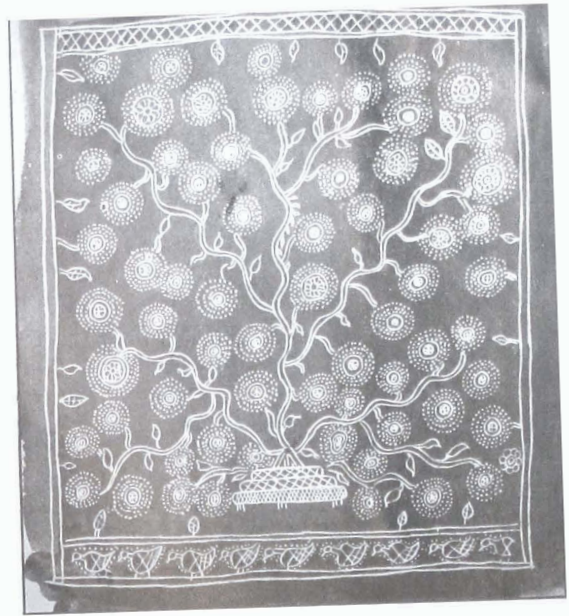
The pillar and platform are said to have been designed and constructed by workmen from Kallicota on the mainland near Samal some generations ago.

„ 4.—Unfinished design in colours on background of red earth on wall of inner passage in a third house.

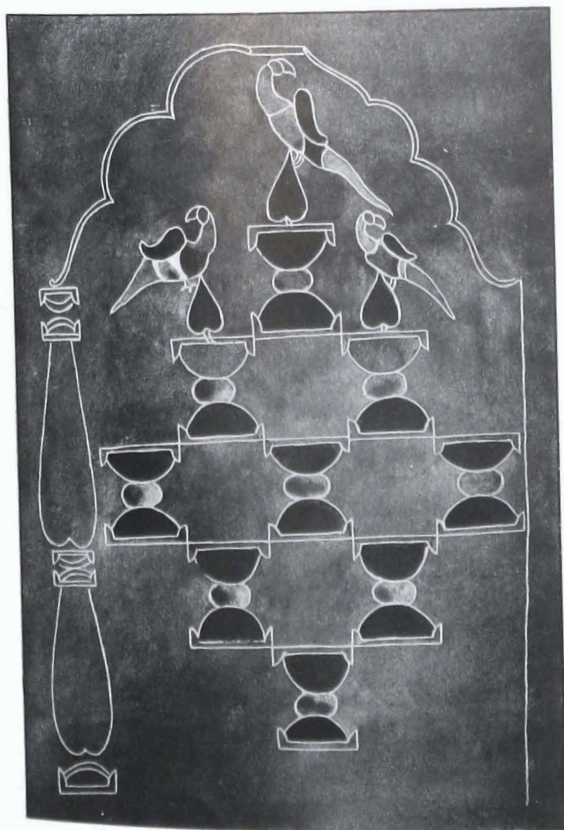
Note the white outlines painted before the colours were put on.



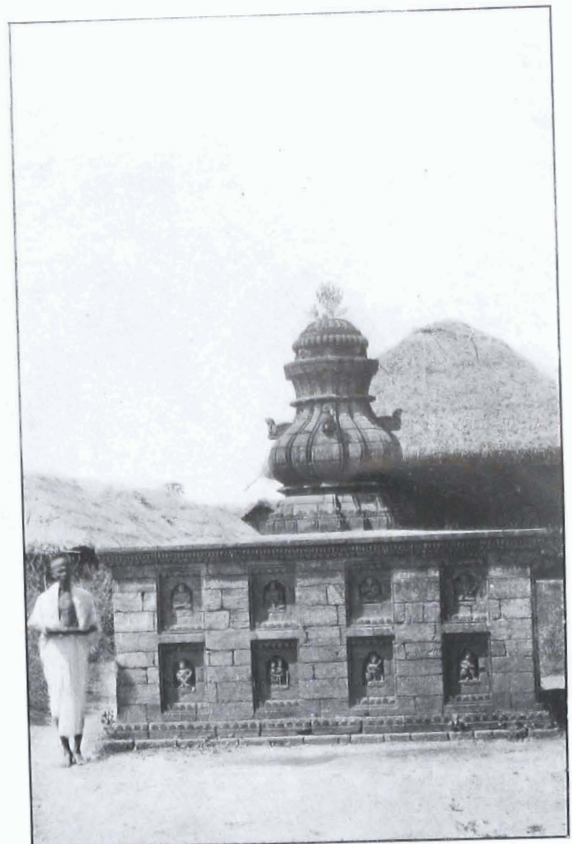
2.



1.



4.



3.

A WORKING MODEL OF THE ORIGIN OF THE GANGES
IN A TEMPLE IN GANJAM.

By N. ANNANDALE, D.Sc., F.A.S.B., F.R.S., C.I.E., *with notes by* MAHAMAHOPADHYAYA HARAPRASHAD SHASTRI, M.A., C.I.E., *and*
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The myths of the origin of the Ganges are numerous and diverse. No two books on Indian mythology or folklore relate them in precisely the same way, or even tell precisely the same stories; but, roughly speaking, they fall into two categories (which, with the natural inconsistency of folklore, are often combined), namely, those in which the river is regarded as a goddess or nymph and those in which it is described as a body of water. It is with myths of the latter type this paper deals. I cannot relate or discuss all such myths; my task is of humbler scope, for I propose merely to describe a peculiar little group of sculptures, which I first saw in 1921, in a temple situated in the jungle some miles from the village of Kallikote in the north-eastern part of the Ganjam district of the Madras Presidency near the Chilka Lake. Value is added to my notes by those appended to them by my friends Mahamahopadhyaya Haraprashad Shastri and Mr. Percy Brown.

The people of the Kallikote valley speak Uriya and their culture is that of Orissa, within a few miles of the political frontier of which their home is situated. Like other inhabitants of this part of the district they are of a mixed origin, as is evident from their physical characters, and aboriginal "Kollarian" blood is clearly indicated by the common occurrence of curly hair, flat noses and other features.

The temple in which the sculptures were found is called Nirmal Jahara or Johor, the "Clear Springs." As to its age I have no information except that conveyed in Mr. Percy Brown's note (*postea*). The actual fabric is for the most part modern, for it is built of very friable and coarse pink laterite, which needs constant renewal. The buildings, however, are all designed and decorated, notwithstanding the gross indecency of many of the sculptures, in a good style of Uriya art and the care and feeling with which the Uriyas repair and replace the artistic work of their temples is well known. Even in their most ancient shrines much of the stonework is quite recent, though the old designs have often been reproduced with great fidelity.

The Temple of Clear Springs is built in a large enclosure on the lower slopes and at the base of a range of low scrub-clad hills which forms one side of the Kallikote valley. It seems to have been designed to take advantage of a little hill-stream of clear water,—a rare phenomenon in the district, where most of the rainfall disappears from sight among the separate masses of gneiss of which the hills are composed. The enclosure contains a considerable number of shrines dedicated to different Vishnuvite deities, a gigantic and highly decorated stone

arch for the old hook-swinging ceremony, many little pavilions for the use of visitors, and other structures. The waters of the stream finally make their way into a large bathing-tank through the mouth of a gigantic *magara* head carved in pink laterite.

The stream enters the enclosure at its upper end and is divided into two channels, which are called "Ganga" (Ganges) and "Jamuna" (Jamna) and are

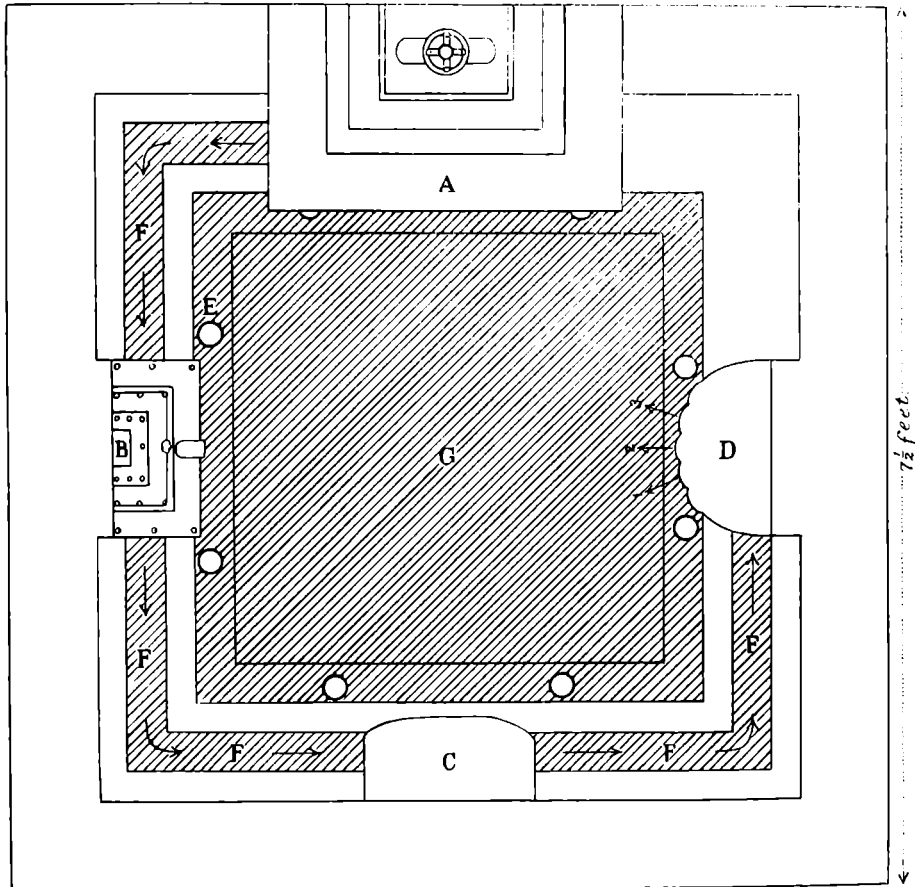


FIG. 1.—Plan of the Model of the Origin of the Ganges in the Vishnuvite Nirmal Johor Temple ("the Temple of Clear Springs") near Kallikote in the Canjam District of Madras.

A. Shrine of Narayana. B. Shrine of the Five-headed Mahadev. C. Figure of Jahnui. D. Model of Mt. Meru (*Sumeru*) with three streams of the Ganges (1), the Jamna (2), and the Saraswati (3), issuing from it. E. Figure of one of the Eight-Deformed ones (*Ashtabakra*) in the water. F. Channel of running water representing the primeval Ganges. G. Central pool representing Lake Manasarovar. The arrows indicate the direction of the flow of the water. Shading indicates the presence of water.

treated ritually as if they actually were those sacred rivers. The "Jamuna" is conducted underground into a large stone basin, called "Priag" (Allahabad). Here ceremonies are conducted on the same dates as those on which they are conducted at the actual junction of the Ganges and Jamna at Allahabad. The basin, of which a photograph is reproduced, is quite plain.

Lower down in the enclosure there is, however, a much more interesting basin into which the "Ganga" (or rather a part of it) flows in underground pipes.

This basin is called "Manasarowar." The model which it is the object of this paper to describe is associated with it.

The basin forms a square cistern, completely open above but with a broad ledge running round it above the level of the water. Each side is $7\frac{1}{2}$ feet long, measured along the outer margin.

At one end of the cistern, on the ledge above the water, a figure of the God Narayana is seated. Like the other figures to be described, it is carved in stone much less friable and of finer grain than that of which the temple buildings are built. The figure is considerably less than life size. It has four arms, two of which seem to be fixed on behind the others. The upper right hand bears a flaming disc, the upper left hand a chank shell, the lower right hand a club and the lower left hand a lotus. The figure is decorated with many necklaces and jewelled girdles and is clad in a *dhoti*. There is a (painted) caste-mark on the forehead. The features are of a characteristic Indian type, now seen commonly among Rajputs, with a protruding lower lip and with the nose prominent and finely chiselled in profile and in a straight line with the forehead but with expanded nostrils; the eyes large but relatively narrow and deep-sunk. There is a large curled moustache. The hair is hidden by a jow diadem. The left leg is crossed near the right and the foot hangs down a little. A little stream of water issues from a hidden pipe under this foot and runs to the right along a narrow channel in the ledge. The figure is seated under a stone shrine ornamented in front with ornamental scroll-work and bearing on its summit an object like a covered bowl supported by a squatting lion on either side.

The water after flowing from the foot of Narayana turns a corner and continues to flow along the right side of the cistern in the same channel. This, in the middle of the side, passes into a second, much smaller and lower shrine, which contains a grotesque five-headed figure with outspread hair, over which the water flows—or rather it contains the five heads with a mere indication of the figure below them. The workmanship is much cruder than that of the Narayana. These five heads are stated to represent Mahadeva. They are naturally more eroded by water than the other sculptures.

From the locks of Mahadeva the water continues to flow in the same direction and, turning a second corner, reaches the lower end of the cistern. In the middle of this it passes under another figure, said to represent the Rishi Jahnu. This figure also seems to me cruder than that of Narayana though not so grotesque as the five heads of Mahadeva. It represents an elderly bearded man seated cross-legged and of by no means ascetic proportions. His features are of the same physical type as those of Narayana, but coarser. His whiskers and beard, which is pointed, are continuous and he has long, apparently braided hair hanging down his back. His right hand is held against his upper abdomen, while his left hand rests on his lap. Three parallel ridges are carved vertically on his forehead. He wears a large rosary and apparently a tight-fitting garment.

After passing under Jahnu, the water in the channel again turns a corner and reaches the left side of the cistern. In the middle of this it enters a semicircular

mass of stone, whence it issues in three little jets into the cistern. The semicircular mass represents Sumeru (Mount Meru) and the three jets the Ganges (to the left), the Jamna (in the middle) and the Saraswati (to the right), the water in the cistern representing that of the sacred Lake Manasarowar, whence the Ganges is supposed to take its origin. The stone is decorated with conventional foliage and with the figure of a tree above. Amidst the foliage small figures of men (or spirits) and animals can be detected.

In the water of the cistern below the ledge there are eight figures of water-spirits, the Ashtabakra or Eight Deformed Ones. They are arranged in pairs, one pair below each of the two gods, one below the *rishi* and the fourth below Sumeru.

The interpretation of this cistern and group of sculptures was given me by a *sadhu* who had constituted himself a kind of guide to the temple. He spoke in Uriya but his words was translated literally and then explained to me by my photographer Babu D. N. Bagchi. The myth (or confusion of myths) is as follows:—

The world was out of tune and everything was in decay, for the Raginis, who preside over the modes of music, had grown old and forgotten how to sing. Narayana, the Creator, summoned the Gods to a feast and called on one of the Raginis, now decrepid like her sisters, for a song ; but her voice was cracked. Then the five-headed Mahadev lifted up his voice and sang. Harmony was restored to the universe, the Raginis grew young again and Narayana in ecstasy was dissolved in perspiration, which flowed down his body and issued from his left foot in a mighty stream. The stream flowed over the head of Mahadeva, who combed it from his flowing locks, and it fell to earth, where it washed away crops and houses. To save the works of men the Rishi Jahnu swallowed the flood, but the waters which had issued in heaven from the body of Narayana were sacred and the Gods came to the Sage and asked him to release the holy river. He replied that it would be defiled if it came out of any of the natural orifices of his body but finally set it free through a gash in his thigh, and thus the Ganges finally became an earthly river. The introduction of Sumeru and Manasarowara into the model seems to be due to a confusion with other myths of a more geographical nature.

The story of a God combing the Ganges from his hair is well known and is to be found in all the books on Indian mythology or folklore, though his name is variously given. In the confused complex of Indian mythology it is impossible to expect precise limits to the personality or even the iconography of the different deities. The story of the decay of harmony, its restoration by Mahadev and Narayana's ecstatic perspiration is much less familiar, but seems to be known to educated Bengalis. I have asked M. M. Haraprashad Shastri to add a note on its origins, while Mr. Percy Brown has kindly prepared another on the artistic style of the sculptures.

NOTES.

In the short dedicatory inscriptions of the 2nd and 1st centuries of B. C. at Sanchi, Barhaut and other places, names often occur with Gangā as the first member of the compound word. This shows that even at that remote age Gangā was an object of veneration in India. The myths to explain her sacred character are to be found in the Rāmāyana and in the Purāṇas.

Viṣṇupurāṇā, Part II, chap. VIII, contains a classical astrological myth of the rise of the river and of her fall in the terrestrial regions. She rises in the highest heaven beyond the Pole star, beyond the constellation of the Great Bear, in what is called the "pada" or heaven of Viṣṇu. She came out of the toe of the left foot of that deity. Druva or fixed Pole star held her on his head. The seven Ṛsis of the Great Bear had a dip in her waters. The moon was flooded by her. She at last falls on the Meru, the highest point in the terrestrial region. There she is divided into four streams and she flowed in four directions under four different names. The southern stream falls on the head of Śiva and then it flows to save the wicked descendants of Sagara.

Here, in the photographs, Viṣṇu spreads out his left foot a little but the toe is prominent under which the stream flows. Then come the five heads of Mahadeva, then Jahnu and then Meru. Jahnu is not in the Viṣṇu Purāṇā. He comes in the Rāmāyanā but on earth and not in heaven. The Meru is not in Rāmāyanā. Gangā comes to the earth directly from the braided hair of Śiva. From the braided hair in the Rāmāyanā Gangā flowed towards Vindu Sarah. This may be Mānasasarovara. There she is divided into seven streams, three flowing towards the East, three towards West and the Ganges towards the South. Bhagiratha undertook to direct her course towards the place where his ancestors were.

The myth of Viṣṇu's perspiration is to be found in the very late Brahma Vaivartta Purāṇā. In the highest heaven of Viṣṇu, Kṛṣṇā and Rādhā heard the song of Sarasvatī, the goddess of music, and they were so pleased as to give all they possessed of value to her in *bukhsis*. But then the five-headed God rose and began to sing and both Kṛṣṇā and Rādhā melted into a stream which produced Gangā. The account of the Brahma Vaivartta seems to be an enlarged edition of the myth given by the Sādhu who served as a guide in the Nirmal Johor.

It is well known in the Rāmāyanā and in the Purāṇas that Mānasasarovara is the source of the Saraya, a tributary to the Ganges, and not of the Ganges herself. Perhaps the Vindusara and the Mānasa have been either identified or confused. In the B. V. Purāṇā, Gangā is asked to take the sea as her lord. The cistern may represent the sea. The same Purāṇa says that in the highest heaven Viṣṇu had three wives Gangā, Laksmī and Sarasvatī besides Rādhā. But there quarreled among themselves and cursed each other to become rivers. Laksmī became Padma and Gangā and Sarasvatī rivers were named after the other two. Jamunā is not a wife of Viṣṇu. Her association with the Ganges myth in the account of the Sādhu seems to be

the outcome of a folklore that the Gangā, Jamunā and Sarasvatī united at Allahabad and separated at Triveni, a few miles north of the city of Hugli. The Ganges myth seems to have been expanded as the time went on. One variant is that in heaven itself the Ganges divides herself into three streams—one going to heaven (*mandākinī*), one to the Nether-regions called *Bhogavati*, and another to the earth under the name of *Bhagīrathi* or *Jahnavi*.

But the funniest expansion of the myth is the story of the celestial elephant, *Airāvata*. Requested to resist the force of the Ganges falling from heaven he readily assented but was carried away legs upward to where no body knows.

H. SHASTRI.

The design of the sculpture on the model of the Ganges in a Ganjam temple is what may be termed in the Orissan style, similar to that we find at Bhubaneswar, Puri, and Konarak. This style of work flourished in Orissa from the 8th to the 13th century A.D., but it is doubtful whether these identical carvings are so old. In fact there is every evidence that they are much more recent copies of an old design, as the treatment of the ornament is somewhat degenerate. The general plan of the ornament, the lines of the design, and the mouldings of the architecture are of the same character as the mediæval examples referred to above, but the actual technique and modelling is slightly inferior. The best work seems to be that on the sculptured stone said to represent *Sumeru* (Mount Meru), while the figure of the God *Narayana*, although it shows some fairly good workmanship in parts, is, as a whole, rather a **mannered conception**.

PERCY BROWN.

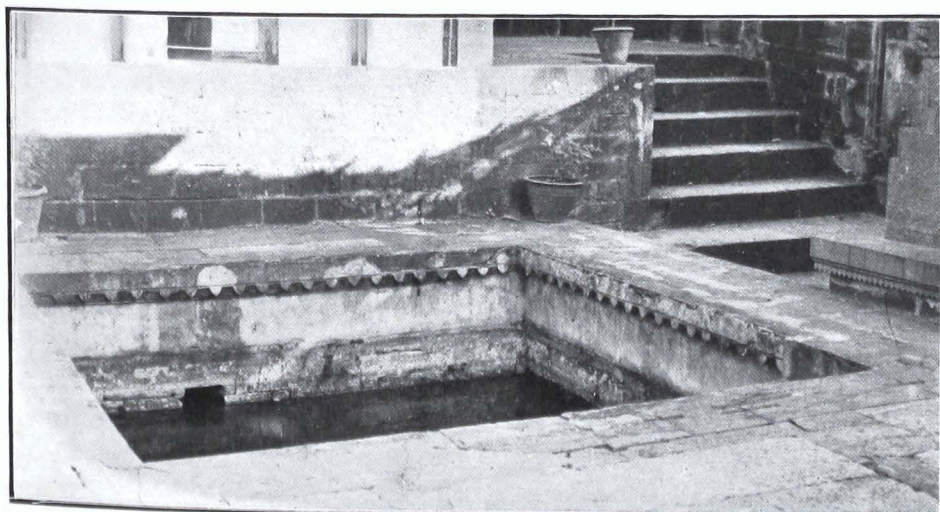
DESCRIPTION OF PLATE (V).

FIG. 1.—The basin called “Priag” in the temple of Nirmal Johor, near Kalliacote, Ganjam district, Madras Presidency.

FIG. 2.—General view of the basin called “Ganga” in the same temple, standing the figure of Narayana *en face*, the shrine of the five-headed Mahadeva at one side with the figure of Mt. Meru opposite it, at the back of the figure of the Rishi Jahnu. Note also the figures of the Ashtabakra in the water.



2.



1.

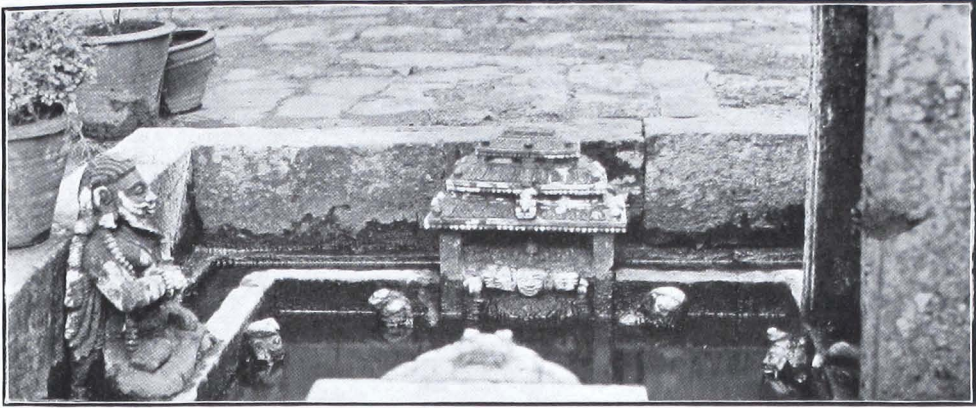
DESCRIPTION OF PLATE (VI).

Different views of the basin called "Ganga."

FIG. 1.—General view of the basin from one side.

FIG. 2.—The five-headed Mahadeva and the Rishi Jahnu.

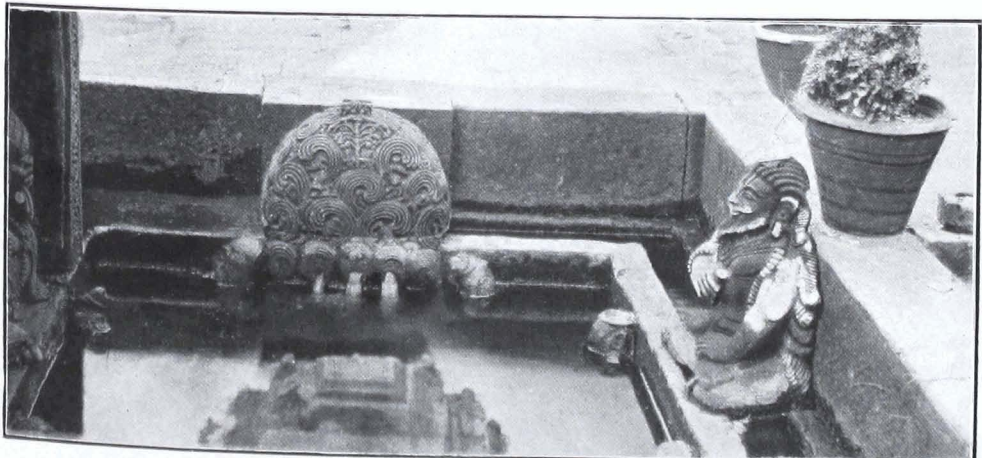
FIG. 3.—Mt. Meru with the three streams issuing from it and the Rishi Jahnu.



2.



1.



3.

MEMOIRS

OF THE

ASIATIC SOCIETY OF BENGAL

VOL. VIII, No. 5, pp. 257—316.

ALGAE OF THE LOKTAK LAKE.

BY

PAUL BRÜHL AND KALIPADA BISWAS.



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ALGAE OF THE LOKTAK LAKE.
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CORRECTION SLIP.

Page 258, line 5 from top	<i>read</i> Annandale	<i>for</i> Annandle.
„ 259 „ 16 „ „ „	I22	„ I2I.
„ 263 „ 5 „ bottom „	Vaucher	„ Vancher.
„ 283 „ 14 „ „ „	mahabaleshwarensis	„ mahabaleshwarensio.
„ 288 „ 16 „ „ „	lateralibus	„ ateralibus.
„ 301 „ 12 „ „ „	ambitu	„ ambito.
„ 302 „ 17 „ „ „	inferiores	„ inferioribus.
„ 302 „ 17 „ „ „	superiores	„ superioribus.
„ 304 „ 5 „ top „	oblongis	„ oblonga.
„ 304 „ 7 „ bottom „	cellula	„ cellulis.
„ 304 „ 7 „ „ „	visa	„ visis.
„ 304 „ 5 „ „ „	utraque	„ utraque.
„ 313 „ 11 „ top	<i>insert</i> I20	<i>before</i> Desmidium.
„ 314 „ 1 „ „ „	<i>read</i> I2I	<i>for</i> I20.
„ 314 „ 4 „ bottom „	I22	„ I2I.

ALGAE OF THE LOKTAK LAKE.

A memoir dedicated to the memory of the late Dr. N. Annandale, who was ever ready to encourage and assist those engaged in genuine research work.

By PAUL BRÜHL AND KALIPADA BISWAS.

The following is an account of the Algae forming the greater part of specimens collected by DR. HORA and the late DR. ANNANDALE in Manipur during a zoological expedition undertaken in 1920 for the main purpose of investigating the Fauna of the Loktak Lake. DR. ANNANDALE, in 1923, made over to us ten phials containing algae preserved in spirits of wine. The present memoir is the result of our study of the collection. A paper on "The aquatic and amphibious mollusca of Manipur" by Dr. Annandale, Dr. Baini Prasad and Mr. Amin-ud-Din has been published in vol. XXII, Pt. IV, No. 28 of the Records of the Indian Museum. The Introduction to this paper by the late Dr. Annandale deals with the geographical and physiographical features of the Loktak Lake and its surroundings. It further discusses the origin of the Loktak Lake, the general characters of its fauna and flora and the chemical composition of the water of the lake.

The following statements are based on Dr. Annandale's introduction to his account of the aquatic and amphibious mollusca of Manipur already referred to :

The State of Manipur covers an area of more than 87,000 square miles and is situated between $28^{\circ}50'$ and $25^{\circ}41'$ North latitude and $93^{\circ}2'$ and $94^{\circ}47'$ East longitude. The Manipur valley lies at an elevation of about 2,600 feet and forms a flat swampy plain about 50 miles long and 25 miles broad ; it is surrounded by mountains apparently consisting of hard shale associated with sandstone of probably pretertiary age. The Loktak Lake occupies a variable area in the southern part of the valley and is fed by hill streams with a scanty aquatic vegetation ; most of these streams arise in the Naga Hills. The lake itself occupies one of the several depressions met with in the Manipur valley, most of which dry up more or less during the colder season, the Loktak Lake being the only one of the lakes formed during the monsoon which contains some water all the year round. At no time is it little more than a large, deep swamp, though in places the depth reaches ten feet. It is largely filled with submerged vegetation ; a considerable part is covered with floating islands formed of living and decayed plants. The bottom of the Lake is composed of evil-smelling mud containing much rotten vegetation.

"Towards the eastern side of the Loktak Lake a chain of small rocky islands, the chief of which is called Thanga, rise from the surface to a height of several hundred feet. In February, 1920, these islands were separated from a broad peaty area, occupying the eastern part of the valley, only by a stream of running water."

“At no point has the lake definite shores, and even the rocky islands are surrounded in winter by flat mud-banks, which slope down under the water very gradually. On the northern and western sides the floating islands become, as it were, gradually stranded and changed into grass-land.”

Dr. Annandle draws attention to the luxuriance of the vegetation of the lake, which gives the latter the character of a large swamp. Specially notable among the phanerogamic plants are *Trapa bispinosa* and species of *Potamogeton* and *Hydrilla*. *Pistia*, *Lemna* and *Azolla* are seen in the open channels among the floating islands. The bulk of the vegetation of the islands are grasses and sedges. The leaves and stems of the “submerged plants are as a rule densely covered with small algae.”

The algae collected by Dr. Annandale and Dr. Hora were contained in ten phials and were gathered at “stations” 13, 14 and 19.

Numbering the phials from 1 to 10, the contents were obtained at the following places:—

- (1) A small channel south of Thanga Island; contents: some diatoms and a few desmids.
- (2) The small muddy bathing-post at Thanga Island; contents: a few diatoms.
- (3) A narrow open channel; 5–8 feet deep, joining the stream draining the lake, south of Thanga Island; contents: a few species of *Spirogyra* and *Mougeotia*.
- (4) From the same locality; contents: some diatoms and a few desmids.
- (5) From the same locality; contents: a *Spirogyra*.
- (6) Open channel; scrapings from a shell: fragments of a filamentous alga.
- (7) Open space in Loktak Lake; contents: *Spirogyra varians*.
- (8) Open space surrounded by floating islands; contents: *Spirogyra varians*.
- (9) From the same locality; contents: *Desmidiium Swartzii* and a few species of *Spirogyra* and *Mougeotia*, none of them in copulation.
- (10) From the same locality; this gathering consisted of practically all the species described in the following account.

The preceding statement indicates clearly that the harvest gathered in cases like the present one depends very much on accident as to its plentifulness or otherwise.

We do not consider it improbable that the Loktak Lake and similar accumulations of water within the Manipur State would yield at least five hundred species of Algae, if collections are made all the year round. It so happens that in what may be called “chance” collections Desmids and Diatoms take the lion share, filamentous algae being often deliberately left aside. Wallich’s collections described by Prof. Turner contained 22 species of Myxophyceae, 542 species of Desmids and 60 species of Green Algae not Desmids. Burkill’s collection of Algae chiefly from Burma, identified by W. West and G. S. West, is composed of 58 species of Diatoms, 148 species of Desmids and 53 species of other Green Algae. Freeman’s collection of Ceylon fresh-water Algae, worked out by W. West and G. S. West, contained 7 species of Rhodophyceae, 49 species of Diatoms, 33 species of Myxophyceae,

246 species of Desmids and only 84 species of Chlorophyceae exclusive of Desmids ; W. West and G. S. West note that " Very few Algae were observed belonging to the families Confervaceae and Ulotrichaceae ; this we are unable to account for, as many of the collections were from suitable localities for these plants." That one should expect a larger proportion of non-Desmid Chlorophyceae follows from a census of the number of species of Chlorophyceae described or referred to by De Toni in his *Sylloge Algarum*. It is true that a certain number of species are doubtful ; but considering that since the appearance of the volume containing the Chlorophyceae of the *Sylloge* a considerable number of newly discovered species have been described, the relative proportions may not have been greatly changed. It is thus found that the species of Chlorophyceae enumerated in the *Sylloge* are 2,826, of which 1,011 are Desmids ; that is to say that of the whole of the Chlorophyceae 35·8 per cent are Desmids and 64·2 per cent are non-Desmids. Among the latter most frequently gathered by collectors are members of the families Pleurococcaceae, Protococcaceae, Botrydiaceae, Hydrodictyaceae and Coelastraceae.

Of the 121 species described and figured in the present memoir 41 appear to be new. In our investigations into the algal flora of North-Eastern India we have often realised the correctness of Prof. Turner's dictum that " the value of gatherings is often in inverse ratio to the extent of country traversed." What may be called " botanical raids " lead rarely to results of appreciable value. It is always desirable to continue the investigation, at least at regular intervals, during the whole at least of one year. The sudden appearance and disappearance of algal species is often very startling.

Only in a few cases have we come across any zygospores. Our descriptions are therefore incomplete, as far as this matter is concerned ; but we have made it a point only to describe what we have actually seen. With reference to the dimensions stated it may be noted that the numbers outside brackets are based on our own measurements, which have been taken by means of a Metz echelon eye-piece micrometer ; the numbers within brackets are quoted from literature. The drawings have been made by using a Leitz No. 164 Drawing Ocular.

The literature quoted is that which we have had opportunity of referring to and of which we subjoin a list. We have not considered it to serve any useful purpose to refer to literature not available in Calcutta and probably not in the whole of India. Those who are interested in the latter will find information in De Toni's *Sylloge Algarum*, which for many years to come will be an indispensable work of reference ; further in Nordstedt's *Index Desmidiacearum* and in West's invaluable volumes on British Desmidiaceae.

List of Literature consulted :—

- (1) Kützing, *Species Algarum* (1840).
- (2) Kützing, *Tabulae Phycologicae* (1845—1869).
- (3) Hassall, *British Fresh-water Algae* (1845).
- (4) Ralfs, *British Desmidiaceae* (1848).
- (5) Rabenhorst, *Flora Europaea Algarum*.

- (6) Delponte, Specimen Desmidiacearum Subalpinum. Le Desmidiacee del Lago di Candia, in Memorie della Reale Accademia delle Scienze di Torino, Serie Seconda, Tomo XXVIII (1876).
- (7) Continuation of (6) in Tomo XXX (1878).
- (8) Cooke, British Fresh-water Algae (1882—1884).
- (9) Wolle, Desmids of the United States (1884).
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- (11) Joshua, Burmese Desmidiaceae in vol. 21 of the Journal of the Linnean Society, Botany (1886).
- (12) Nordstedt, Fresh-Water Algae collected by Dr. Berggren in New Zealand and Australia, in vol. XXII of the Kongliga Svenska Vetenskaps—Akademiens Handlingar (1888).
- (13) Hansgirg, Prodromus zur Algenflora von Böhmen (1888).
- (14) Turner, Fresh-Water Algae of East India, in Kongliga Svenska Vetenskaps—Academiens Handlingar, Ny Följd, Bd. XXV, No. 5 (1892).
- (15) W. West and G. S. West, Fresh-water Algae from Burma, in Annals of the Royal Botanic Garden, Calcutta, Vol. VI, pt. II (1907).
- (16) Josephine Tilden, Minnesota Algae (1910).
- (17) Wildeman, Prodrome de la Flore Algologique des Indes Néerlandaises (1897).
- (18) Karl Hirn, Monographie and Iconographie der Oedogoniaceen, in Acta Societatis Scientiarum Fennicae, t. XXVII, No. 1. (1909.)
- (19) Pascher, Die Süßwasserflora Deutschlands, Oesterreichs and der Schweiz. Chlorophyceae in Heft 4, 5, 6 (1912—1914).
- (20) Oltmanns, Morphologie and Biologie der Algen. 2. Auflage. 3. Bände (1922—1923).
- (21) Revue Algologique, edited by P. Allorge and G. Hamel (since March, 1924).

Besides these we have consulted papers by various authors in *La Nuova Notarissia*, *Hedwigia*, the *Annals of Botany*, the *Botanical Gazette*, *The New Phytologist*, the *Journal of the Linnean Society*, *Berichte der deutschen botanischen Gesellschaft*, *Die Oesterreichische Botanische Zeitschrift*, the *Annales du Jardin Botanique de Buitenzorg*, *Beihefte zum Botanischen Centralblatt*.

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MYXOPHYCEAE.

CHROOCOCCACEAE.

MICROCYSTIS, Kützing.

1. *Microcystis flos aquae*, Kützing.

Plate I, fig. 1 (a), (b), (c).

Cellulae globosae vel subglobosae, in familias amorphas, saepe compactas, saepissime vix lobatas neque clatratas confertae, tegumento gelatinoso circumdatae, diametro 4–6 μ , contentu pallide coeruleo-viridi.

Reported from various parts of Europe and from Central America.

De Toni, Myxophyceae, p. 86.

Hansgirg, Prodromus II, p. 144.

Tilden, Minnesota Algae, p. 35, pl. II, fig. 17.

Borge, Die Algenflora des Tåkernsees, p. 7.

Crow, The New Phytologist, vol. XXII, No. 2, p. 61.

2. *Microcystis elabens*, (Meneghini) Kützing.

Plate I, fig. 2 (a), (b).

Cellulae ellipsoideo-oblongae, 1–2.5 μ latae, longitudine circiter duplum latitudinis, (in manipurensibus) in familias sphaericas, tegumento gelatinoso circumdatas, 40(–80) μ latas consociatae; contentu granuloso, coeruleo-viridi.

Reported from various parts of Europe, from the United States, Anatolia and Ceylon.

De Toni, Myxophyceae, p. 88.

Rabenhorst, Flora Eur., II, p. 53.

Hansgirg, Prodromus, II, p. 155.

Tilden, Minnesota Algae, p. 35, pl. II, fig. 19.

Crow, New Phytologist, vol. XXII, No. 2.

OSCILLATORIACEAE.

OSCILLATORIA, Vancher.

3. *Oscillatoria tenuis*, Agardh.

Plate I, fig. 7.

Trichomatibus rectis vel subrectis, ad articulationes vix vel haud constrictis, apicem versus leviter vel vix attenuatis; cellulis 4–12 μ diametro, 2–4 μ longis,

plerumque longioribus quam latioribus ; dissepimentis utroque latere serie granulorum notatis ; contentu granuloso, aerugineo.

De Toni, Myxophyceae, p. 173.

Gomont, Monographie, p. 224, pl. 7.

Brühl et Biswas, Algae of Bengal Filter-beds, p. 6, pl. I, fig. 8.

4. *Oscillatoria amphibia*, Agardh.

Plate I, fig. 4.

In the Loktak form the diameter of the trichome is 2.5μ , the length of the cells is $4-6\mu$; there is a large granule situated on either side of the partition, and the contents are very finely granular, almost homogeneous, and bluish-green.

For a detailed description of the species see Brühl and Biswas, "Algae of Bengal Filter-beds" in the Journal of Science of the Calcutta University, vol. IV, p. 4, pl. I, fig. 4.

5. *Oscillatoria chlorina*, (Kützing) Gomont.

Plate I, fig. 3.

Trichomatibus aliis algis intermixtis, rectis, ad genicula non constrictis, $4-6\mu$ longis, $3-4\mu$ crassis, plerumque paullo longioribus quam latioribus, apice rotundato-obtusis ; calyptra nulla ; dissepimentis conspicuis, hyalinis, achrois ; contentu uniformiter granuloso, sine serie granulorum dissepimento appoximata, colore, ut videtur, coeruleo-viridi (in loktakensibus haud luteo-viridi).

Except in coloration the characters of the Loktak form agree entirely with those of the typical *O. chlorina*, and it does not appear to be advisable to separate the Loktak form specifically from the Kützingian species on the ground of its different shade of colour alone.

De Toni, Myxophyceae, p. 172.

Gomont, Monographie, p. 223.

Tilden, Minnesota Algae, p. 75, pl. IV, fig. 22.

6. *Oscillatoria formosa*, Bory., forma *loktakensis*, f. nova.

Plate I, fig. 5.

Trichomatibus aliis algis intermixtis, 4.5μ crassis, rectis vel modice flexuosis, flexilibus, ad genicula haud vel vix constrictis, apice brevissime attenuatis, haud capitatis ; cellulis $2.5-3\mu$ longis, semper diametro brevioribus ; dissepimentis manifestis, sine seriebus granulorum ; contentu granuloso, caeruleo-viridi.

The Loktak form agrees, on the whole, better with the typical *O. formosa*, than with any other species belonging to the section *Attenuatae*.

De Toni, Myxophyceae, p. 182.

Gomont, Monographie, p. 29, pl. 7, fig. 16.

Brühl et Biswas, Algae of Bengal Filter-beds, pp. 6-7, pl. II, fig. 10.

SPIRULINA, Turpin.

7. *Spirulina maior*, Kützing.Plate I, fig. 6, *a-c*.

Trichomatibus (in loktakensibus) sparsis, in spiram laxam, regularem contortis, diametro spirae 2-3 (-4) μ , distantia inter anfractus 2-3 (-5) μ ; contentu, ut videtur, homoganeo, coeruleo-viridi.

Reported from Europe, the United States, Madagascar, Java, Central Asia, India.

De Toni, Myxophyceae, p. 210.

Gomont, Monographie, p. 251, t. VII. fig. 29.

Cooke, Brit. Freshw. Algae, p. 246, t. XCVI, fig. 3.

Hansgirg, Prodrumus, II, p. 120.

NOSTOCACEAE.

MICROCHAETE, Thuret.

8. *Microchaete loktakensis*, sp. nov.Plate I, fig. 8 *a-c*.Plate XV, fig. 160 *a, b*.

Filamentis aggregatis, elongatis, uniformiter cylindricis vel basin versus paullulum (2μ) incrassatis, flexilibus, basi saepe decumbentibus et 12-14 μ crassis, superne fere uniformiter circiter 8 μ crassis, apicem versus interdum ad 6 μ decrescentibus; vagina 1.5-2-3 μ crassa, saepe trilamellata, superne interdum incrassata, achroa vel pallide coeruleo-viridi; trichomate 6-8 μ crasso; cellulis inferioribus 6 \times 6, vel 6-8 \times 10, vel 6 \times 8, vel 8 \times 8 μ . superne 8-10-12-14-16 μ longis, 8 μ crassis, prope heterocystas saepe 12-16 μ longis, ad apicem 6 \times 8 vel 6 \times 6 μ ; heterocystis basalibus sphaericis vel interdum ellipsoideis, 9 \times 9 vel 9 \times 8 vel 6 \times 8 μ , intercalaribus nullis vel sparsis et 16-24 μ longis, 8 μ latis; contentu cellularum granuloso, heterocystarum minute sparseque granuloso, pallide luteo-coeruleo.

Compare *Microchaete robusta*, Setchell et Gardner, in *Algae of North-western America*, p. 194; further Tilden, *Minnesota Algae*, p. 203, and De Toni, *Myxophyceae*, p. 483.

Microchaete loktakensis is evidently closely allied to Setchell and Gardner's species *Microchaete robusta*. It may therefore be useful to add here Setchell's description of this species, which has been reported only from fresh water ponds near Seattle in Washington, U. S.

"In tufts and stellate clusters on water weeds; filaments elongated and perfectly cylindrical, decumbent at the very base, but scarcely thickened, 16-18 μ in diameter; trichome composed of cells which are quadrate or slightly longer than broad in the lower portion and which are shortened to one-third in the upper part, 12 μ in diameter and the cells 6-16 μ long, aeruginous and filled with fine granules; sheath thin at first, but later stratified, hyaline; heterocysts basal and intercalary,

the former being spherical or nearly so, while the latter are elongated and rectangular."

The chief difference between *M. loktakensis* and *M. robusta* lies in the upper cells of the former being nearly uniformly 8–10 μ in diameter, whilst those of the latter are 12 μ thick; further the length of the upper cells of *M. loktakensis* are usually one to one and a half, more rarely twice as long as broad, that of the upper cells of *M. robusta* may be only one-third as long as broad.

CHLOROPHYCEAE.

DICTYOSPHAERIACEAE.

DIMORPHOCOCCUS, A. Braun.

9. *Dimorphococcus lunatus*, A. Braun.

Plate I, fig. 9 *a, b*.

Coenobiiis multicellularibus, ad 100 μ diametro, botryoideis; cellulis plerumque subdense aggregatis, stratis vel filamentis brevissimis gelatinosis connexae, externis paucis fere retuso-cordatis, pluribus plus minusve asymmetricice semilunatis vel asymmetricice oblongo-elipsoideis subreniformibusve, 12–15 (–20) longis, 6–9 μ latis; membrana firma; contentu dense granuloso.

Appears to be common in the Loktak Lake.

Reported from Germany, North Wales, Sweden.

De Toni, Chlorophyceae, p. 676.

Cooke, Brit. Freshw. Algae, p. 27.

Pascher, Chlorophyceae II, p. 185.

AUTOSPORACEAE.

SCENEDESMUS.

10. *Scenedesmus acuminatus*, (Lagerheim) Chodat.

Plate I, fig. 11.

Coenobium a cellulis quattuor vel octo 15–30 μ longis, 6–7 μ latis, in seriem simplicem aut alternantibus in seriem duplicem ordinatis formatum; cellulis intermediis fusiformibus, longe acuminatis, saepe leviter sigmoideis, extremis conspicue lunatis, apice utroque gradatim in caudam acutissimam circiter 6 μ longam productis; contentu dense granuloso, viridi.

De Toni, Chlorophyceae, p. 566.

Pascher, Chlorophyceae, II, p. 163.

11. *Scenedesmus Annandalei*, sp. nova.

Plate II, fig. 14 *a, b*.

Coenobium e serie simplici cellularum duarum, quattuor vel octo formatum; cellulis oblongo-cylindricis, rectis, apice utroque rotundatis atque aculeo brevissimo

armatis, laevibus, extremis dorso modice convexis, $15-18\mu$ longis, $4-5\mu$ latis, in sectione transversa circularibus; contentu dense granuloso, viridi; pyrenoidibus singulis, centraliter positis.

This species resembles *S. Hystrix*, Lagerheim, in the side-view of the cells and the terminal very short spines, but differs from it by the absence of a longitudinal rib as well as of numerous minute spinules.

It does not appear to be common.

12. *Scenedesmus brasiliensis*, Bohlin.

Plate I, fig. 12 a-c.

Coenobia 4-ad 8-cellularia, cellulis uniseriatis, oblongo-cylindricis, sectione transversa plus minusve polygonis, intermediis costa unica longitudinali, extremis saepe costis duabus notatis, apice subtruncatis, 2-4 denticulatis, $12-21$ ($11-27$) μ longis (2-) $3-8\mu$ latis; membrana firma; contentu dense granuloso; pyrenoidibus in utraque cellula singulis, centraliter positis.

Not uncommon.

Reported from Brazil and Central Europe.

O. Borge in Arkiv för Botanik, vol. XV, No. 13, p. 82.

A. Pascher, Süßwasserflora, Chlorophyceae II, p. 165.

13. *Scenedesmus quadricauda*, (Turpin) Brebisson.

Plate I, fig. 10 a-c.

For a general description of the species see Brühl et Biswas, Algae of Bengal Filter-beds, in Journal of the Department of Science, vol. IV, p. 10, 11.

The dimensions of the Loktak specimens vary considerably, the length of the cells varying between 9 and 18μ , the width between 3 and 6μ and the length of the spines varying between 9 and 15μ .

14. *Scenedesmus bijugatus*, (Turpin) Kützing,

var. *alternans*, (Reinsch) Hansgirg.

Plate II, fig. 13.

Coenobia saepissime 8-cellularia; cellulis alternatim in series duas dispositis, circiter 9μ longis, $5-6\mu$ latis, oblongo-ellipsoideis, plus minusve asymmetricis, apice rotundato-obtusis; membrana firma, laevi; contentu dense granuloso.

Frequent.

Probably cosmopolitan.

According to Hansgirg the cells of var. *alternans* are $13-16\mu$ long and $12-13\mu$ wide. The dimensions of the various forms of *Sc. bijugatus* vary between 7 and 18μ in length and $4-7-10\mu$ in width. The Loktak specimens vary very little in size and have generally the dimension stated in our description.

De Toni, Chlorophyceae, p. 563, 564.

Pascher, Chlorophyceae, II, p. 167.

ANKISTRODESMUS, Corda.

15. *Ankistrodesmus falcatus*, (Corda) Ralfs.Plate II, fig. 15 *a-e*.

Cellulis gracillime fusiformibus, utroque apice acutissime cuspidatis, leviter semilunatis vel sigmoideis, 2-32, saepius 4 in fascies congregatis, 39-50 μ longis, 2-3 μ latis; contentu subtiliter granuloso.

Cosmopolitan.

De Toni, Chlorophyceae, p. 592, 593.*Pascher, Chlorophyceae, II*, p. 188.

Brühl et Biswas, "Algae of Bengal Filter-beds" under the name of A. sigmoides (Rabenhorst).

COELASTRUM, Naegeli.

16. *Coelastrum microporum*, Naegeli.Plate II, fig. 16 *a-c*.

Coenobia globosa, 34-75 μ diametro, intus cava; cellulis saepissime 32, plus minusve irregulariter polygonis, (6-) 15-21 (-27) μ diametro; membrana cellularum crassa, lamellosa; contentu granuloso; interstitiis inter cellulas diametro cellularum minoribus.

Reported from various parts of Europe and the United States, also from India.

De Toni, Chlorophyceae, p. 571.*Cooke, Brit. Freshw. Algae*, p. 46.*Wolle, Freshw. Algae U.S.*, p. 170, t. 156.*Pascher, Chlorophyceae, II*, p. 195.

Turner, Freshw. Algae of East India, p. 161, t. XX, fig. 11, sub nomine *Coelastrum indici*.

17. *Coelastrum cambricum*, Archer, var. *intermedium*, (Bohlin) Pascher.

Plate II, fig. 17.

Coenobia subglobosa vel plane *globosa*, 20-51 (-70) μ diametro, intus cava; cellulis (6-) 9-12 μ diametro, angulatis, periphericis facie externa subhemisphericis atque gelatinoso-incrassatis, interstitiis minutis vel subnullis; membrana hyalina; contentu granuloso.

The species has been reported from Great Britain, Switzerland, Germany, Bohemia, Africa and the United States.

De Toni, Chlorophyceae, p. 577.*Cooke, Brit. Freshw. Algae*, p. 46.*Wolle, Freshw. Algae U.S.*, p. 170, t. 156.*Pascher, Chlorophyceae, II*, p. 196.

HYDRODICTYACEAE

PEDIASTRUM, Meyer.

18. **Pediastrum clatratum**, (Schroeter) Lemmermann,
var. **Bailey anum**, Lemmermann.

Plate VI, fig. 41 *a-b*.

Coenobium orbiculare, lacunosum, in loktakensibus circiter 125μ diametro, 16-cellulare; cellulis periphericis $20-25\mu$ latis, $40-45\mu$ longis, subovato-acuminatis, lateribus basalibus leviter concavis, lateralibus multo brevioribus, subreetis, cum vicinis connatis, apicalibus duobus elongatis, plerumque modice concavis, apice minute irregulariterque bifidis; cellulis centralibus irregulariter pentagonis vel hexagonis, lateribus valde irregularibus; lacunis conspicuis, tri- vel quadrangulatis; membrana laevi; contentu granuloso.

Apparently not common.

We retain the varietal name of *Bailey anum*, as generally the name *duodenarium* is incorrect, and there seems to be no necessity of using incorrect varietal names. The "rules of nomenclature" were never meant to be stretched to a point where they become absurd.

The species has been reported from Europe and the United States.

DeToni, Chlorophyceae, p. 574.

Pascher, Chlorophyceae II, p. 94.

Brühl et Biswas, Algae of Bengal Filterbeds, p. 13.

- 19a. **Pediastrum duplex**, Meyen, var. **genuinum**, A. Braun.

Plate VIII, fig. 60.

Coenobium circumscriptione orbiculare, (8-16-)32-cellulare, 65μ diametro; cellulis periphericis circumscriptione ovatis, 12μ longis, 9μ latis, basi ad tertiam vel quartam partem cum vicinis connatis, lateribus sub segmentis convergentibus, segmentis subparallelis, rectis vel leviter curvatis, lanceolato-linearibus, apice angustissime truncatis, minute bidenticulatis; cellulis centralibus rotundato-subquadratis, $12\mu \times 9\mu$; lateribus concavis lacunis subcircularibus vel rotundato-triangularibus, 6μ diametro; contentu granuloso; pyrenoidibus singulis, centraliter positus; membrana laevi, hyalina.

The species has been reported from various parts of Europe and from the United States.

De Toni, Chlorophyceae, p. 579.

Pascher, Chlorophyceae, II, p. 95.

- 19b. **Pediastrum duplex**, Meyen, var. **subgranulatum**, Raciborski.

Plate VI, fig. 43 *a-b*.

Coenobium orbiculare, 16 (-32-64)-cellulare, $100 (-180)\mu$ diametro; cellulis periphericis circumscriptione ovatis, $25 \times 21\mu$, basi ad quartam vel sextam partem

cum vicinis connatis, inferiore parte laterum aut rectis divergentibusque aut rotundatis, superne subrectis vel paullum concavis, segmentis anguste triangularibus, apice angustissime truncatis, bidenticulatis, margine granulatis; sinu apicali obtriangulari; cellulis centralibus transverse oblongo-rotundato-quadrangularibus, marginibus concavis; lacunis subtriangularibus vel biconvexis, $9-15 \times 15-25\mu$; contentu granuloso; pyrenoidibus singulis.

Reported from Europe.

Pascher, Chlorophyceae, II, p. 95.

19c. **Pediastrum duplex**, Meyen, var. **coronatum**, Raciborski.

Plate XV, fig. 159.

Coenobium orbiculare, lacunosum, ad 135μ diametro, 32-cellulare; cellulis periphericis circiter 25μ longis, 21μ latis, circumscriptione subquadratis vel irregulariter polygonis, cum cellulis vicinis circiter ad tertiam partem lateribus rectis connatis, segmentis terminalibus duobus, elongato-triangularibus, apice anguste truncatis, bidentulatis, marginibus granulato-dentatis; sinu apicali obtriangulari, inter apices segmentorum 15μ lato; basi cellularum retusa; lacunis biconvexis vel obtuse triangularibus, $6-9\mu$ diametro; cellulis centralibus irregulariter rotundato-tetragonis vel pentagonis lateribus concavis, $18 \times 18-21\mu$; membrana tenui, hyalina, granulis reticulatim dispositis notata.

Pascher, Chlorophyceae, II, p. 96, fig. 57, 1.

19d. **Pediastrum duplex**, Meyen, var. **loktakense**, var. nova.

Plate II, fig. 19.

Coenobium circumscriptione ellipticum, (8-) 10 (-32)-cellulare, lacunis plerumque subtriangularibus, conspicuis pertusum, circiter $80 \times 50\mu$ diametro; cellulis circiter 18μ longis latisque, periphericis subpentagonis, apice fere ad medium bifidis, marginibus internis modice concavis, lateralibus divergentibus rectisque, apicalibus convergentibus et rectis, segmentis (cornubus) apicalibus hyalinis, subparallelis vel paullum convergentibus, acutis; cellulis centralibus valde irregulariter pentagonis, marginibus liberis concavis; membrana firma, laevi; contentu granuloso; pyrenoidibus in cellulis singulis, conspicuis.

This variety varies probably considerably in the number of cells forming a coenobium and in the relative dimensions of the latter. It appears to be comparatively rare.

20. **Pediastrum angulosum**, (Ehrenberg) Meneghini, var. **laevigatum**, Raciborski.

Plate II, fig. 18 a-b.

Coenobium orbiculare, a cellulis (8-16-) 32 (-64) compositum, sine interstitiis, strato simplici formatum, $95-100\mu$ diametro; cellulis circiter 15μ longis, $18-20\mu$ latis, periphericis basi truncatis, lateribus inferioribus modice divergentibus, superiori-

bus convergentibus, apice rotundato-excisus incissura 5–6 μ lata, angulis apicalibus acutis vel brevissime acuminatis; cellulis centralibus plus minusve irregulariter hexagonis, antica parte saepe repanda; membrana laevi; contentu granuloso.

De Toni, Chlorophyceae, p. 578.

Pascher, Chlorophyceae, II, p. 99., fig. 60 a.

21. **Pediastrum Tetras**, (Ehrenberg) Ralfs.

Plate II, fig. 18 a–b.

Plate VI, fig. 42.

Coenobia 4–8–16-cellularia, plerumque clausa (sine lacunis), 16-cellularia circiter 50 μ diametro, suborbicularia; cellulis periphericis subpentagonis, lateribus rectis vel in coenobiis 4-cellularibus plus minusve rotundatis, apice ultra tertiam partem vel fere ad medium bifidis, segmentis acutis et subparallelis vel paullum divergentibus; cellulis centralibus irregulariter pentagonis, extrorsum haud profunde bifidis vel repandis; membrana laevi; contentu granuloso; pyrenoidibus singulis.

Common.

De Toni, Chlorophyceae, p. 581.

Pascher, Chlorophyceae, II, p. 103.

Brühl and Biswas, Algae of Bengal Filter-beds, p. 13, sub nomine *P. Ehrenbergi*, Corda.

OEDOGONIACEAE.

BULBOCHAETE, Agardh.

22. **Bulbochaete** sp.

Plate II, fig. 21 a–d.

The material not being in a good state of preservation we confine ourselves to giving some figures only, as we expect to be soon in possession of more satisfactory specimens.

23. **Oedogonium undulatum**, (Brébisson) A. Braun.

Plate III, fig. 23 a–b.

Cellulae intermediae cylindricae, undulato-constrictae undulis saepissime quinque, 45–82 μ longae, 10–24 μ crassae; cellula basali oblongo-obovoidea aut irregulariter cylindrica, saepe undulata, inferne in pedem plus minusve lobulatum expansa; cellula terminali interdum valde elongata, multi-undulata, apice incrassato-capitata.

We have seen only sterile filaments. The species has been reported from various localities in Europe, from North and South America, from Australia, Tropical Africa and Bengal.

De Toni, Chlorophyceae, p. 49.

Rabenhorst, Flora Eur. Alg. III. p. 351.

Hansgirg, Prodromus, p. 43.

Cooke, Brit. Freshw. Algae, p. 100, t. LIX, fig. 9.

Wolle, Freshw. Algae U.S., p. 76, t. LXXVII, fig. 8.

Turner, p. 163, t. XXI, fig. 20.

Nordstedt, *Freshw. Algae from New Zealand and Australia*, p. 13.

Karl Hirn, *Acta Societatis Scientiarum Fennicae*, vol. XXVII, p. 257, t. XLV, fig. 273-277.

ZYGNEMACEAE.

MOUGEOTIA, Agardh.

24. *Mougeotia parvula*, Hassall.

Plate III, fig. 24 a-c.

Cellulae filamentorum cylindricae, 6-12 μ crassae, diametro 6-9 (-12)—plo longiores; zygotae globosae vel sphaeroidales, globosae (8-) 18-36 μ diametro, axi maiori sphaeroidalium 27-39 μ , minori 21-33 μ longo; membrana laevi; contentu bruno.

West, in "Freshwater Algae from Burma" proposes a variety *ellipsoidea* and defines it "sporis tranverse rhomboideo-ellipsoideis," and states that the thickness of the vegetative cells is 9.6-11.5 μ , the length of the spores 27-58 μ and their width 21-23 μ .

Our species would in most respects fit into *Mougeotia nummuloides* of Hassall, the zygotes of which, according to De Toni, are sometimes 44 μ long and 34 μ wide, although the ordinary dimensions are 17-23 μ ; but the membrane of *M. nummuloides* is foveolate, whilst that of the Loktak specimens is decidedly smooth.

Mougeotia parvula has been reported from various parts of Europe, from the United States, Brazil and Burma.

De Toni, *Chlorophyceae*, p. 714.

Hassall, *Brit. Freshw. Algae*, p. 169.

Cooke, *Brit. Freshw. Algae* p. 104, t. 42.

Wolle, *Freshw. Algae, U.S.*, p. 230, t. 3, 4.

West and West, *Freshw. Algae from Burma*, t. X, fig. 14, 15.

Borge, *Die Algenflora des Tåkernsees*.

SPIROGYRA.

25. *Spirogyra varians*, (Hassall) Kützing.

Plate III, fig. 25 a-b.

Plate IV, fig. 27 a-d.

Cellulae vegetativae 30-40 (-47) μ longae, diametro 1-2 (-3)—plo longiores, cylindricae vel plus minusve doliiformibus; fructiferae in manipurensibus plus minusve asymmetricis doliiformibus; chlorophoris singulis, taeniiformibus, vix crenatis, anfractibus 1 $\frac{1}{2}$ -3; zygotis sphaeroidalibus vel saepius ellipsoideis, axi maiori in loktakensibus 35-40 μ , minori 25-30 μ longo.

As the name implies, the form of the cells, especially of the ones containing the zygotes as well as those which have unsuccessfully attempted to conjugate, varies considerably. In the Loktak specimens the purely vegetative cells are pretty regularly cylindrical, whilst the cells containing zygotes are shortly and more or less

asymmetrically barrel-shaped with the inner side more tumid than the outer. The inflated not conjugating cells are often $40-50\mu$ wide.

De Toni, Chlorophyceae, p. 746.

Wolle, Freshw. Algae U.S., p. 212, t. 134, fig. 8-13.

Hassall, Brit. Freshw. Algae, t. 29, fig. 1-4, t. 34, fig. 4.

DESMIDIACEAE.

PENIUM, Brébisson.

26. *Penium Libellula*, (Focke) Nordstedt.

Plate III, fig 28.

Cellulae fusiformes vel biconicae, $260 (230-360)\mu$ longae, medio haud constrictae, in loktakensibus cum striis transversis angustis tribus, diametro maximo $28 (-44)\mu$, longitudine cellularum quinquies ad sexies maximae latitudinis; semicellulis a medio ad apicem rotundato-subacutum 4μ latum sensim acuminatis; membrana laevi.

We have observed only empty cells. The species is very widely distributed, having been reported from Great Britain, Germany, France and other parts of Europe, further from Greenland, Ceylon, Singapur, Java, China, New Zealand and Brazil.

De Toni, Chlorophyceae, p. 860.

West, Brit. Desmidiaceae, vol. I, p. 101.

27. *Penium inconspicuum*, West.

Plate X, fig. 103 a-b.

Cellula minutissima, e facie visa $(15-19) 27\mu$ longa, $(4.8-5.8)-9\mu$ lata, longitudine 3-ies latitudinis, subcylindrica, medio leviter constricta, e medio ad apices rotundato-subtruncatos sensim sed paullo attenuata, a vertice visa circulari; membrana laevi, achroa.

Reported from Great Britain and Ireland, Central Europe, United States, Ceylon and Siam.

West, Brit. Desmidiaceae, vol. I, p. 101, t. X, fig. 15-17.

CLOSTERIUM, Nitzsche.

28. *Closterium parvulum*, Naegeli.

Plate IV, fig. 31.

Plate V, fig. 34 a-c.

Cellula latere exteriori (magis curvato) ad angulum $100-180^\circ$ curvata, distantia inter apices $66-175\mu$, medio $9-15 (7-16)\mu$ lata neque tumida, sexies ad novies longior quam latior; semicellulis anguste lanceolatis, apice acutis; membrana laevi; pyrenoidibus in utraque semicellula tribus (2-4); locellis minutis.

Reported from various parts of Europe, from Greenland, the United States and the Sandwich Islands.

De Toni, Chlorophyceae, p. 841.

Hansgirg, Prodrromus, p. 182.

Wolle, Desmids U.S. t. VII, fig. 7, t. VIII, fig. 16.

West, Brit. Desmidiaceae, p. 133, t. XV, fig. 13, 14.

29. *Closterium Venus*, Kuetzing.

Plate IV, fig. 30.

Plate V, fig. 33.

Curvatura dorsali cellulae in forma loktakensi fere exacte semicirculari (secundum West 150-160°); distantia inter apices semicellularum 30 μ , longitudine secus lineam mediam circiter 48 μ ; semicellulis e medio 6 μ (8-12 μ) lato ad apicem subacutum sensim attenuatis; locellis apicalibus conspicuis; pyrenoidibus in utraque semicellula (2-) 4-6; membrana tenui, laevi, hyalina.

Turner mentions the species as occurring at Raniganj.

Joshua reports it from Burma.

Cosmopolitan.

De Toni, Chlorophyceae, p. 841.

West, Brit. Desmidiaceae, p. 137, t. XV, fig. 15-20.

Joshua, Journ. Linn. Soc., vol. XXI, p. 652.

30. *Closterium Leibleinii*, Kuetzing.

Plate V, fig. 36.

Cellula semilunaris, conspicue curvata, e medio ventre modice inflato ad apices achroos acutosque gradatim acuminata, margine dorsali uniformiter convexo, 107-200-250 μ longa, 17-37 (-60) μ lata (in forma loktakensi 130-140, interdum 253 μ longa, ad mediam partem 24-30 μ lata, apice 6 μ lata); pyrenoidibus (3-) 6-12 in seriem unicam axillarem dispositis; vacuolis apicalibus conspicuis; contentu granuloso; membrana laevi, plerumque achroa.

Cosmopolitan.

Some of the Loktak forms closely resemble those depicted in Wolle, Desmids of the United States, t. VII, fig. 13, 14.

De Toni, Chlorophyceae, p. 846.

31. *Closterium loktakense*, sp. nova.

Plate V, fig. 35 a-c.

Cellula paullum curvata, a medio ad apices usque gradatim attenuata, apicibus subobtusis, 135 μ -150 μ longa, parte media 20-24 μ et ad apices 6 μ lata, latere ventrali ad mediam partem acute inflato, semicellulis utroque latere modice concavis; contentu granuloso; pyrenoidibus in utraque semicellula sex; membrana firma, laevi.

The cell-contents of the specimens of *C. loktakense*, as well as those of the Loktak Lake specimens of *C. moniliforme* and *C. Leibleinii* are so much contracted by

the action of the preservative that it has been impossible to make out the structure of the chloroplast, as also the shape and contents of the terminal vacuoles.

C. loktakense is undoubtedly near *C. Ehrenbergii*, which, however, is much larger (342-541 μ in length and 72-137 μ in width, according to West) and has its pyrenoids arranged irregularly in several rows; *C. moniliferum* is also larger (length 222-370 μ , width 25-50 μ) and relatively longer, although smaller forms appear to occur in India; moreover the median inflation of *C. moniliferum* is gently rounded and does not form a rather sharp transverse ridge. *C. Leibleinii* is relatively longer, but the chief difference between it and *C. loktakense* lies in the considerable greater curvature of its dorsal margin.

32. *Closterium moniliferum*, (Bory) Ehrenberg.

Plate V, fig. 37 a-c.

Cellula modice curvata, in forma loktakensi angulo inter radios extimos interdum 100°-110° sed saepius minus 90°, margine ventrali distincte inflato, distantia inter apices cellulae 235-270 μ ; semicellulis a medio cellulae ad apicem subobtusum usque gradatim attenuatis, basi 25-35 (in forma typica 36-55-72) μ latis; pyrenoidibus in utraque semicellula sex vel pluribus; locello apicali in loktakensibus haud prominente (in forma typica submagna); membrana hyalina, laevi.

Probably cosmopolitan.

The moderate curvature of the dorsal margin separates the Loktak form from *C. Leibleinii*. It is nearest var. *minus* of Kuetzing.

De Toni, Chlorophyceae, p. 845, 846.

Ralfs, Brit. Desmids, t. XXVIII, fig. 3.

Cooke, Brit. Desmids, t. XI, fig. 3.

Wolle, Desmids U. St., t. VII, fig. 16.

West, Brit. Desmidiaceae, vol. I, t. XVI, fig. 15, 16.

33. *Closterium manipurense*, sp. nova.

Plate V, fig. 40.

Cellula falcato-incurva, medio ventre modice tumida, e parte tumida ad apices usque gradatim attenuata, medio costis tribus transversis tenuibus notata, 35 μ lata, distantia inter apices 275 μ , apicibus rotundato-obtusis; membrana laevi, tenui sed firma, sine striis, pallide fulva; contentu non viso.

This species belongs to the group of which *C. Leibleinii* is a member. It agrees with the latter generally in its outline, but differs from it, as well as from *C. Ehrenbergii*, *C. Malinvernianum* and *C. moniliferum* by its three transverse middle ridges. Moreover, *C. Ehrenbergii* is generally of larger dimensions and the middle part of its intumescence forms a distinct transverse ridge; *C. Malinvernianum* is delicately longitudinally striated; the cell-walls of *C. moniliferum* is colourless; *C. Wallichii* of Turner agrees with *C. manipurense* in possessing three median transverse costae, (see Turner, *The Fresh-water Algae of East India*, in Vol. XXV, No. 5, of Kongl.

Svenska Vetenskaps-Akademiens Handlingar, 1892, p. 21, t. I, fig. 31 a), but differs by the absence of a median intumescence.

34. **Closterium Annandalei**, sp. nova.

Plate V, fig. 39.

Cellula subrecta, medio ventre leviter tumida atque e parte tumida ad apices versum leniter concava, medio costis duabus transversis tenuibus approximatis notata, 125μ longa, medio 25μ lata; membrana laevi, fulva.

This species resembles in shape *C. tumidum*, which, however, has a colourless membrane and is devoid of transverse median ridges; *C. manipurensis* is more curved, larger, and has three transverse ridges.

35. **Closterium lanceolatum**, Kuetzing, var. **parvum**, West and West.

Plate IV, fig. 29.

Cellula subrecta, lanceolato-fusiformis, latere dorsali leniter curvata, ventrali vel subrecta vel leniter convexa, longitudine 6 (-9)ies latitudinis, ad apices conicos subacutosque versum aequaliter attenuata; membrana laevi; chlorophoris 5 (-8)-costatis; pyrenoidibus seriem unicam formantibus, in utraque semicellula (6-) 8-10; longitudine cellulae $150-165 (-183)\mu$, latitudine maxima $20 (-27)\mu$.

According to West the dimensions of the typical form are: length $234-370\mu$, breadth $32-72\mu$.

36. **Closterium rostratum**, Ehrenberg.

Plate V, fig. 38.

Plate XIII, fig. 144 a-c, figs. 145, 146.

Cellula leviter curvata vel fere recta, $245-530\mu$ longa, $19-39\mu$ lata (in loktakensibus $300-375-485\mu$ longa, circiter $30\mu-50\mu$ lata), parte media lanceolato-fusiformi, marginibus dorsali atque ventrali fere aequaliter convexis aut margine ventrali convexiore, extremitatibus in processus longos, achroos, leviter incurvos vel subacutos productis, apicibus subobtusis vel levissime dilatatis; pyrenoidibus uniseriatis, in utraque semicellula 4-6; membrana straminea vel fere achroa et hyalina, striis numerosis longitudinalibus tenuissimisque ornata; zygotis transverse oblongis vel formam literae H imitantibus, $65-75 \times 40\mu$, lateribus leviter concavis, contentu dense granuloso, membrana luteo-brunea.

Cosmopolitan.

De Toni, Chlorophyceae, p. 851.

West, Brit. Dasmidiaceae, vol. I, p. 188, 189.

DOCIDIUM, Brébisson.

37. **Docidium Baculum**, Brébisson.

Plate V, fig. 32 a-p.

Cellula fere cylindrica, recta, ad apices truncata, medio modice constricta, $335-550\mu$ longa; semicellulis e basi $20-35\mu$ lata ad apicem $16-24\mu$ latum sensim attenuatis,

supra, basim transverse bi-vel triundulatis, ceteroqui marginibus rectis; membrana firma, laevi, hyalina; pyrenoidibus numerosis.

Reported from Europe, the United States and Burma.

De Toni, Chlorophyceae, p. 872.

Ralfs, Brit. Desmids, p. 158, t. XXXIII, fig. 5.

Cooke, Brit. Desmids, p. 16, t. VII, fig. 4.

Wolle, Desmids U. S., p. 49, t. XI, fig. 3, 4.

Wolle, Freshw. Algae U. S., p. 26, t. LIV, fig. 5,

Turner, p. 38.

West, Brit. Desmidiaceae, p. 193, t. XXVII, fig. 1-6.

EUASTRUM, Ehrenberg.

38. ***Euastrum inermius***, (Nordstedt) Turner, var. ***burmense***, West.

Plate VI, fig. 44 *a-d*.

Plate VII, fig. 59 *a-b*.

Cellula e facie visa circumscriptione orbicularis, tam longa quam lata aut paullo longior quam latior, circiter 45μ longa; sinu angustissime lineari; isthmo 12μ lato; membrana firma; semicellulis quinquelobis, lobo terminali trapezoideo leviterque retuso; lobis intermediis apice rotundatis, lateribus subparallelis; lobis basalibus late semiovatis, tumore centrali isthmo approximato, utrinque prominentia singula associato; marginibus lateribusque loborum aculeolis haud dense obsitis; pyrenoidibus in utraque semicellula binis; cellula e latere visa medio incisa, apice paullo producta, angulis obtuse rotundatis; cellula e vertice visa oblongo-elliptica, medio modice inflata.

Turner, p. 86, t. X, fig. 51.

West, Algae, p. 356, fig. 220 (*c*) (*a*), (*b*).

39. ***Euastrum ansatum***, Ralfs, var. ***pyxedatum***, Delponte.

Plate VIII, fig. 61 *a-b*.

Cellula 60 ($65-86$) μ longa, $18-20\mu$ crassa; sinu angusto, ad angulum internum paullo ampliato; isthmo $9-(12-14)\mu$ lato; semicellulis basi 36 ($33-42$) μ , apice 15μ latis, subtrilobis; lobo basali ad sinum rotundato, superne bisinuato; lobo polari leviter cuneato, apice truncato, angulis terminalibus rotundatis, incisura angustissima, 3μ profunda; pyrenoidibus in utraque semicellula singulis.

The variety has been reported from Scotland, Ireland, Italy and Poland. The typical and other varieties have been observed in various parts of Europe, in Greenland, the United States, Brazil, the Sandwich Islands, New Zealand, Japan, Siberia; also in Burma, the Khasia Hills and Bengal.

West, Brit. Desmidiaceae, vol. I, p. 27-29.

Turner, p. 77.

West, Annals Bot. Gard., vol. VI, pt. II, p. 196.

Borge in Arkiv för Botanik, vol. XV, No. 13, p. 57.

40. **Euastrum praepandum**, Turner, var. **euryisthmum**, var. nova.Plate VI, fig. 48, *a-c.*, 49.

Plate X, fig. 105.

Cellula oblonga, subrectangularis, apice truncato paullo angustior quam prope basim semicellularum, 21μ longa, 15μ lata; sinu brevi, angustissimo; isthmo 12μ lato; semicellulis transverse suboblongis, obscure trapezoides; lobis basalibus paullum protrusis spinulis singulis ascendentibus superne praeditis, lateribus bisinuatis, utroque latere obscure lobulato spinuloque instructo; incisura apicali angusta et semicirculari; prominentia media suprabasali modica; pyrenoidibus in utraque semicellula singulis; cellula e latere visa biovata, apicibus duobus productis, apice vero rotundato, sinu acuto, latitudine maxima 6μ ; a vertice visa oblonga, ad angulos spinulis singulis praedita, medio utroque latere breviter tumida.

Turner, p. 83, t. X, fig. 57.

41. **Euastrum elegans**, (Brébisson) Kuetzing, var. **loktakense**, var. nova.Plate VI, fig. 50 *a-c.*

Cellula 10μ crassa, a facie visa circumscriptione oblonga, 30μ longa, 18μ lata; isthmo 4μ lato; sinu anguste lineari; incisura apicali angusta, $3-6\mu$; semicellulis a facie visis angulato-ovatis, lateribus basi breviter divergentibus, hinc angulum acutum formantibus, deinde leniter concavis et sursum in dentem abeuntibus, supra dentem in apicem emarginato-rotundum transeuntibus, supra basim prominentia verruculis minutis obsita praeditis; cellula a latere visa subangusté oblonga, apice utroque dente praedita, medio triangulariter incisa; a vertice visa oblongo-rectangulari, polis truncato-rotundatis, medio utroque latere protuberantia notata.

The typical variety varies in length between 29 and 37μ , in breadth between 5.8 and 7μ , in thickness between 10 and 14.5μ , whilst the largest varieties—*Novae Semliae* and *Lundellii*—reach $53-60\mu$ in length and $34-40\mu$ in breadth.

Var. *loktakense* differs from other varieties by the side-and top-views being much more decidedly rectangular-oblong and the lateral margin of the semicells just beyond the linear sinus being sharply inclined obliquely outward on either side; the protuberance is granulate. Turner's *Euastrum incurvatum* is near our variety of *E. elegans*; but the configuration of the margin differs, judging by Turner's figure, t. XI, fig. I.

De Toni, *Chlorophyceae*, p. 1101.West, *Brit. Desmidiaceae*, vol. II, p. 48, t. XXXVIII, fig. 16-21.42. **Euastrum loktakense**, sp. nova.Plate VI, fig. 45 *a-c.*

Cellula a fronte visa circumscriptione elliptico-oblonga, magnitudine varia, $60 \times 36\mu$, 42×27 , $33 \times 20\mu$ aliisque dimensionibus, sesquies ad subduplo longior quam latior; sinu angusto, extrorsum modice ampliato; isthmo tertia vel quarta parte cellulae latitudinis, $5-9\mu$ lato; semicellulis e basi recta ovatis, subtrapezoides, apice anguste breviterque incisus, margine apicali ab incisura utrinque extrorsum declinato,

paullulum concavo, lateribus trisinuatis, dentibus inter sinus aculeolo brevi validoque instructis, spinulis 2-3 μ longis; membrana firma; chlorophoro lobuloso; pyrenoidibus in utraque semicellula singulis; cellula e latere visa medio modice incisa, subtriangulari-biovata, sinuata; a vertice visa oblongo-elliptica.

Related to *E. elegans*, Brébisson, *E. Nordstedtianum*, Wolle, and *E. longifrons*, Turner. *E. longifrons*, which resembles *E. loktakense* in size and shape, differs by the possession of seven tumors visible on the frontal face, which are absent in the Loktak species (cf. Turner, t. XI, fig. 3); *E. Nordstedtianum* has nine tumors and sharply dentate lateral lobules (cf. Turner, t. XI, fig. 17), and *E. elegans* is generally of smaller size, but differs especially in the much less regular outline in front view and in the vertical aspect being biconvex with acute, not rounded polar ends.

43. ***Euastrum spiculatum***, sp. nova.

Plate VI, fig. 46, 47.

Cellula a fronte visa tam longa quam lata, longitudine latitudineque 48 μ , medio profunde constricta; isthmo 9 μ lato, sinu aut anguste lineari et extrorsum abrupte ampliato aut rarissime ex angulo interno uniformiter anguste cuneatim ampliato; semicellulis ambitu e basi lata trapezoides trilobisque; lobis lateralibus horizontalibus, late semiovatis, angulis obtusiusculis vel subacutis, superne sinuatis; lateribus lobi apicalis transverse oblongi ad angulos rotundati-concavis, margine polari leviter concavo; semicellulis paullo supra isthmum tumore instructis, tumore annulo granulorum circiter septem circumdato; lobis marginem versus marginibusque spinulis brevissimis validisque ornatis; chlorophoris a facie visis in utraque cellula profunde bisectis et pyrenoidibus binis; cellula a latere visa spinulosa, medio obtriangulariter incisa, divisionibus lanceolato-ovatis, lateribus concavis, polis rotundatis; a vertice visa bilanceolata medio tumida, lateribus paullulum concavis, polis rotundato-obtusis, 15 μ crassis.

Euastrum spiculatum is closely related to *E. spicatum* of Turner (see Turner, p. 87, t. X, fig. 43); but in the latter species the sinus between the lateral and the terminal lobes is much deeper and the sinus between the semicells is much widened in the outward direction, not nearly linear, as commonly in *E. spiculatum*.

MICRASTERIAS, Agardh.

44. ***Micrasterias pinnatifida***, (Kuetzing) Ralfs.

Plate VI, fig. 51.

Plate VII, fig. 58 a-b.

Plate IX, fig. 115.

Cellula 60 (53-76) μ longa, 70-75 (57-80) μ lata, 15(-18) μ crassa; isthmo 10-20 μ lato; sinu acute obtriangulati; semicellulis trilobatis, lobis lateralibus horizontalibus vel paullo incurvis, margine basali leviter vel manifeste convexo, apice minute bifidis vel bidentatis; lobo apicali apice recto vel levissime convexo, raro obscure retuso, 40-50 μ lato, extremitatibus bidentatis; sinu interlobulari amplo profundoque et rotundato; chlorophoris in utraque semicellula binis; pyrenoidibus in semicellulis

duobus vel pluribus; cellula a latere visa anguste ovato-pyramidata, polis rotundatis; a vertice visa lanceolato-rhomboidea, polis acutis acuminatisve; membrana minutissime punctata.

Reported from various parts of Europe, Central Africa, Madagascar, the United States, Antilles, Brazil, Ceylon and India.

De Toni, Chlorophyceae, p. 1110, 1111.

Ralfs, Brit. Desmids, p. 77, t. X, fig. 3.

Kützing, Species Algarum, p. 171.

Wolle, Desmids U. S., p. 116, t. 37, fig. 7, 8.

Turner, p. 88, t. V, fig. 3.

West, Brit. Desmidiaceae, vol. II, p. 80-82, t. XLI, fig. 7-13.

A monstrosity is shown in our plate XI, fig. 151, a. Similar monstrosities have also been recorded by other observers elsewhere (*See West, Brit. Desmidiaceae*, vol. II, p. 82).

45. ***Micrasterias incisa***, (Brébisson) Ralfs.

var. ***Wallichiana***, Turner.

Plate VI, fig. 52 *a-d*.

Cellula paullo longior quam latior aut latior quam longior, $48-53\mu$ longa, $45-50\mu$ lata, aut in loktakensibus 57μ longa, 60μ lata; sinu acutissime obtriangulari, ore externo hiante vel paullulum contracto; semicellulis ambitu trapezoideis, profunde trilobis, lobis basalibus oblique trapezoideis, 15μ latis, marginibus externis apicem versus convergentibus, supra retusis, angulis inferioribus cuspidatis, superioribus rotundatis; lobo polari anguste trapezoideo, apice truncato, plano vel leviter concavo, circiter 12μ alto, $40-46\mu$ lato, extremitatibus lateralibus in spinulam leviter deflexam desinantibus; incisura subpolari 3μ lata, isthmo subpolari $13-21\mu$ lato; cellula a latere visa anguste elliptico-oblonga, margine tri-vel quadriundulata, polis rotundato-obtusis; a vertice visa elliptico-oblonga vel oblongo-linearis in apices brevissimos spinulatos desinens, 55μ longa, 9μ lata, spinulis 3μ longis; membrana laevi; chlorophoro in utraque cellula triloba pyrenoidibusque binis.

Micrasterias incisa has been reported from various parts of Europe, from Brazil, Bengal and Burma.

The following varieties may be distinguished—

a. var. ***mansangensis***, West. Length $38-39\mu$, breadth 46μ ; basal lobe of semicells asymmetrically ovate with a single spinelet; cell in side-view biovate, median incision rounded; in end-view elliptical-oblong with gently rounded sides; membrane conspicuously and irregularly granulate. (*See Annals of the Royal Botanic Gardens, Calcutta*, vol. VI, part II, p. 200-201, t. XIV, fig. 18 *a-c*.)

Reported from Mansang near Hsipaw in Burma.

b. var. ***Wallichiana***, Turner. $48-57\mu$ long, $45-60\mu$ broad; basal lobe of semicells broadly trapezoidal, the outer margins converging towards the apex, gently rounded or slightly retuse or shallowly bilobulate; cell in side-view fusiform, sinuous, in end-view oblong-elliptic or linear-oblong.

(*See Turner, plate VI, fig. 7, 9.*)

Two forms of this variety may be distinguished—

- a. forma *Turneriana*, slightly longer than broad, outer margin of basal lobe gently rounded or slightly retuse, and
- β. forma *loktakensis*, slightly broader than long, outer margin of the basal lobe shallowly bilobulate.

c. var **zeylanica** (*M. zeylanica*, Fritsch in Proceedings of the Royal Society of London, series B, vol. LXXIX, p. 245, 246, fig. 4 C), 60–65 μ long, 55–60 μ broad, basal lobes of semicells trapezoidal in outline, bluntly bilobulate, lobules separated by a shallow rounded depression, subapical lobule shorter, all lobes and lobules ending each in a short spinelet.

d. var. **Brebissoniana**, 56–58 μ long and about as broad; basal lobes of each semicell rectangular-oblong with the upper and lower margins parallel or somewhat converging and the outer margin subtruncate, the upper and lower angles ending each in a short spine: membrane smooth or minutely punctate. Occurs in various parts of Europe and in the Raniganj Coal-field.

e. var. **excisa**, Nordstedt, 32–44 μ long, about as broad, upper angles of basal lobes bidentate, the teeth being separated by an obtusely angled incision; semicells seen from above elliptical-fusiform, slightly triundulate; membrane finely punctate. Reported from Brazil. (See De Toni, Chlorophyceae, p. 1110.)

f. var. **aculeata**, Turner. 52 μ long, 60 μ broad; basal lobes deeply bilobulate, lobules oblong, rounded at the end and each ending in a spine; membrane smooth.

(See Turner, p. 89, t. VI, fig. 11.)

46. **Micrasterias radians**, Turner.

Plate VII, fig. 54.

Cellula circumscriptione subcircularis, stelliformis, 160 (130–145 sec. Turner) μ longa, 135 (sec. Turner 104–120) μ lata; semicellulis trifidis, segmentis radiantibus, inferioribus circiter ad medium bifidis, segmentis secundariis rectangulariter oblongis, bifidis, segmentis ultimis breviter linearibus, 15–18 μ longis, bicuspidatis vel bidentatis vel interdum irregulariter tridentatis, marginibus segmentorum rectis vel saepius distincte curvatis; segmento apicali fere rectangulari-oblongo, 50 μ longo, 30 μ lato, apice in segmenta secundaria duo divergentia, bicuspidata vel bidentata fisso, margine apicali concavo; sinu interne paullulum ampliato, angulum rotundatum formante, extrorsum gradatim modiceque ampliato; incisuris primariis atque secundariis acute obtriangularibus; membrana laevi (vel subtilissime punctata).

The much more slender ultimate segments distinguish *M. radiata*, Hassall, at once from *M. radians*, Turner.

Turner, p. 91–92, t. VI, fig. 6 a, t. V, fig. 4, a–g.

Turner reports the species from Bengal.

47. **Micrasterias Crux-Melitensis**, (Ehrenberg) Ralfs.

Plate VII, fig. 55.

Cellula circumscriptione subcirculari, (82-) 100-126 μ longa, (76-) 98-120 μ lata; semicellulis tripartitis, divisionibus lateralibus bifidis, interdum inaequaliter trifidis, subrectangulariter oblongis vel interdum transverse oblongis, basim versus paullum cuneatis, marginibus plus minusve curvatis; segmentis secundariis bifidis, segmentis ultimis breviter vel longiuscule linearibus, bi-vel irregulariter tricuspidatis; incisuris primariis et secundariis acute obtriangularibus; segmento apicali rectangulari-oblongo, apice paullum ampliato, margine terminali leviter concavo, ad angulos bicuspidato; membrana laevi vel minute punctata; sinu obtriangulari, angulo interno acuto.

Micrasterias Crux-Melitensis is very variable, particularly as regards the number and depth of the subdivisions.

Turner enumerates nine forms; West defines a variety *punctulata*. It is very doubtful whether Turner's *M. radians* is specifically distinct from *M. Crux melitensis*; as a matter of fact, our fig. 54, Pl. VII hardly differs from Ralfs' fig. 3, t. IX in "Brit. Desmids." It is therefore quite possible that Turner's *M. radians* really represents the type of Ralfs' *M. Crux melitensis*, and that the more common forms of the latter species are merely variations of the standard form, which we have described under Turner's name *M. radians*.

Micrasterias Crux-melitensis has been reported from various parts of Europe, Japan, Northern India, Burma, Ceylon, Celebes, Madagascar, Central Africa, the United States and Brazil.

It does not appear to be common anywhere.

De Toni, Chlorophyceae, p. 1113, 1114.

Ralfs, Brit. Desmids, t. IX, fig. 3.

Cooke, Brit. Desmids, t. XXI, fig. 2.

West, Brit. Desmidiaceae, vol. II, p. 116, t. LIII, fig. 1-3.

Turner, p. 92, t. XIX, fig. 17.

48. **Micrasterias foliacea**, Bailey.

Plate VI, fig. 53.

Cellula ambitu subquadrata vel transverse rectangulari-oblonga, 60-75 μ longa, 80-95 μ lata; sinu angustissime lineari vel lineari-obcuneato; semicellulis profunde trifidis, segmentis cuneatis, bifidis vel trifidis, segmentis secundariis irregulariter incisive vel inciso-dentatis; segmento polari obovato, basim versus cuneato, apice lato et saepe fere obcordato et irregulariter inciso dentatoque; membrana laevi; contentu granuloso; pyrenoidibus pluribus.

The cells are frequently united endways into ribbons (*see* plate VII, fig. 57, a).

Turner distinguishes two forms—

a. typica, cells as broad or broader than long,

β . elongata, cells longer than broad.

The species has been reported from the United States, Brazil, Bengal, the Khasia Hills and Lower Burma.

De Toni, Chlorophyceae, p. 1129.

Ralfs, Brit. Desmids.

Wolle, Desmids U.S., p. 118, t. 38, fig. 10-11.

Turner, p. 94, t. VI, fig. 12-14.

West, Algae, Vol. I, p. 736, fig. 239, I.

West in Annals of Roy. Bot. Gard., Vol. VI, pt. 2, t. XIV, fig. 22.

49. ***Micrasterias mahabaleshwarensis***, Hobson.

Plate VII, fig. 56 a-b.

Cellula ambitu prolato-ellipsoidea, 105-225 μ longa, 83-220 μ lata, 40-72 μ crassa; isthmo (linea contactus semicellularum) 19-25 μ lato; sinu a fundo acuto ad orem apertum vel paullo constrictum anguste obtriangulari vel oblanceolari, segmento polari ant parte inferiore subquadrato vel rectangulariter oblongo-cylindrico, apicem versus abrupte vel sensim dilatato aut (in brasiliensibus) obpyramidato, basi paululum dilatato, apice aut truncato aut vix convexo aut concavo et ad angulos in processus quattuor, interdum duobus accessoriis interpositis, apice denticulatos, varia longitudine, anguste conicos, plus minusve divergentes, margine minutissime denticulatos producto; segmentis lateralibus radiantibus, ambitu obovatis vel obtriangularibus, profunde bifidis vel rarius inaequaliter trifidis, incisuris late obtriangularibus, margine superiore recto, segmentorum recto vel modice convexo; segmentis secundariis angustissime triangularibus vel lineari-lanceolatis, apice tri-vel quadridenticulatis, interdum ad marginem interiorem apicem versus dente denticulato praeditis vel inaequaliter bifidis vel paullo supra basim latere utroque dente maiore instructis; semicellulis supra isthmum protuberantiis singulis vel binis, granulatis vel denticulatis vel laevibus praeditis; lobis omnibus seriebus denticulorum minutissimorum instructis; cellula a latere conspecta anguste biovato-oblonga; a vertice visa rhomboideo-fusififormis, in apices denticulatos attenuata.

The various forms of *M. mahabaleshwarensis* may be classified as follows:—

I. Subspecies **genuina**; lateral lobes bifid, upper lobule entire or unequally bifid.

Var. a, **typica**. Lower part of polar lobe in face-view subquadrate or rectangular oblong.

Subvar. *a*. Semicells above the isthmus with a small, granulate or denticulate protuberance; incision of the lateral lobes *not* constricted at the inner angles by two opposite teeth of the lobules.

Subvar. *β* . *excelsior*, Turner, incision constricted above the inner angles by two opposite teeth.

Subvar. *γ* . *bengalica*, Lagerheim, semicells above the isthmus with two denticulate protuberances.

Subvar. *δ* . *surculifera*, Lagerheim, semicells above the isthmus with a single denticulate protuberance.

Var. b. **sessilis**, Borge, polar lobe obconical *without* a subquadrate or rectangular-oblong basal part. In Brazil. (See Borge in Arkiv för Botanik, vol. XV, No. 13.)

II. Subspecies **Wallichii**, (Grunow) West (as variety), lateral lobes of semi-cells somewhat unequally trifid. Grunow reported this subspecies first from Banka; West reports it from certain Scottish Lochs, from Germany, Sweden, India, Fiji, Samoa and New Zealand. It is very doubtful whether this subspecies really occurs in India. Turner's figure 1 on plate VI, which is quoted by West as *M. Wallichii*, forma typica, is Turner's *M. mahabaleshwariensis* forma maior and indicates a typical *M. mahabaleshwariensis*.

De Toni, Chlorophyceae, p. 1122.

Rabenhorst, Algae eur., III, p. 196.

Hansgirg, Prodr., p. 253.

Wolle, Desmids. U.S., p. 112, t. XXXVII, fig. 10.

Turner, p. 95, t. VI, fig. 1.

COSMARIUM, Corda.

50. **Cosmarium viride**, (Corda) Joshua.

Plate XVI, fig. 162 a-c.

Cellula subcylindrica, apice utroque hemisphaerica, medio paullulum constricta, sectione transversa rite circularis, circiter 60μ longa, maximo diametro $28-30\mu$, diametro ad constrictionem 25μ ; membrana in exemplaribus loktakensibus laevi, haud punctata; chlorophoro axili et, sicut pyrenoides, contraliter posito, in utraque semi-cellula singulo.

The Loktak form differs very little from the typical form of *Cosmarium viride*. The latter is stated by West (British Desmidiaceae) to be $41-55\mu$ in length, $20-33\mu$ in breadth, with an isthmus $14-22\mu$ wide. The membrane of the Loktak form is not punctate, but smooth, like West's Forma *glabra*, which, however, is $34-39\mu$ long, $18-22\mu$ broad, with a breadth of isthmus equal to $14-16\mu$; forma *minor* of West is even yet smaller. As regards the shape of the Manipur form, it strongly recalls the illustration of *Cosmarium hibernicum*, West, in vol. III of West's British Desmidiaceae, plate LXXIV, fig. 21. But in the latter species the chloroplasts are parietal and each contains several small pyrenoids.

Cosmarium viride has been reported from England, Ireland, France, Germany, Bohemia, the United States, Nova Scotia, Madagascar and Northern India.

De Toni, Chlorophyceae, p. 885 (sub nomine *Dysphinctium viride*).

Rabenhorst, Flor. Eur. Alg., III, p. 177 (sub nomine *Cormarium Cordanum*).

Hansgirg, Prodr., p. 180 (sub nomine *Dysphinctium Cordanum*.)

Wolle, Freshw. Algae U.S. p. 27, t. LX, fig. 28; (sub nomine *Calocylindrus Cordanus*).

West, Brit. Desmidiaceae, vol. III, p. 113, 114, t. LXXIV, fig. 16-18.

51. *Cosmarium biobconicum*, sp. nova.

Plate VIII, fig. 64.

Cellula biobconica, 15μ longa, 9μ maximo diametro, ab apice truncato ad medium usque sensim contracta, angulis superioribus paullo rotundatis; isthmo $6-7\mu$ diametro; cellula a vertice visa exacte circularis; pyrenoidibus in utraque semicellula singulis, subcentraliter positis; membrana laevi.

52. *Cosmarium Lundellii*, Delponte.Subsp. *corruptum*, Turner pro sp., West pro var.

Plate IX, fig. 90 a-d.

Cellula a fronte visa ambitu circularis vel subprolato-elliptica, dimensionibus in exemplaribus loktakensibus $70 \times 63\mu$ vel $60 \times 55-57\mu$ vel $45 \times 40\mu$; isthmo $25-30\mu$, in minoribus 18μ lato, latitudine isthmi saepissime circiter dimidia pars latitudinis cellulae; sinu saepissime ad instar literae graecae gamma ad angulum internum paullo ampliato, deinde sensim constricto fere clauso, orem versus ampliato; semicellulis circumscriptione subtrapezoideis aut una alterave semicirculari; angulis basalibus obtuse rotundatis, lateribus inter se apicem versus convergentibus subrectisque, apice plus minusve truncatis; semicellulis a latere visis circularibus, incisura lata et profunda; a vertice visis obscure rhomboideis, medio paullulum incrassatis, polis obtuse rotundatis; membrana minute scrobiculata; chlorophoris atque pyrenoidibus in utraque semicellula binis.

Turner's *Cosmarium corruptum* appears to be sufficiently distinct from the typical *C. Lundellii* to rank as a subspecies. The subspecies has been reported from England, Galicia, Ceylon and N. India. The typical *C. Lundellii* is reported from Cornwall, Germany, Italy, Poland, Norway, China, Tropical Africa, Madagascar, South America and the Raniganj Coalfield.

Delponte, *Specimen Desmidiacearum subalpinarum in Memoria della Reale Accademia delle Scienze di Torino, serie seconda, tomo XXX*, p. 13, t. VII, fig. 62-64.

De Toni, *Chlorophyceae*, p. 956.

Turner, p. 51, t. VIII, fig. 2, 7, 48.

West, *Brit. Desmidiaceae*, vol. II, p. 139, t. LVII, fig. 5, 6.

53. *Cosmarium obsoletum*, (Hantzsch) Reinsch.subsp. *palustre*, Turner pro sp.

Plate IX, fig. 91 a-c, 92.

Cellula a fronte visa circularis, $60-65\mu$ diametro, margine laevis; isthmo $25-30\mu$ lato; sinu ad angulum internum circulariter ampliato, deinde aut lineari aut marginibus paullulum divergentibus, ad orem constricto; angulis basalibus semicellularum in protrusionem brevissimum, dentem imitantem incrassatis, protrusionibus oppositis semicellularum inter se convergentibus; semicellulis a latere visis late ellipticis, incisura mediana modice profunda; a vertice visis oblongo-ellipticis, obscure rhomboideis, 65μ longis, 30μ latis, ad extremitates axis maioris obtusis vel

subacutis; pyrenoidibus in utraque semicellula binis, plus minusue inter se remotis; protoplasmate minute granuloso.

Turner, p. 60, 61, t. VIII, fig. 65, t. IX, fig. 1, 29.

West, Brit. Desmidiaceae, vol. II, p. 134, t. LVI, fig. 4.

54. *Cosmarium circulare*, Reinsch.

Plate IX, fig. 87, 88, 89.

Cellula a facie visa circularis vel elliptica, axi maiore saepissime horizontali, dimensionibus $70-75 \times 75-85\mu$ (Wolle), $54-69 \times 54-69\mu$ (Reinsch), $48-50 \times 41-43$ (Lundell), $56 \times 61\mu$ (Turner), $33-36 \times 30-35\mu$ (var. minus, Hansgirg), $45 \times 48\mu$ (in loktakensibus), in forma *minor* $33-35 \times 35\mu$; a latere visa subcircularis, medioque cordatim incisa; a vertice visa oblongo-rhomboida, lateribus fere rectis; semicellulis ambitu semicircularibus vel semiellipticis, uniformiter rotundatis, basi rectis; isthmo in formis maximis circiter tertiam, in plurimis circiter dimidiam partem latitudinis metiente; sinu lineari, ad angulum internum haud ampliato; membrana firma, conspicue scrobiculata; chlorophoris atque pyrenoidibus in utraque semicellula binis.

Reported from Central Europe, Sweden, the United States, Central India and Bengal (here very common according to Turner).

De Toni, Chlorophyceae, p. 975.

Wolle, Freshw. Algae U.S., p. 28, t. 57, fig. 37.

Hansgirg, Prodromus, p. 249.

West, Brit. Desmidiaceae, vol. II, p. 136-137, t. LVI, fig. 11-14.

55. *Cosmarium nanum*, sp. nova.

Plate XVI, fig. 163 a-c.

Cellula a fronte visa ambitu circularis, 25μ diametro; isthmo 15μ lato; sinu ex angulo interno acuto obtriangulariter ad orem circiter 5μ latum aequae ampliato; semicellulis a latere visis subcircularibus, circiter 12μ diametro, angustis, basalibus acutis; a vertice visis elliptico-oblongis, polis obtuse rotundatis; membrana minute punctata.

This species is very close to *Cosmarium circulare* and occurs associated with it; but it is even smaller than *C. circulare*, var. *minor*, West, the diameter of which in front-view is 35μ , whilst the isthmus is only $12-14\mu$; moreover the sinus of *C. circulare* is narrow and linear, not obtriangular as in *C. nanum*. The front-view of the latter recalls *C. curyisthmum*, which in other respects is quite different.

56. *Cosmarium Forceps*, sp. nova.

Plate IX, fig. 86.

Cellula a fronte visa oblato-elliptica vel plane circularis, circiter 65μ diametro, marginibus uniformiter curvatis; isthmo circiter 50μ lato; sinu brevissimo, ad

angulum internum circulariter paullulum ampliatio, deinde clauso, hinc ad orem usque obtriangulariter ampliatio, ore vero paullulum contracto; angulis inferioribus acutissimis, fere denticulum efficientibus, hic ibidem 10μ lato; pyrenoidibus in utraque semicellula binis, conspicuis, inter se remotis; membrana laevi.

The present species reminds one to a certain extent of *C. mordax*, Turner, (*see* Turner, p 50, t. VII, fig. 29 and t. IX, fig. 7), but Turner's species is in face-view distinctly broader than long and the sinus is quite open. In *C. palustre*, Turner, the isthmus is proportionately much narrower, the sinus is not gaping, and the membrane is punctate.

57. *Cosmarium lacustre*, sp. nova.

Plate IX, fig. 93 a-c.

Cellula a fronte visa ambitu fere circularis, tam lata quam longa, diametro 63μ ; isthmo 33μ lato; sinu e fundo acuto ad orem usque 6μ latum cuneatim hiante; semicellulis ab angulo inferiore acuto semiorbicularibus, angulis modice incrassatis; semicellulis a latere visis obovatis, medio modice acuteque incis, amplitudine maxima 38μ , ad incisuram 30μ ; a vertice visis rhomboideis, angulis polisque obtuse rotundatis; chlorophoris atque pyrenoidibus in utraque semicellula binis; membrana glaberrima; isthmo lineis duabus notato.

58. *Cosmarium euryisthmum*, sp. nova.

Plate XI, fig. 107.

Cellula a fronte visa late elliptica vel circularis, circiter 60μ diametro; isthmo latissimo, $35-40\mu$ lato; sinu brevi, obtriangulariter hiante; membrana firma, in superficie frontali tuberculis minimis, conicis, acutis, haud dense aggregatis obsita; margine cellulae laevi; semicellulis a latere visis obovato-ellipticis, constrictione media cordata; cellula a vertice visa rhomboideo-elliptica, polis obtusis, axi minori 35μ longa.

59. *Cosmarium auriculatum*, Reinsch.

Plate XVI, fig. 163 a.

Cellula a fronte visa ambitu late elliptica vel fere circularis, $40 (-50)\mu$ longa, $45 (-55)\mu$ lata, apice vix depressa; isthmo $25 (17.5-21)\mu$ lato; sinu ex angulo interno acuto ad orem 5μ latum obtriangulariter sensimque ampliatio; semicellulis subreniformibus, angulis basalibus brevissime productis breviterque truncatis atque spinulis 3-4 armatis; membrana in exemplaribus loktakensibus minutissime punctatis atque veruculosis; semicellulis a latere visis circularibus; a vertice conspectis oblongo-ellipticis, polis acutis et mucronulum ostendentibus, axi minori 25μ metiente; chlorophoris atque pyrenoidibus in utraque semicellula binis.

De Toni, Chlorophyceae, p. 1040.

Turner, p. 50, t. VII, fig. 35; t. IX, fig. 8 a.

60. **Cosmarium contractum**, Kirchner, var. **abbreviatum**, var. nova.

Plate VIII, fig. 65.

Cellula e facie visa bielliptica, 24μ longa, 20μ lata; isthmo 8μ lato; sinu valde aperto, angulo interno subrotundato; semicellulis rite oblato-ellipticis; membrana firma, laevi, haud punctata; cellula a latere conspecta bielliptica, crassitudine maxima circiter 12μ , incisura media haud profunda; a vertice visa elliptico-oblonga; chlorophoris atque pyrenoidibus in semicellulis singulis, conspicuis.

The typical variety of *Cosmarium contractum* is in face-view about one and a half times as long as broad; De Toni gives the dimensions as 35 and 24μ respectively; Turner gives the dimensions as follows: length 32–35 μ , breadth 22–26 μ , isthmus 9–10 μ broad.

West considers Turner's *Cosmarium proteiforme* to be a form of *C. contractum*. West and West's variety *ellipsoideum* varies in length between 31 and 51 μ , in breadth between 24 and 42 μ . Our variety *abbreviata* is relatively the shortest.

Cosmarium contractum has been reported from various European localities, the United States, Central Africa, Burma, Northern India and Bengal.

De Toni, Chlorophyceae, p. 949.

Wolle, Desmids U.S., t. XVI, fig. 1, t. L. fig. 24.

Turner, p. 48, t. VII, fig. 19, 33, 34.

West, Brit. Desmidiaceae, vol. II, p. 170–174, t. LXI.

61. **Cosmarium pseudophaseolus**, sp. nova.

Plate VIII, fig. 66 a-c.

Cellula a fronte visa fere tam lata quam longa, 22μ longa, 21μ lata, circumscriptione subcirculari; isthmo 4μ lato; sinu ex angulo interno gradatim ampliato, marginibus paullulum convexis; semicellulis asymmetricice reniformibus, angulis ateralibus rotundatis, margine apicali uniformiter convexo rotundatoque; semicellulae a latere visae subcirculares, a vertice visae oblongo-rhombicae, protuberantia media vix conspicua, lateribus leviter concavis, polis rotundato-obtusis; membrana firma, laevi; chlorophoris atque pyrenoidibus in utraque semicellula singulis; crassitudine circiter 12μ .

The present species is very near *C. Phaseolus*, Brébisson, particularly var. *minor*, Boldt, with which it generally agrees in its dimensions; but in *C. Phaseolus* the median protuberance seen in vertical view is much more pronounced, and the sinus, instead of uniformly gaping, outwards, is gamma-shaped and for some distance closed or nearly so.

For *C. Phaseolus* compare *De Toni, Chlorophyceae*, p. 1001 and *West, British Desmidiaceae*, vol. II, p. 158–160, t. LX, fig. 12–17.

62. **Cosmarium rotundatum**, (Gay,) De Toni.

Plate VIII, fig. 67 a-c.

Cellula a facie visa tam lata quam longa, $9 \times 9\mu$ (in forma typica secundum De Toni $15 \times 15\mu$); isthmo 2.5–3 μ lato; sinu angustissime lineari; semicellulis a facie

visis transverse oblongis, apice recto late truncatis, lateribus convexis, rotundatis; semicellulis a latere visis ellipticis, incisura inter semicellulas haud profunda; cellula a vertice visa oblongo-elliptica, ad polos rotundata; membrana laevi; pyrenoidibus in utraque semicellula singulis, centraliter positis.

The species appears to be very rare; it was discovered by Gay in ponds at Roquehaut in France.

De Toni, Chlorophyceae, p. 939.

63. **Cosmarium pseudohehexagonoides**, sp. nova.

Plate VIII, fig. 71 *a-c*.

Cellula quarta vel quinta parte longior quam latior, 15μ long a, $72-13\mu$ lata; isthmo circiter 5μ lato; sinu ex angulo interno gradatim ampliato; semicellulis a fronte visis plus minusve manifeste transversim oblongo-hexagonis, angulis rotundatis; lateribus paullo convexis; margine apicali distincte concavo; semicellulis a latere visis subcircularibus; a vertice conspectis oblongo-ellipticis, lateribus sine protuberantiis; chlorophoris atque pyrenoidibus centraliter positis in utraque semicellula singulis.

From *Cosmarium hexagonoides*, sp. nova, described under No. 64, the present species differs by the well-rounded angles and the absence of two opposite protuberances each on one side of the apical surface.

64. **Cosmarium hexagonoides**, sp. nova.

Plate VIII, fig. 72 *a-c*.

Cellula tam lata quam longa vel paullo latior, 15μ longa, $15-16\mu$ lata, $7-8\mu$ crassa, profunde constricta; isthmo $3-4\mu$ lato; sinu exacte lineari, fundo vix dilatato; semicellulis transverse elongato-hexagonis, margine apicali lateralibus duplo longiore, lateribus omnibus rectis; semicellulis a latere visis subcircularibus, a vertice conspectis elongato-ellipticis, medio in protuberantiam latiusculam apice acutam productis; chlorophoris atque pyrenoidibus centraliter positis, in utraque semicellula singulis; membrana laevi.

Cosmarium sexangulare, Lund, differs by its larger dimensions ($42 \times 34-36 \times 22-24.5\mu$), by its isthmus being $11-12\mu$ broad, by its more rounded angles, and by its sinus being dilated at its inner end and then contracted; *C. abbreviatum*, Raciborski, differs by its sinus being dilated at its inner end and by the vertical aspect of its semicells being broadly elliptic without any median protuberance.

C. pseudobiremmum, Boltdt, the apical aspect of which presents two opposite median protuberances, has, in face-view, its superior angles broadly rounded and a much wider, 13μ broad isthmus, besides being distinctly broader than long.

65. **Cosmarium Strabo**, sp. nova.

Plate VIII, fig. 84.

Plate IX, fig. 85, *a-c*.

Cellula a facie visa prolato-elliptica, $60-70\mu$ longa, $48-55\mu$ lata; sinu ab angulo interno ad orem usque paululum ampliato vel sublineari; isthmo $15-20\mu$ lato; semi-

cellulis ad angulos inferiores obtuse rotundatis, margine aequaliter rotundato, apice haud truncatis; cellula e latere visa oblonga, medio retusa, apicibus rotundatis; a vertice conspecta exacte elliptica; membrana firma, sed non conspicue crassa, laevi; chlorophoris atque pyrenoidibus in utraque semicellula binis; pyrenoidibus ovatis, obliquis, apice acuto ad isthmum spectantibus.

This species is very close to *Cosmarium Lundellii*, Delpino, var. *ellipticum*, West.

With regard to the latter variety, which has been recorded from Wales and Scotland, West states that it is about one and a third as long as broad, being 68-73 μ long, and 53-55 μ broad; the breadth of its isthmus is 16-11 μ .

The form and position of the pyrenoids in face view appears to be remarkably constant in the Loktak species. The sinus of *C. Lundellii*, var. *ellipticum* is gamma-shaped. This is also the case with the thinner-membraned var. *acthiopicum*, West, of *C. pachydermum*.

Compare West Brit. Desmidiaceae, vol. II. t. LVII, fig. 4, 9.

66. *Cosmarium granatum*, Brébisson.

Plate VIII, fig. 73 a-c, 74.

Cellula ambitu subrhomboideo-elliptica, circiter latitudine sesquilingior, 33 (24-50) μ longa, 21 (19-29) μ lata, profunde constricta, (10-18 μ crassa); isthmo 6-9 μ lato; sinu ad angulum internum ampliato, deinde clauso, ore iterum ampliato; membrana firma, laevi, (minutissime punctata); semicellulis a fronte visis triangulari-subtrapezoideis vel fere semiovatis, angulis basalibus rotundatis, marginibus lateralibus subrectis vel leviter concavis vel leviter convexis, angulis superioribus obtusis, apice breviter truncato, subrecto vel leviter convexo vel retuso; semicellula a latere visa elliptica vel obovata, incisura mediana haud profunda, fundo acuta; a vertice conspecta elliptico-rhomboidea, medio utroque latere incrassata, polos versus paullum acuminata, polis obtusis; chlorophoris atque pyrenoidibus in utraque semicellula singulis.

Cosmarium granatum is a cosmopolitan species; the Loktak form resembles in front and side view the typical variety; the slight median protuberance seen in the apical aspect approaches it to var. *subgranatum*, Nordstedt, from which it differs by the somewhat drawn-out polar ends, as seen in apical view.

De Toni, Chlorophyceae, p. 931.

Cooke, Brit. Desmids, p. 83, t. XXXVI, fig. 9.

Wolle, Desmids U.S., p. 60, t. I., fig. 13.

West, Brit. Desmidiaceae, vol. II, p. 186-190, t. LXIII, fig. 1-3, 5-8, 9, 10.

67. *Cosmarium octogibbosum*, (Reinsch) Turner.

Plate VIII, figs. 75 a-c, 76.

Cellula a fronte visa ambitu oblongo-sexangulare, (14-) 18-21 (-24) μ longa, 11-15 (-17) μ lata; isthmo 4-5.5 μ lato; sinu lineari, angusto; semicellulis circumscriptione trapezoideis, angulis inferioribus obtusis, superioribus rotundatis, margine

laterali infra angulum rectum cum sinu formante, supra concavo, apice truncatis, rectis vel leviter concavis, a latere visis late ellipticis, a vertice conspectis ellipticis, polis obtuse rotundatis; membrana laevi; pyrenoidibus in utraque semicellula singulis, 1.5μ diametro, centraliter positis.

Turner distinguishes a variety *indica*, 24μ long and 17μ broad, and a variety *minor*, 14μ long and 11μ broad.

Turner, p. 52, t. VIII, fig. 8, t. X, fig. 14.

68. **Cosmarium nitidulum**, De Notaris.

Plate VIII fig. 70.

Cellula ambitu late elliptica, interdum subhexagonalis, 33 ($52-40$) μ longa, 30 ($22-30$) μ lata; isthmo 12 ($8-10$) μ lato; sinu lineari, amplitudine fere aequali, ore vix ampliato; membrana firma, laevi; semicellulis subtrapezoideis vel semicircularibus (interdum una trapezoidea, altera semicircularis), ad angulos inferiores obtusis, lateribus apicem versus inclinatis (in semicellulis trapezoideis), apice truncato vel plus minusve rotundato; pyrenoidibus in utraque semicellula singulis, centraliter positis, conspicuis.

Reported from Central Europe, Italy, the United States, Japan and Mongolia.

De Toni, Chlorophyceae, p. 935.

Wolle, Desmids U.S., p. 62, t. XVIII, fig. 16-18, t. LII, fig. 9, 10.

69. **Cosmarium bitrapezoideum**, sp. nova.

Plate VIII, fig. 83.

Cellula a fronte visa circumscriptione subsexangularis, circiter 68μ longa, $57-60\mu$ lata, sed etiam tam lata quam longa; isthmo circiter latitudine cellulae dimidio brevior; sinu fere lineari, fundo haud ampliato; semicellulis trapezoideis, linea basali apici parallela, lateribus minime convexis, apice truncato; pyrenoidibus in utraque semicellula binis, conspicuis, circiter 4μ diametro; membrana laevi.

70. **Cosmarium moniliforme**, (Turpin) Ralfs.

Plate VIII, fig. 62 *a-b*, fig. 63.

Cellula a facie visa bicircularis vel rarius bielliptica, 27 ($17.5-52$) μ longa, 15 ($10-27$) μ lata; isthmo 5 ($2-15$) μ lato; semicellulis plerumque exacte sphaericis (interdum prolato-sphaeroidalibus), membrana firma, laevi; pyrenoidibus in utraque semicellula singulis, centraliter positis, conspicuis.

West, in *British Desmidiaceae*, Vol. III, pages 20-24, describes six varieties, including the type. They are distinguished by their dimensions, the shape of the semicells, whether spherical, prolate spheroidal, ovoid, subpyriform or obovoid with a somewhat flattened apex, further by the colour of the membrane and the presence or absence of pores in the membrane. The Loktak specimens belong to the typical variety.

The species has been reported from nearly the whole of Europe, from the United States and the Antilles, Brazil and other parts of South America, Central Africa and Madagascar, Australia, Japan, China, Ceylon, Burma, the Bengal Coalfields.

De Toni, Chlorophyceae, p. 932.

Wolle, Desmids U.S., p. 60, t. XV, fig. 16-18.

Cooke, Brit. Desmids, p. 119, t. XL, III, fig. 2.

71. **Cosmarium Meneghinii**, Bréb., var. **loktakense**, var. nova.

Plate VIII, fig. 68 *a-c*.

Cellula a facie visa oblonga, 15μ longa, 9μ lata; isthmo 3μ lato; sinu ab angulo interno ad orem usque paullulum ampliato, fere lineari, medio haud constricto; semicellulis a facie conspectis irregulariter suboctagonis; marginibus ad basim semicellularum fere angulum rectum efficientibus, lateribus obscure sinuatis, angulos superiores versus oblique inclinatis, apice truncato, recto, obscure sinuato, medio subretuso; membrana laevi; semicellulae a latere visae orbiculares vel subellipticae; a vertice visae oblongo-ellipticae, ad extremitates axis maioris rotundatae.

The sinus of this variety resembles more that of *C. quadratum*, (Gay), but the variety described above differs from the latter species by the form of its semicells, the sides of which are straight and parallel or nearly so.

The description of the typical *C. Meneghinii* is, according to West, as follows—

Cellula suboctangularis, fere sesquilingior quam latior, profunde constricta; sinu anguste lineari; semicellulis transverse rectangularibus in parte inferiore, pyramidato-truncatis versus apicem; marginibus lateralibus inferioribus parallelis leviterque retusis, superioribus manifeste convergentibus retusisque, apice late retuso; angulis omnibus leviter rotundatis; semicellulae a latere visae late ellipticae vel subcirculares; a vertice conspectae ellipticae, ratione axium circiter 1 : 1.5; membrana laevi; chlorophoris axilibus, in utraque semicellula singulis; pyrenoidibus centraliter positus. Longitudo cellularum $12.5-24\mu$; latitudo $9.5-17\mu$; isthmus $3-6\mu$ latus.

The species is cosmopolitan.

De Toni, Chlorophyceae, p. 937.

Cooke, Brit. Desmids, p. 93, t. XXXVII, fig. 11.

West, Brit. Desmidiaceae, Vol. III, p. 90-93, t. LXXII, fig. 29-32, 34.

72. **Cosmarium laeve**, Rabenhorst.

Plate VIII, fig. 77 *a-c*.

Cellula 24 ($15-34\mu$) longa, 18 ($11-25\mu$) lata, 12 ($9-13\mu$) crassa, a facie visa ambitu prolato-elliptica; isthmo 6 ($2.8-6.7\mu$) lato, latitudine circiter tertia pars cellulae latitudinis; sinu ad angulum internum paullo ampliato, deinde clauso, ad orem vix hiante, rarissime angustissime lineari; semicellulis circumscriptione ovatis vel subtrapezoides, angulis basalibus plus minusve rotundatis, marginibus lateralibus biundulatis vel retusis, angulis apicalibus rotundatis, margine apicali medio retuso, brevi; semicellula a latere visa subcirculari; incisura media fundo acuta, lateribus rotundatis; cellula a vertice visa elliptica, polis obtusis.

The Loktak specimens come very near var. *septentrionale*, Wille (compare especially West, Brit. Desmidiaceae, Vol. III, t. LXXIII, fig. 24).

Cosmarium laeve is widely distributed, having been reported from most parts of Europe, from the United States, Greenland, the West Indies, South America, Africa, Australia, Siam, Burma, Ceylon, India.

De Toni, Chlorophyceae, p. 934.

Rabenhorst, Flor. Eur. Alg., III, p. 161.

Wolle, Desmids U.S., p. 62, t. XV, fig. 10.

Cooke, Brit. Desmids, p. 94, t. XLII, fig. 17.

West, Brit. Desmidiaceae, Vol. III, p. 99-103, t. LXXXIII, fig. 8-25.

73. *Cosmarium impressulum*, Elfving.

Plate VIII, fig. 69. *a-c*.

Cellula a facie visa ambitu oblongo-elliptica, $24(-36)\mu$ longa, $18(-26)\mu$ lata; isthmo $3(-9)\mu$ lato; sinu lineari, latitudine aequali; membrana laevi; semicellulis rite semicircularibus vel subsemiellipticis, margine aequaliter octoundulato; apice ambitu rotundo, angulis basalibus fere rectangularibus; semicellulis a latere visis ellipticis, a vertice conspectis ellipticis, polis obtusis vel rotundatis; chlorophoris atque pyrenoidibus in utraque semicellula singulis.

The species is widely distributed, having been reported from various parts of Europe, the United States, South America, Greenland, Australia, New Zealand, Africa and India.

Turner distinguishes a variety *minor* of the following dimensions: length 16μ , breadth 12μ , breadth of isthmus 4.5μ ; the apex of the semicells is truncate, and it is doubtful whether it really belongs to *C. impressulum*.

De Toni, Chlorophyceae, p. 940.

Turner, p. 66, t. IX, fig. 4 e.

West, Brit. Desmidiaceae, Vol. III, t. LXXII, fig. 14-18.

74. *Cosmarium undulatum*, Corda.

Plate X, fig. 94.

Cellula a facie visa circumscriptione prolato-elliptica, 36μ longa, $28-30\mu$ lata, margine undulato-sinuosa; sinu ad angulum internum ampliato, extrorsus clauso, ore paullum ampliato; isthmo 9μ lato; membrana firma, achroa, laevi; $1.5-2\mu$ crassa; chlorophoris atque pyrenoidibus in utraque semicellula binis.

The Loktak form is not marked along the margin of the cell by any dots. According to De Toni (*Chlorophyceae*, pt. 969 and 972), Hansgirg (*Prodromus*, pt. I, p. 196) and Wolle (*Desmids U.S.*, t. XVI, fig. 20) *C. undulatum* has two chlorophores and pyrenoids in each semicell, which agrees with the Loktak form, whilst West (*Brit. Desmidiaceae*, vol. II, p. 148-151, t. LIX, fig. 1-12) says: "Chloroplasts axile, each with one pyrenoid." As the number of chlorophores and pyrenoids contained in each semicell is an important sectional character, West's species cannot be identical with the *C. undulatum* of other authors. We propose *C. undatum* for the species described by West.

75. **Cosmarium Regnesi**, Reinsch.Plate XI, fig. 110 *a-c*.

Cellula à facie visa ambitu subquadrata vel transverse rectangulariter oblonga, medio profunde constricta, (6--9-10 (-16) μ longa, 6.2-9.5) 12-14 μ lata; isthmo (3-4.7-) 6 μ lato; sinu obtriangulari vel semielliptico, ad angulum internum subacuto, ore aperto; semicellulis transverse rectangulariter oblongis, apice medio retusis, marginibus lateralibus apicalique dentis 6-8 plus minusve aequidistantibus instructis, raro edentatis; semicellulis a latere visis polygonis vel subcircularibus vel transverse polygono-ellipticis, margine denticulato; cellula a vertice visa elliptica, vel oblonga, marginibus lateralibus fere parallelis; membrana laevi; chlorophoris atque pyrenoidibus in utraque semicellula singulis.

A number of cells are sometimes associated into chains.

The following varieties may be distinguished:--

Var. *tritum*, West. margin of semicells not toothed. Madagascar.

Var. *montanum*, Schmidle, semicells with a central and one smaller tooth in the middle of each side of the vertical view. Europe, Madagascar, Patagonia.

Var. *typica*, apical margin widely retuse between the two apical teeth, lateral marginal teeth two on each side of the semicell. Cosmopolitan. The Loktak specimens are of this variety.

76. **Cosmarium actinophorum**, sp. nova.

Plate X, fig. 104.

Cellula a fronte visa prolato-elliptica, 69 μ longa, 45 μ lata; isthmo 15 μ lato; sinu ad angulum internum circulariter ampliato, deinde anguste lineari, marginibus extrorsum vix divergentibus; semicellulis semiellipticis; marginibus modice uniformiterque convexis, crebre minuteque crenulatis, ad apicem angustum rotundatumque convergentibus, crenulis circiter 24; granulis faciei frontalis a crenulis marginalibus paullo ultra medium radiatim convergentibus; area mediana sine granulis.

This species appears to be scarce; in *C. Euastron*, Joshua, (see Journ. Lin. Soc., vol. XXI, p. 645, t. XXIV, fig. 30), which may be compared, the semicells are semi-circular, the radial arrangement of the granules is much less pronounced and the suprabasal area of the front-surface is marked with peculiarly shaped tubercles; *Cosmarium speciosum*, Lund, var. *simplex*, Nordstedt, (see West, British Desmidiaceae, vol. III, p. 250, 251, t. LXXXIX, fig. 6) agrees pretty well with our species, but the sinus is less deep, the marginal crenulations are shallower and less sharply demarcated from each other and the radiating rows of granules extend from the margin only to about one-fourth of the radius towards the centre, leaving a large central area free from granules.

77. **Cosmarium ellipsoideale**, sp. nova.Plate X, fig. 102 *a-c*.

Cellula tota circumscriptione ellipsoidea, a fronte visa prolato-elliptica, axi maiori sesquolongiori quam axis media (in conspectu frontali horizontalis), 96 μ longa,

66μ lata; isthmo 27μ lato; sinu fere lineari, angusto, angulo interno circulariter ampliato, latitudine fere aequali, ore paullum ampliato; semicellulis a fronte conspectis late semiellipticis, margine uniformiter convexo, apice haud truncato; semicellulis a latere visis ellipticis, axi minori (crassitudine maxima cellulae) 45μ longo, incisura media haud profunda; cellula a vertice visa rite oblongo-elliptica, polis rotundatis; membrana tota granulis hemisphaericis obsita; chlorophoris atque pyrenoidibus in utraque semicellula binis.

Except for the median incision the surface of the cell represents a triaxial ellipsoid; there is a certain resemblance between the present species and *C. tetraophthalmum*, Brébisson, but the top of the latter species is always more or less flattened and nearly or entirely devoid of granulation.

78. **Cosmarium chondriophorum**, sp. nova.

Plate X, fig. 99 *a-c*.

Cellula a fronte visa prolato-elliptica paullo longior quam latior, $34-38\mu$ longa, 32μ lata; isthmo 10μ lato; sinu fere lineari, fundo circulariter ampliato, ore vix latiori; semicellulis subsemicircularibus, aut aequaliter curvatis aut apice obscure applanatis, angulis basalibus subacutis; cellula a latere visa elongatoelliptica, medio paullum incisa, axi maiori duplo longiore quam axis minor, polis obtusis; cellula a vertice visa elongatoelliptica, polis rotundatis; membrana firma, ubique granulis conspersa; chlorophoris atque pyrenoidibus in utraque semicellula binis, pyrenoidibus circiter 3μ diametro.

79. **Cosmarium manipurensis**, sp. nova.

Plate X, figs. 97 *a-c*, 98.

Cellula a fronte visa prolato-elliptica, $40-42\mu$ longa, $31-33\mu$ lata; isthmo $11-12\mu$ lato; sinu ad angulum internum circulariter ampliato, deinde anguste lineari, ad orem vix dilatato; semicellulis semicircularibus vel saepius obscure trapezoideis, lateribus basi cum sinu fere angulum rectum efficientibus, rotundatis, apice semicellularum vix vel paullulum truncato, marginibus lateralibus et. apicali creberrime granulatis, granulis marginalibus arcte adiacentibus, $22-28$ in utraque semicellula; superficie frontali semicellularum seriebus tribus intramarginalibus concentricis granulorum hemisphaericorum paullulum inter se remotorum obsitis, supra isthmum series sex, $5-6$ longas, granulorum minutissimorum gercnte, area media circiter 9μ lata, laevi; cellula a latere visa medio incisa, latitudine maxima circiter 18μ , incisura fundo acuta, semicellulis supra incisuram subtrapezoideis, lateribus parte inferiore rotundato-convexis, apicem versus modice convergentibus, subrectis, apice truncato, circiter 8μ lato, angulis obtusis; superficie laterali semicellularum apicem versus seriebus tribus granulorum minutissimorum paullulum convexis notata; cellula a vertice conspecta circumscriptione elongato-subrhomboidea, polis late rotundatis, parte media in protuberantiam humilem truncatam granulis minutissimis obsitam, in latera subconcaeva abrupte transientem expansa; superficie apicali parte centrali fere plana, extror-

sum leniter convexa, lineis transversis curvatis punctulatis notata; chlorophoris atque pyrenoidibus in utraque semicellula binis.

C. manipurensis is very close to *C. radiosum*, Wolle. More plentiful material from the Loktak Lake may lead to the conclusion that it should be taken to be a subspecies or variety of that species. The chief differences lie in the linear, not partly closed sinus, in the lesser number of the supra-isthmal series of minute granules and in the fact that in *C. radiosum* the marginal granules do not touch each other.

For the sake of comparison we reproduce West's description of *C. radiosum*.

"Cells of medium size, $1\frac{1}{8}$ – $1\frac{1}{3}$ times as long as broad, deeply constricted, sinus narrowly linear with a slightly dilated extremity; semicells pyramidal, semicircular, sides strongly convex, apex subtruncate or truncately rounded, basal angles rounded, cell-wall finely granulate, granules in radiating and concentric series, about 30–35 showing at the margin, and 6 or 7 in each radial row, gradually diminishing in size from the periphery towards the centre, median basal part of semicell with 8 or 9 subvertical (somewhat divergent) series of granules, 6 or 7 in each series, and gradually becoming reduced in size from the base upwards, side-view of semicell oblong-rectangular, slightly tumid at the base on each side apex subtruncate. Vertical view elliptic with a slight central inflation. Length 55–58 μ ; breadth 45–50 μ : breadth of isthmus 12 μ ; thickness 23 μ ."

For the literature of *C. radiosum* see Wolle, Desmids U.S. p. 90, t. 19, fig. 21–22; De Toni, Chlorophyceae, p. 1052.; and West, British Desmidiaceae, vol. III, p. 137, 138, t. LXXVI, fig. 3, 4.

The tumor-like thickenings of the cell-wall of the suprabasal part of the semicells shown on plate LXXVI in the third volume of West's work does not occur in the specimens from Manipur, their cell-wall being of uniform thickness throughout.

That *C. manipurensis* represents *C. radiosum* in South-eastern Asia admits of no doubt. The distribution of the form-group—Pensylvania in the United States, the Creggan Loch in Ireland, and the Loktak Lake in Manipur—is certainly most remarkable.

80. *Cosmarium granulosum*, sp. nova.

Plate X, fig. 96 a-c.

Cellula a fronte visa circularis vel paullum prolato-elliptica, circiter 35 μ longa, 30–35 μ lata; isthmo 10 μ lato; sinu ab angulo interno rotundato gradatim ad orem modice ampliatus dilatatus, marginibus aut rectis aut paullulum curvatis; semicellulis semicircularibus vel margine apicali paullum depressis; membrana ubique granulis hemisphaericis conspicuis creberrimis obsita; semicellulis a latere visis ambitu circularibus, incisura media haud profunda; cellula a vertice visa elongato-elliptica, polis rotundatis; chlorophoris atque pyrenoidibus in utraque semicellula binis.

81. *Cosmarium longicollum*, sp. nova.

Plate XI, fig. 109 a-c.

Cellula a fronte visa ambitu oblongo-elliptica, duplo longior quam latior, 105 μ longa, 54 μ lata; isthmo circiter 27 μ lato, 9–12 μ longo, cylindrico; sinu fere uni-

formiter lato, annulum circulare circum isthmum formante; semicellulis a fronte visis prolato-semiellipticis, basi cum sinu angulum fere rectum efficientibus, apice rotundis neque truncatis; membrana tota dense verruculosa; pyrenoidibus in utraque semicellula singulis; semicellulis a latere visis aspectum similem praebentibus atque aspectum frontalem, sed latitudine minori, 45-49 μ ; a vertice visis ellipticis.

82. **Cosmarium scissum**, sp. nova.

Plate X, fig. 100 *a-b*.

Cellula a fronte visa subcircularis, diametro 30 μ ; isthmo angusto, 6 μ lato; sinu ad angulum internum rotundato, lineari, latitudine aequali, 6 μ metiente; semicellulis a fronte visis semiorbicularibus, ad angulos inferiores subacutis, vix denticulatis, lateribus leviter curvatis vel subrectis, apice convexo vel paulum applanato, margine laterali et apicali minutissime denseque crenulatis, superficie ceteroqui laevi; pyrenoidibus plus minusve remotis atque chlorophoris in utraque semicellula binis; cellula a vertice visa oblongo-elliptica, polis obtusis, medio haud protruso.

83. **Cosmarium scutellum**, Turner.

Plate X, fig. 95.

Cellula tam lata quam longa vel paulo longior, diametro 37-44 μ , vel longitudine 42 μ , latitudine 36 μ ; isthmo 11-13 μ lato; sinu ad angulum internum circulariter ampliato, deinde ad orem usque sensim sensimque dilatato, sed toto angusto; semicellulis subtrapezoidis vel fere semicircularibus, apice plane truncatis vel truncato-rotundatis; lateribus lenissime convexis; margine sinuato-crenulato, crenulis plus viginti; facie frontali serie unica intramarginali verruculorum notata, ceteroqui laevi vel subtiliter punctata: chlorophoris semicellularum manifeste per isthmum connexis, divergentibilobis, lobulis integris vel bilobulatis, lobo utroque pyrenoidem includente.

Turner. p. 66, t. IX, fig. 38.

84. **Cosmarium thangaicum**, sp. nova.

Plate XI, fig. 106 *a-c*.

Cellula a fronte visa prolato-elliptica, 55 μ longa, 40 μ lata; isthmo circiter 15 μ lato; sinu lineari, ad extremitatem internam rotundato neque ampliato; semicellulis fere semiorbicularibus, angulis basalibus rectis, margine aequaliter curvato, minutissime sinuato-crenulato, crenulis circiter viginti; superficie frontali seriebus 2-4 granulorum margini parallelis ornata, parte centrali isthmoque laevibus; semicellulis a latere visis circumscriptione fere orbicularibus, incisura media latere utroque cordata; a vertice conspecto elliptico-oblonga, axi maiori duplo longiore quam axis minor, polis obtusis; chlorophoris atque pyrenoidibus in utraque semicellula singulis.

85. **Cosmarium loktakense**, sp. nova.

Plate XI, fig. 108 *a-c*.

Cellula tam longa quam lata, 18 μ crassa, longitudine et latitudine 33 μ ; isthmo 9 μ lato; sinu ex angulo interno ad oram usque gradatim ampliato, marginibus laevibus,

rectis; semicellulis a fronte conspectis subtrapezoideis, angulis inferioribus subacutis vel obtusis; lateribus rectis, apicem versus convergentibus; apice truncato, recto; lateribus sinuato-crenulatis, crenaturis circiter sex; tuberculis apicalibus 5-6, brevissime truncato-conicis, angulis apiculatis; superficie frontali serie unica intramarginali granulorum hemisphaericorum ornata, granulis circiter 15; cellula a latere visa medio obtriangulariter incisa, semicellulis ad angulos basales rotundatis, cum lateribus fere rectis apicem versus convergentibus, apice truncato, margine minute sinuato-crenulato; cellula a vertice conspecta rhomboidea, polis obtusis, angulis medianis paullum incrassato-productis; pyrenoidibus in utraque semicellula binis.

86. **Cosmarium pseudocoronatum**, Turner.

Plate XI, fig. 112.

Cellula a fronte visa subquadrato-oblonga, modo paullo longior quam latior, modo paullo latior quam longior, 51μ longa et 45μ lata vel in exemplaribus alteris 46μ longa et 48μ lata; isthmo $15-18\mu$ lato; sinu fundum versus ampliatio, medio fere clauso, ore modice ampliatio; semicellulis ambitu transverse oblongis, apice leviter rotundato-truncatis, angulis basalibus rotundatis margine crebre minuteque sinuato-crenulatis, in superficie frontali seriebus quinque vel sex granulorum rotundato-conicorum concentricis ornatis; pyrenoidibus et chlorophoris in utraque semicellula binis.

87. **Cosmarium quadrilaterum**, sp. nova.

Plate XI, fig. 111 a-c.

Plate XIII, fig. 143.

Cellula a fronte visa circumscriptione exacte rectangularis, 51μ longa, 45μ lata, ad angulos paullulum rotundata; isthmo 13μ lato; sinu lineari vel ab angulo interno ad orem usque sensim modice ampliatio; semicellulis transverse rectangulari-oblongis, basi subacutis, lateribus subrectis, apice truncato, vix convexiusculo, marginibus lateralibus et apicali crenato-granulatis, granulis arcte appositis; semicellulis a latere visis circularibus, incisura media haud profunda, fundo acuto; cellula a vertice conspecta oblongo-elliptica, polis rotundatis, lateribus leniter convexis; superficie membranae frontali, laterali apicalique granulis minoribus inter se paullulum remotis uniformiter obsitis; chlorophoris atque pyrenoidibus centraliter positis, in utraque semicellula binis.

Cosmarium quadrilaterum is very close to *E. pseudobroomei*, Wolle. Generally the latter species is smaller in size, the cells being $33-38\mu$ long and $29-36\mu$ broad, although Borge mentions that Australian specimens measure up to 45.5μ in length and breadth. Wallich's measurements of Indian specimens of *C. pseudobroomei* are according to Turner:

Length 33μ , breadth 29μ .

In all the illustrations of *C. pseudobroomei* seen by us all the marginal granules, whether seen in front, side, or end-view are similar to those occupying the intermarginal parts of the cell-wall and are similarly slightly remote from each other, not touching each other and of somewhat larger size than in *C. quadrilaterum*.

C. pseudobroomei has been reported from Wales, Galicia, the United States, Brazil, Africa, Central China, Java, Ceylon and Northern India. For illustrations of this species see: Wolle, Desmids, U. S., t. LI, fig 36, 37; Turner, Freshwater Algae of East India, t. IX, fig. 41; West, British Desmidiaceae, vol. IV, t. C, f. 7, 8; West, Fresh-water Algae of Ceylon, Trans. Lin. Soc., vol. VI, Bot., t. XXI, fig. 4.

88. **Cosmarium decacuminatum**, sp. nova.

Plate VIII, fig. 80.

Cellula a fronte visa ambitu truncato-elliptica, 30μ longa, 27μ lata; isthmo 9μ lato; sinu fere aequaliter lineari, ore vix ampliato; semicellulis circumscriptione subtrapezoideis, angulis basalibus obtusis, apicalibus rotundatis, apice truncato 16μ lato; membrana verruculosa, verruculis confertis, in superficie frontali in series margini parallelas dispositis; semicellulis a latere visis incisura abrupta separatis, subovatis, apice rotundato-truncatis; a vertice visis oblongo-ellipticis, polis subacutis; pyrenoidibus in utraque semicellula singulis.

Cosmarium decacuminatum is closely related to the following species, but differs from it by the more rounded upper angles seen in face-view, by the abrupt incision as seen in side-view and by the poles of the apical surface being rather acute.

89. **Cosmarium sexlaterum**, sp. nova.

Plate VIII, figs. 79 a-c, fig. 81 a-c.

Cellula a fronte visa ambitu fere sexangularis, medio profunde constricta, lateribus fere acquilongis, longitudine cellulae $22-33\mu$, latitudine $20-27\mu$, crassitudine $10-15\mu$, parte apicali $12-18\mu$ lata, $\frac{1}{2}-\frac{2}{3}$ maximae latitudinis; isthmo $10-15\mu$ lato; sinu anguste lineari, latitudine aequali aut angulo interno paullo ampliato; semicellulis ambitu a fronte visis trapezoideis, ad angulos inferiores obtuse rotundatis, lateribus apicem versus inclinatis, margine apicali recto; membrana tuberculis parvis, densis, in series tres ad quinque margini subparallelis ordinatis ornata, serie extima tuberculorum marginali; semicellulis a latere visis ellipticis, a vertice conspectis oblongo-ellipticis, polis rotundato-obtusis; chlorophoris atque pyrenoidibus in utraque semicellula singulis.

90. **Cosmarium subprotractum**, sp. nova.

Plate VIII, fig. 78 a-c.

Cellula a fronte visa ambitu truncato-subelliptica, 15μ longa, $12-13\mu$ lata; isthmo angusto, circiter 4μ lato; sinu lineari, angustissimo; semicellulis ad angulos inferiores obtusiusculis; lateribus parte inferiore cum sinu angulum rectum formantibus, supra medium leviter concavis, semicellulis idcirco apicem versus breviter productis; margine apicali recto, latitudine maxima cellulae tertia parte breviori; membrana crebrissime granulata, granulis ad marginem apicalem atque secundum margines laterales sex; semicellulis a latere visis subcircularibus, incisura modice profunda; a vertice conspectis elliptico-rhomboideis, polis obtusis, fere subacutis; pyrenoidibus in utraque semicellula singulis.

As regards the face-view *Cosmarium subprotractum* has some resemblance to *C. protractum*, (Naegeli) De Bary, *C. Corbula*, Brébisson, *C. Sportella*, Brébisson, and *C. Turpinii*, Brébisson, see West, Brit. Desmidiaceae, vol. III, t. LXXXII), but it differs from all of them by the absence of a central inflexion and in other characters.

91. ***Cosmarium protractulum***, sp. nova.

Plate X, fig. 101.

Cellula a fronte visa tam lata quam longa, 15μ diametro; isthmo dimidio angustiore latitudine cellulae; sinu angulo interno circulariter ampliato, deinde anguste lineari, ore vix ampliato; semicellulis ad angulum inferiorem obtuse rotundatis, margine laterali aut cum linea transversa cellulae angulum rectum efficiente aut saepius convexo rotundatoque, apice paullulum producto, truncato, recto; lateribus apiceque minutissime sinuoso-granulatis, superficie tota granulis vacata.

This species closely resembles in its outline and dimensions our species *Cosmarium subprotractum*, but the isthmus of the latter has only half the breadth (4μ), and, what is of special importance, the front surface of *C. protractulum* is entirely devoid of granulation. We have seen only empty cells and have therefore not been able to ascertain the number of pyrenoids in each semicell.

ARTHRODESMUS, Ehrenberg.

92. ***Arthrodesmus convergens***, Ehrenberg.

Plate XI, figs. 116, 117, 118.

Cellula a fronte visa circumscriptione late elliptica, medio late profundeque incisa, $45-48$ ($33-54$) μ longa, sine spinis $48-57$ ($40-64$) μ lata; spinis $4-6$ ($5-15$) μ longis; sinu ex angulo interno anguste rotundato mox valde ampliato, marginibus convexis, in spinas singulas, validas, acutissimas, convergentes vel rectas transeuntibus, semicellulis asymmetrice oblato-ellipticis, margine supra spinas leniter convexo vel apice vix applanato; cellula a latere visa utrinque medio cordatim incisa, semicellulis subcircularibus; a vertice conspecta elliptico-oblonga, utrinque in spinam singulam acuminatim producta; pyrenoidibus in utraque semicellula singulis, centraliter positis.

Two varieties occur:—

var *typica* (plate XI, fig. 116), with the opposite spines belonging to the two semicells convergent, and

var, *rectispina* (plate XI, fig. 117, 118) with the spines parallel.

De Toni, Chlorophyceae, p. 1058.

Ralfs, Brit. Desmids, p. 118, t. XX, fig. 3.

Cooke, Brit. Desmids, p. 136, t. XLVII, fig. 1.

Wolle, Desmids U. St., p. 95, t. XXIII, fig. 19-21.

Turner, p. 134, t. XI, fig. 42, t. XII, fig. 31.

West, Brit. Desmidiaceae, vol. IV, p. 106, t. CXVI, fig. 4-13.

XANTHIDIUM, Ehrenberg.

93. *Xanthidium fasciculatum*, Ehrenberg.Plate XII, fig. 119 *a-c*.

Cellula a fronta visa circumscriptione subpolygono-prolato-elliptica, sine spinis 56 (44-77) μ longa, 48 (44-65) μ lato; isthmo 16 (12-21) μ lato; sinu aut lineari aut angulo interno ampliato, deinde plus minusve constricto, ore iterum ampliato; semi-cellulis transverse polygono-ellipticis subreniformibusve, ad angulos plus minusve rotundatos spinas geminas, subbreves, validas, acutissimas, (8-) 11-16 μ longas gerentibus; superficie intramarginali in centro cum protuberantia humili granulis circumdata, aut protuberantia nulla, maxima parte areae laevi; semicellulis a latere visis subcircularibus, in parte medio cum protuberantia, raro sine ulla protuberantia; cellula a latere conspecta ad angulos apicales paribus spinarum instructa, media subcordatim incisa; a vertice visa elliptico-oblonga, lateribus leviter convexa, ad angulos polorum rotundatorum bispinosa; pyrenoidibus in utraque semicellula singulis (vel binis), centraliter positis.

Xanthidium fasciculatum has been reported from various parts of Europe, from Greenland, the United States, Brazil, Africa, and North Eastern India.

De Toni, Chlorophyceae, p. 918.

Ralfs, Brit. Desmids, p. 114, t. XX, fig. 4.

Wolle, Desmids U.S., p. 93, t. XXII, fig. 4, 5.

Turner, p. 100, t. XII, fig. 34.

West, Brit. Desmidiaceae, p. 75-77, t. CXI, fig. 6-8.

94. *Xanthidium antilopaeum*, (Brébisson) Kützing.Plate XVI, fig. 168, 169 *a-c*.

Cellula fere tam lata quam longa, 50 (42-76) μ longa, 50 (42-72) μ lata, medio profunde constricta; crassitudine cellulae 25 (21-37) μ ; isthmo 15 (14.5-26) μ lato; sinu ad angulum internum rotundato, fere lineare, ad orem ampliato; semicellulis a fronte visis ambito elongato-ellipticis, irregulariter hexagonis, angulis rotundatis, axi majori horizontali, quam axis minor duplo longiori; angulis apicalibus atque lateralibus spinis geminis armatis; spinis 15-20 (12-40) μ longis, validis, acutissimis, rectis vel plus minusve curvatis; area centrali superficiei frontalis scrobiculis obsita, incrassata, ambitu elliptica vel circulari, circiter 20 μ diametro; semicellulis a latere visis circularibus vel subcircularibus, medio paullum incrassatis, apice spinas binas divergentes ostendentibus; a vertice conspectis ellipticis, medio paullulum incrassatis, polis utrisque spinis modice divergentibus armatis.

Lund's variety *triquetrum* and Schmiegle's variety *lacva* are considerably larger.

Xanthidium antilopaeum is widely distributed.

For the extensive literature we may refer to West, *British Desmidiaceae*, p. 63, 64, 66, 67-70 of vol. IV.

95. **Xanthidium raniganjense**, Turner.Plate XI, fig. 113 *a-c*.

Plate XV, fig. 161.

Cellula a fronte visa circumscriptione subcircularis vel saepius late elliptica, sine spinis 40-45 (-50) μ longa, 35-40 (-48) μ lata, tam longa quam lata, vel paullum longior quam latior; isthmo 10-15 μ lato; sinu ad extresnitatem internam paullum ampliato rotundatoque, deinde contracto, fere clauso, orem versus iterum dilatato; semicellulis a latere visis subcircularibus; cellula a latere conspecta medio acute obtriangulariterque incisa; a vertice visa elliptico-oblonga, polis rotundatis quinque-spinosis, lateribus modice convexis sine spinulis, axi maiore sesqui longiore quam axis minor; marginibus lateralibus atque apicali et linea intramarginali spinis crebris brevibus obsitis; tumoribus centralibus nullis, sed interdum areola supra pyrenoides circulo spinulorum circumdata; chlorophoris et pyrenoidibus in utraque semicellula binis.

Common in the Loktak Lake; reported from the Raniganj Coalfield and Central India.

Turner, l.c., p. 102, t. XIII, fig. 11.

96. **Xanthidium loktakense**, sp. nova.Plate VIII, fig. 82 *a-c*.

Cellula a fronte visa tam lata quam longa, 22 μ longa lataque; isthmo 6 μ lato; sinu ab angulo interno acuto sensim ampliato, ore 2-3 μ lato; semicellulis a fronte conspectis transverse oblongis, lateribus cum axi transversario angulum rectum efficientibus, ad angulos inferioribus atque superioribus obtusos spinulis brevibus acutissimis binis instructis, tertia parte superficiei apicalis breviter sed manifeste protrusa, relinquis duabus partibus lateralibus fere planis vel paullulum concavis, parte elevata denticulata; semicellulis a latere visis septemlateris, lateribus basalibus semicellularum inter se divergentibus, lateralibus parallelis, subapicalibus concavis, terminali recto denticulatoque; cellula a vertice visa ambitu anguste elongato-subrhomboidea, angulis truncatis, medio utroque latere rotundato-protrusa, polis rotundatis, lateribus concavis; polis atque protrusionibus medianis utroque angulo spinulis binis instructis; pyrenoidibus conspicuis, centraliter positis, atque chlorophoris in utraque semicellulis singulis.

Xanthidium loktakense is only distantly related to *X. indicum*, Lagerheim.

STAURASTRUM, Meyen.

97. **Staurastrum muticum**, Brébisson.Plate XII, fig. 128 *a-c*.

Cellula a fronte visa ambitu circularis vel late prolato-elliptica, 36 (22-44) μ longa, 30 (21-38) μ lata; isthmo 12 (7.5-12) μ lato; sinu aperto, obtriangulari, marginibus rotundatis, angulo interno acuto, apertura circiter 10 μ lata; semicellulis asymmetricis

ellipticis vel subreniformibus, angulo supra sinum obtuse rotundato, margine super angulum convexo; cellula a vertice visa circumscriptione triangularis (vel quadrangularis), angulis late rotundatis, lateribus concavis; membrana laevissima, firma; pyrenoidibus in utraque semicellula singulis, conspicuis.

Staurastrum muticum is cosmopolitan.

De Toni, Chlorophyceae, p. 1177.

Ralfs, Brit. Desmids, p. 125, t. XXI, fig. 4, t. XXXIV, fig. 13.

Rabenhorst, Flor Æur. Alg., III, p. 200.

Wolle, Desmids U.S., p. 119, t. XXXIX, fig. 11, 12.

Cooke, Brit. Desmids, p. 156, t. LI, fig. 6.

Hansgirg, Prodrumus, p. 210.

West, Brit. Desmidiaceae, vol. IV, p. 133-135, t. CXVIII, fig. 16-20.

98. *Staurastrum triskeles*, sp. nova.

Plate XII, fig. 129 a-c.

Cellula a fronte visa quadriloba, 18μ longa lataque, lobis divergentibus; isthmo 6μ lato; sinu lato, fere rectiangulo, angulo apice subacuto; semicellis a fronte visis ambitu obtriangularibus, apice profunde retusis, a vertice conspectis ambitu triangularibus, lateribus concavis, polis late rotundatis; lobis crassis, angulum 120° inter se efficientibus, oblique sursum divergentibus, subcylindricis, apice hemisphaerice rotundatis; pyrenoidibus conspicuis, in utraque semicellula singulis; membrana laevi.

The relationship of the present species appears to be with *St. Clepsydra*, Nordstedt, and *St. inelegans*, W. et G. S. West, but the differences are considerable. (Compare West, British Desmidiaceae, vol. IV, 152-154, t. CXXII, fig. 6. and t. CXXIV, fig. 2-4.) *St. Clepsydra* has been reported from Northern Europe, Greenland, Poland, the United States and Brazil; *St. inelegans*, has only been found in a loch on the island of Lewis belonging to the Outer Hebrides.

99. *Staurastrum orbiculare*, Ralfs, var. *depressum*, Roy et Bisset.

Plate XII, fig. 125 a-b.

Cellula a fronte visa circumscriptione orbicularis, vel paullulum longior quam latior, 22-30 μ longa, 25-27 μ lata; sinu lineari, ad orem vix ampliato; isthmo 6-9 μ lato; membrana laevi; semicellis semicircularibus, apice uniformiter rotundatis vel paullum depresso (saepe una semicellula stricte semicircularis, altera rotundato-subtruncata); angulis basalibus obtuse rotundatis; pyrenoidibus in utraque semicellula singulis.

Staurastrum orbiculare, var. *depressum* has been reported from England, Wales, Scotland, Ireland, Sweden, Northern Russia, Galicia, Central China, Japan, Siam, Madagascar, Australia and New Zealand.

De Toni, Chlorophyceae, p. 1181.

West, Brit. Desmidiaceae, vol. IV, p. 158, t. CXXIV, fig. 17-19.

100. *Staurastrum thangaicum*, sp. nova.

Plate XII, fig. 127 a-c.

Cellula a fronte visa tam lata quam longa, longitudine circiter 21μ , medio profunde constricta; membrana laevis, haud punctulata; semicellulis transverse oblonga, lateribus rotundato-convexis, apice truncato, aut recto aut leniter convexo, haud retuso; sinu ad orem clauso, ad angulum internum paullulum ampliato; isthmo circiter 6μ lato; cellula a vertice visa ambitu triangularis, angulis late rotundatis, lateribus manifeste incurvis; pyrenoidibus in utraque semicellula singulis, conspicuis, centraliter positis.

The affinities of the present species are undoubtedly with *Staurastrum retusum*, Turner (see Turner, Fresh-water algae of East India, p. 104, t. XIII, fig. 13; West, British Desmidiaceae, vol. IV, p. 160; also West, Fresh-water algae from Burma, in Annals of the Royal Botanic Garden, Calcutta, vol. VI, part II, p. 216, t. XI, fig. 30-32). The typical form of *St. retusum*, as described and figured by Turner, has semi-cells which in front-view are trapezoidal in outline and, as the name indicates, the apical margin is retuse; West's figures are similar, although figure 32 of plate XV of the account of algae from Burma comes tolerably close to our species. *Staurastrum retusum*, var. *boreale* W. et A. S. West, although smaller, is similar in outline, except that the sides of the triangular vertical aspect are less incurved than seen in the Loktak Lake specimens.

It may be advisable to unite *Staurastrum retusum* var. *boreale* with *St. loktakense*; the two agree with each other in the outline of the cell and in the total absence of punctulations in their membrane. We should have preferred to adopt the name *St. boreale*, if that name were not inappropriate with regard to a species which occurs also in subtropical regions, the name, in addition, being originally applied only to a variety. We may therefore distinguish two varieties—

Var. **subtropicum**, 21μ and more in length and breadth, and

Var. **boreale**, 16-19 μ long and broad.

101. *Staurastrum Dickiei*, Ralfs.

Plate XII, fig. 123 a-b.

Cellula a fronte visa fere circularis, 24-32 μ longa, 26-30 μ lata; isthmo 8-10 μ lato; sinu ex parte interiore angustissimo, fere lineari, modice ampliato; membrana firma, laevi; semicellulis semicircularibus, angulis basalibus acutis, in spinas brevissimas, 1-1.5 μ (in aliis formis 2-3 μ) productis, spinis oppositis semicellularum plus minusve inter se convergentibus; cellulis a vertice visis circumscriptione triangularis, lateribus 30 μ longis concavis, polis rotundatis in spinam validam terminatis; pyrenoidibus in utraque semicellula singulis, conspicuis.

Staurastrum Dickiei has been reported from various parts of Europe, Novaya Zemlya, the United States, Japan, Siberia, Northern India, and New Zealand.

De Toni, *Chlorophyceae*, p. 1130.

Ralfs, *Brit. Desmids*, p. 123, t. XXI, fig. 3.

Wolle, *Desmids U.S.*, p. 122, t. XL, fig. 5, 6, t. LI, fig. 20, 21.

Cooke, *Brit. Desmids*, p. 140, t. XLIX, fig. 3.

102. **Staurastrum delectum**, Brébisson.

Plate XII, fi. 120, t. a, b, 121 a, b, 122 a-c.

Cellula a fronte visa 16-30 μ longa, sine spinis 18-25 μ lata; isthmo tertiam partem cellulae latitudinis metiente, interdum distincte elongato; sinu semielliptico aut latissime obtriangulari, marginibus subrectis vel convexis, angulo interno acuto; semicellulis ambitu subtrapezoideis vel obtriangularibus, apice subtruncatis vel convexis vel concavis, medio marginis apicalis interdum leviter inciso, polis in spinam validam brevem inflexam vel reflexam abeuntibus; spinis 3-5 (-8) μ longis; pyrenoidibus in utraque semicellula singulis.

Reported from various parts of Europe, from the United States, Siberia, Northern India, and New Zealand.

De Toni, Chlorophyceae, p. 1137.

Ralf, Brit. Desmids, p. 121, t. XX, fig. 5.

Hassall, p. 350, t. LXXXIV, fig. 8.

Wolle, Desmids U.S., p. 121, t. XL, fig. 7-11.

Cooke, p. 138, t. XLIX, fig. 1.

Turner, p. 106, t. XIX, fig. 14.

103. **Staurastrum Annandaleanum**, sp. nova.

Plate XII, 124 a-b.

Cellula 48 μ longa, 36 μ lata; isthmo 15 μ lato; sinu latissimo, ad angulum internum constricto; semicellulis trigono-obpyramidatis, costis lateralibus medio rotundato-retusis, angulis apicalibus rotundatis et aculeo valido, fere verticali, brevi, acuto munitis; cellula a vertice visa ambitu triangulari, polis rotundatis; lateribus medio concavis, distantia inter angulos 34 μ ; membrana laevi; chlorophoro semicellulae subconformi, a vertice conspecto late obtriangulariter trisecto; pyrenoidibus in utraque semicellula singulis.

104. **Staurastrum loktakense**, sp. nova.

Plate XII, fig. 131 a-b.

Cellula a fronte visa circumscriptione quadrata vel rectangulari-oblonga, 24 μ longa, 18-24 μ lata; sinu isosceles-obtriangulari, fundo acuto; isthmo 9 μ lato; membrana firma, laevi; semicellulis a fronte visis obtriangularibus, apice truncato, recto, angulis interne rotundatis, externe aculeis tribus, validis, acutis, brevibus, 6 μ longis armatis; cellula a vertice visa cruciformis, processibus apice rotundatis, longitudine tertia pars cellulae diametri; pyrenoidibus in utraque cellula singulis, conspicuis, centraliter positis.

105. **Staurastrum Horae**, sp. nova.Plate XII, fig. 130 *a-c*.

Cellula a fronte visa circumscriptione rectangulari-oblonga, 24μ longa, 18μ lata; isthmo 9μ lato; sinu amplo, obtriangulari, angulo interno fere recto; membrana firma, laevi; semicellulis a fronte visis circumscriptione inaequaliter sexangulari, inferiore parte laterum extrorsum inclinata, superiore parte verticali, margine apicali recto, spinis duabus ad angulos positis et duabus intermediis instructo, superiore parte laterum spinis duobus armata, margine inter spinas retuso; cellula a latere visa ambitu inaequaliter pentagona, lateribus sinum apertum limitantibus rectis, iis ad apicem convergentibus, ad angulos spinis binis, medio spina singula armatis, inter spinas retusis; cellula a vertice conspecta stricte quadrata, angulis rotundatis atque spinis tribus obsitis; chlorophoro in conspectu frontali et laterali in utraque semicellula late obtriangulare, in conspectu apicali cruciformi; pyrenoidibus in utraque semicellula singulis.

106. **Staurastrum Prasadianum**, sp. nova.Plate XI, fig. 114 *a-b*.

Cellula a fronte visa circumscriptione transverse oblongo-elliptica, 60μ lata, 39μ longa; isthmo circiter 10μ lato; sinu obtriangulari, late aperto, fundo anguste acuto, lateribus obscure sigmoideis, introrsum laevibus, extrorsum denticulis 3-4 obsitis; semicellulis a fronte visis subtrapezoideo-obtriangularibus, margine apicali leniter uniformiterque convexo, denticulis crebris (12-14), breviter conicis, truncatis, bi-apiculatis ornatis; polis bidentatis; superficie frontali serie denticulorum intramarginali notata, ceteroqui laevi; cellula a vertice visa fusiformi-elliptica, versus polos spinis binis instructis acuminatim angustata, in sectione optica lineas denticulorum ostendens, axi minore 12μ longa; pyrenoidibus, ut videtur, in semicellula utraque binis.

The present species is undoubtedly a *Staurastrum*; the contents of the cell under the influence of the preservative are greatly contracted, but their appearance clearly indicates the presence of two pyrenoids in each semicell. Although most of the species of *Staurastrum* possess only one pyrenoid in each semicell, *St. grande* may have 1-3.

107. **Staurastrum leptocladum**, Nordstedt.Plate XIII, fig. 140, 141 *a-b*.

Cellula $35-45\mu$ longa, medio leviter incisa, angulo interno incisurae acuto; isthmo $8-12\mu$ lato; semicellulis a fronte visis parte inferiore subcampanulatis, apice plus minusve convexis, paullum sub apicem utroque latere in processum achroum, elongatum e basi ad apicem breviter bi-vel trispiculosum gradatim attenuatum transeuntibus, processibus quattuor cellulae in eodem plano verticali dispositis, rectis vel plus minusve recurvis, marginibus cellulae atque processuum minutissime crebreque sinuato-crenulatis, superficie inferiore semicellularum saepius laevi; semicellulis prope apicem medium aut aculeis oblique dispositis praeditis aut sine aculeis; cellula a vertice visa centro subcircularis, aculeis binis oblique oppositis aut sine

aculeis, in processum gracilem latere utroque prolongata; pyrenoidibus in utraque semicellula singulis.

Both var. *typicum* (see Wolle, Desmids of the United States, t. XLIV, fig. 4-5) and var. *cornutum* Wille (see Turner t. XIV, fig. 12, 16) occur in the Loktak Lake; var. *cornutum* appears to be rather more common.

Staurastrum leptocladum typicum has been reported from the United States and Brazil and possibly occurs in Burma, whilst the variety *cornutum* has been gathered in Brazil, in Central India and in the Raniganj Coalfield.

The dimensions of *St. leptocladum* are according to Nordstedt: length 30-38 μ , width including horns 66-97 μ ; according to Wolle: length 25 μ , width including the horns 80-100 μ ; the Brazilian var. *cornuta* is, according to Wille, 40 μ long, 100 μ wide; Turner gives the dimensions, according to Wallich's drawings: length 45-50 μ , breadth 90-98 μ , thickness 17 u, horns 33 μ .

De Toni, Chlorophyceae, p. 1233, 1234.

Turner, p. 121, t. XIV, fig. 12-16.

108. *Staurastrum ascendens*, sp. nova.

Plate XIII, fig. 142 a-c.

Cellula a fronte visa biobtriangularis, quadricornuta, cornubus ascendentibus, circiter 12 μ longis, basi 5-6 μ , apice 2-2.5 μ crassis, distantia inter apices cornuum eiusdem semicellulae 30 μ , inter apices oppositos ambarum semicellularum 36-40 μ ; longitudine cellulae 18-21 μ , latitudine et crassitudine 9-10 μ ; semicellis a fronte visis circumscriptione (cornubus exclusis) obtriangularibus, marginibus lateralibus modice convexis in marginem exterum cornuum sensim transeuntibus, omnibus creberrime sinuato-denticulatis, margine apicali semicellularum spinulis binis bidenticulatis instructis, cornubus apice bispinulosis; cellula a latere visa medio acute incisa, ambitu oblongo-elliptica, utrinque in cornum sublinearem attenuata; a vertice visa elliptica, bicornuta; pyrenoidibus in utraque semicellula singulis, centraliter positus.

This species belongs to the group which includes, among others, *St. tetracerum* Ralfs, *St. leptocladum* Nordstedt, *St. gralatorium*, Nordstedt and *St. assurgens* Nordstedt; its front-view and ornamentation distinguishes it at once from all the other species of the group.

109. *Staurastrum manipurense*, sp. nova.

Plate XII, fig. 132 a-b; fig. 133 a-b; fig. 134 a-b; fig. 135; fig. 136 a-b.

Cellula, cornubus inclusis, a fronte visa 30-35 μ lata, 21-29 μ longa; isthmo 6-12 μ lato; sinu valde aperto, subsemielliptico, angulo interno acuto, amplitudine aperturae plus pars dimidia latitudinis cellulae (cornubus inclusis); semicellis a fronte visis ambitu subtrapezoides; margine apicali paullum convexo, lateralibus modice concavis, marginibus omnibus minute sinuosis; processibus e basi ad apices bi-vel trispinulosos sensim attenuatis, transverse rugulosis; cellula a vertice visa tri-vel quinque-vel sexradiata; chlorophoro a vertice viso aut lobato aut stellato,

lobis acutis vel obtusis, integris vel bifidis, eodem numero quam radii; pyrenoidibus in utraque semicellula singulis, conspicuis.

It is possible that more than one species is included in the above description; but the state of preservation of the specimens renders an accurate description of the chlorophore impossible.

110. *Staurastrum dicodon*, sp. nova.

Plate XII, fig. 137 *a-b*.

Cellula bicampanulata, 36μ longa, cornubus inclusis, 39μ lata, sub cornua circiter 18μ diametro; isthmo 9μ diametro; sinu amplissimo, apertura maxima inter apices cornuum oppositorum plus 25μ metiente; processibus a vertice visis radiantibus, in exemplaribus visis quinque, marginibus minutissime sinuosis, apice subtruneato retuso vel bispinuloso; incisura mediana cellulae manifesta, sed minime profunda; margine apicali modice convexo; chlorophoro forma cellulae conformi, a vertice viso obtriangulariter quinquelobo, lobis bilobulatis; pyrenoidibus in utraque semicellula singulis, conspicuis.

111. *Staurastrum pseudosebaldí*, Wille.

Plate XII, fig. 126 *a-b*.

Cellula bicampanulata, $45-50\mu$ longa, distantia inter apices processuum longitudinem cellulae circiter quarta parte excedente; isthmo 15μ lato; sinu truncato-semielliptico, amplissimo, inter apices processuum circiter 45μ lato, ad angulum internum brevissime obtriangulariter constricto; semicellis prope basim seriebus binis horizontalibus spiculorum obtuse conicorum praeditis, lateraliter gradatim in processus (cornua) apice tricuspidatos rectos vel paullum incurvos, seriebus quatuor denticulorum obsitos transeuntibus; cellula a vertice visa triangularis, triradiata, lateribus concavis, superficie apicali modice convexa, dentibus truncato-conicis vel obscure bidenticulatis, circiter 3μ longis instructa; chlorophoro corpori cellulae subconformi; pyrenoidibus in utraque semicellula singulis, conspicuis.

The Loktak Lake form comes close to the form first described by Wille, which is said to have been found in the Himalayas.

Forms of this species have been observed in Bohemia, Poland, Norway, the United States, Siberia, and New Zealand; Turner describes two varieties from the Raniganj Coalfield.

De Toni, Chlorophyceae, p. 1178, 1179.

Wolle, Desmids U.S., p. 139, t. XLVI, fig. 8, 9.

Turner, p. 123, 124, t. XIV, fig. 14, t. XVI, fig. 14.

112. *Staurastrum pansum*, Turner.

Plate XIII, fig. 139 *a-b*.

Cellula $27(-33)\mu$ alta, e semicellis forma pyramidis trigonalis fere acquilateralis apice truncatae composita; basi pyramidis modice rotundato-convexa, zonis angulariis rotundato-obtusatis, medio infractis, parte suprabasali fere verticali cum parte

subapicali obliqua angulum obtusum efficiente; angulis omnibus processibus geminis, brevibus, validis, inter se divergentibus, apice tridentatis $6-8\mu$ longis instructis; zonis lateralibus inter processus asymmetricè incavatis, parte earum ad isthmum inclinata sigmoideo-curvata; cellula a superficie latiori visa circumscriptione triangularis, angulis late rotundalis; lateribus isthmi circiter dimidia longitudine quam latera superficiei oppositae, partibus duabus zonarum lateralium fere tertiam partem zonarum superficiei terminalis metientibus; pyrenoidibus in utraque semicellula singulis, conspicuis, centraliter positis.

The species was founded by Turner on specimens collected by Dr. Wallich in the Raniganj Coalfield.

Turner, *l. c.* p. 117, t. XIII, fig. 32.

Plate XII, fig. 138 represents a species of *Staurastrum* evidently belonging to the group of which *St. gracile* Ralfs is a member. It was represented only by a single specimen and we have secured only the end-view.

SPHAEROSOMA, Corda.

113. *Sphaerosoma pygmaeum*, Cooke.

Plate XIV, fig. 150 *a-d*.

Cellulae in filamentum taeniiforme superficibus terminalibus subplanis firme coniunctae, $8-10\mu$ longae, ($8-10-12\mu$) latae, 6μ crassae, in exemplaribus loktakensibus latiores quam longiores; a fronte visae medio sinu aut rotundato-obtriangulari aut sublineari fundo acuto profunde incisae; semicellulis a fronte visis lineari-oblongis, lateribus rotundatis; a latere conspectis circularibus; a vertice visis linearibus, polis rotundatis, 12μ longis, 6μ latis; isthmo 4μ lato; contentu dense granuloso; pyrenoidibus in utraque semicellula singulis, centraliter positis.

Reported from England and Ireland.

De Toni, *Chlorophyceae* p. 793.

Cooke in *Grevillea*, vol. IX, p. 39.

114. *Sphaerosoma pulchrum*, Bailey, sub. sp. *thangaense*, subsp. nova.

Plate XIV, fig. 147 *a-c*, fig. 148 *a-c*.

Cellulae in filum longum, taeniiforme, manifeste tortum coniunctae, a fronte visae circumscriptione transversim oblongae, tertia parte vel dimidio brevior quam latior, profunde bilobae, $10-16\mu$ longae, $22-27\mu$ latae, crassitudine cellulae 10μ ; lobis rotundatis; isthmo 6μ lato; sinu aut fere lineari aut saepius e fundo acuto sensim ampliato; semicellulis a fronte visis lineari-oblongis, a latere conspectis circularibus, a vertice visis oblongo-ellipticis, polis obtusis; pyrenoidibus in utraque semicellula singulis; processus brevissimi inter cellulas frequenter adsunt.

As just mentioned, a pair of tubercles at the end surfaces of the cells is frequently visible; they are more evident on the outer end-surfaces of the cell chains; within the chain they appear, where present, to be squeezed together. Wollé's figure 12, t. LIX, in *Fresh-water Algae of the United States*, indicates the existence of terminal tubercles.

All the other forms previously described by various authors are distinctly or even considerably larger than the Loktak form. Thus the dimensions of var. *brasiliense* are: length 37–43 μ , breadth 70–84 μ , thickness 22–25 μ , width of isthmus 21–26 μ . Whether Lundell's var. *triquetrum* belongs really to *Sph. pulchrum* may be considered doubtful; it is 24 μ long and 36 μ broad (De Toni, *Chlorophyceae*, p. 794). Nearer to our subsp. *thangaense*, as far as dimensions are concerned, is *Spondylosium Lundellii*, Borge (see Borge, in *Arkiv för Botanik*, vol. XV, No. 13); it is 18.5 μ long, 31.5–33 μ broad, 18–19 μ thick, the isthmus being 23–24.5 μ wide, but as shown in fig. 6 of t. 6 of the publication just cited, the cell of *Sp. Lundellii* as seen from the top appears oblong with nearly parallel sides and triangularly produced ends.

Sphaerosma pulchrum appears to be chiefly confined to the United States and Brazil. For literature refer to

De Toni, Chlorophyceae, p. 793, 794.

Ralfs, Brit. Desmidiaceae, p. 209, t. XXXV, fig. 2.

Wolle, Desmids U.S., p. 29, t. IV, fig. 1, 2.

Wolle, Freshw. Algae, U.S., p. 22, t. LIX, fig. 2 and Borge, *l. c.*

115. ***Sphaerosma trilobum***, (Joshua pro var. *Sphaerosmatis pulchri*).

Plate, XIV, 149 a–d.

Cellulae in filum consociatae, 24–30 μ longae 15–30 (–45) μ latae, medio plus minusve profunde rotundato-incisae; semicellulis a fronte visis rotundato-triangularibus (vel oblongis, apice late rotundatis) saepissime manifeste inter se inaequalibus; isthmo 6–10 μ lato; sinu ad angulum internum rotundato; cellula a vertice visa ambitu triangularis, lateribus conspicue concavis, polis late rotundatis; pyrenoidibus in utraque semicellula singulis.

We describe the form under a separate specific name, although it appears to be abnormal and possibly pathological. If the latter view should turn out to be correct, the form would not even be entitled to varietal rank. Both it and *Sphaerosma pulchrum* forma genuina appear to be rather common in the Loktak Lake, but we have observed no transitional forms between the two. Chains of cells without any separating walls developed between successive cells are not uncommon. The same appears to be the case with the form from Lower Burma. The cells are, as a rule, attached to each other by their narrower end. In the form collected by Dr. Romanis in or near Rangoon and described by Joshua the three lobes seen in end-view are attenuated towards their base, giving the end-view a propeller-like appearance and reminding the observer, to a certain extent, of *Streptonema trilobatum* Wallich or *Phymatodocis alternans* Nordstedt. In the Loktak Lake form, however, the constriction is not seen. *Spondylosium nitens* (Wallich) Archer may also be compared (see Turner, t. XVIII, fig. 6, 7, 10, 11, 17).

De Toni, Chlorophyceae, p. 793.

Joshua in Linnean Society's Journal, Botany, vol. XXI, p. 635, 636, t. XXII, fig. 1, 2.

116. *Sphaeroszma manipurens*, sp. nova.

Plate XIV, fig. 152 a-c.

Cellulae in filamentum planum vel plus minusve tortum consociata et processibus binis brevissimis arcte appositae; a fronte visae ambitu fere quadratae, circiter 12μ longae lataeque, ad quartam partem bilobae, lobis rotundatis; sinu subquadrangulati vel obtriangulati, fundo rotundato; superficie terminali fere plana, utroque latere processum tuberculiformem gerente; semicellulis a fronte conspectis transverse oblongis, lateribus rotundatis; isthmo 6μ lato; semicellulis a latere visis late ellipticis, fere circularibus; a vertice visis elliptico-oblongis; pyrenoidibus in utraque semicellula singulis.

The present species is closely related to *Sph. filiforme*, as described by Ralfs, Cooke, Wolle, Hansgirg and Turner, but differs from that species by the tubercles connecting adjacent cells being very short, the result being that the end-faces are practically in contact with each other and not leaving an appreciable gap between them, as shown in Cooke, British Desmids, t. II, fig. 6 and in Turner's monograph, p. 142, t. XVII, fig. 20. Turner says with reference to the gap: "Frondes non appositae, seiunctae; processus intervenientes foramen quasi formantes." Wolle's figures in "Desmids of the United States," plate IV, fig. 5, 6 shows the gap only indistinctly, the end-surfaces being more or less convex, as also indicated by Turner, when he remarks of the cells: "dorso leniter convexis." We have not observed forms between that depicted by Turner under the name of *Sph. filiforme* and the Manipur specimens. The dimensions of the former are stated to be: length of cell 13-14 μ , breadth 17-19 μ , thickness 8-9 μ , breadth of isthmus 5-6 μ , processes 3 μ . The absence of a mucous sheath in our Loktak specimens is probably due, as in other cases, to the action of the preservative.

117. *Sphaeroszma loktakense*, sp. nova.

Plate XV, fig. 158, a-d.

Cellulae in catenam pluricellularem, haud fragilem coniunctae, a fronte visae circumscriptione octagonae, 24μ longae, 21μ latae, crassitudine 6-8 μ , medio obtriangulater acuteque constrictae, apice utroque in processum subtrapezoideum 3μ longum, 15μ latum, 3μ crassum, lateraliter subconvexo-rotundatum, et ad busim 4μ latum, apice truncatum terminatae; segmentis lateralibus cellulae ovatis, circiter 6μ longis, apice brevissime mucronatis, lateribus convexis; sinu ad angulum internum paullulum rotundato, haud plane acuto; cellulae a latere visae partes quattuor orbiculares ostendentes, mediis binis 6-8 μ , terminalibus 3μ diametro; cellula a vertice conspecta lineari-oblonga, 6-8 μ lata, polis mucronula instructis, subrotundatis; chlorophoro circumscriptione cellulae simili; protoplasmate dense granuloso; pyrenoidibus in utraque semicellula singulis.

As in other cases, the absence of a mucous envelope in the Loktak specimens is evidently due to the action of the preservative medium. The latter cause is clearly shown to have been at work in the case of *Hyalotheca desiliens* forming part of the

Loktak Lake collection; in these specimens no trace of a mucous sheath is discernible, whilst fresh specimens gathered from a drain in Shillong exhibit the mucous envelope most beautifully.

The present species appears to have its nearest ally in *Spondylosium lamelliferum* (Corda) Turner, var. *attenuatum* Turner (see Turner, Freshwater Algae of East India, p. 46, 47, plate XXI, fig. 2), but in *Sph. loktakense* the connecting "cushion"—we should prefer the term "buffer"—is subtrapeziform, with the end-surface broader than the inner joint, whilst in Turner's figure the joint is somewhat broader than the end-surface; further in *Sph. loktakense* the lateral main-lobes are ovate and mucronate and the sinus separating them is obtriangular, whilst in Turner's variety the main-lobes are narrow-oblong, rounded at their apex and the sinus is broadly sublinear. *Spondylosium lamelliferum* and *Sphaerosoma loktakense* may be considered to constitute a distinct section of the genus *Sphaerosoma*.

ONYCHONEMA Wallich.

118. *Onychonema laeve*, Nordstedt, var. *micracanthum* Nordstedt.

Plate XIV, fig. 151 *a-c*.

Cellulae in catenam taeniiformem consociatae, processibus alternantibus, oblique positae, 4–6 μ longae coniunctae, a fronte visae ambitu transversim oblongae, 15–17 μ longae, 18–21 μ latae, medio profunde incisae; isthmo circiter 16 μ lato; sinu ad angulum internum subcirculariter ampliato, deinde fere clauso, ad orem usque iterum obtriangulariter dilatato; semicellulis a fronte visis transversim oblongo-linearibus, polis in aculeum minutissimum, 2–2.5 μ longum, rectum vel paullum inclinatum terminatis; a latere visis subcircularibus, circiter 10 μ diametro; a vertice conspectis oblongo-linearibus, polo utroque in aculeum rotundato-attenuatis; pyrenoidibus in utraque semicellula singulis, centraliter positae.

The species has been reported from Java (Nordstedt), Japan and Porto Rico (Lagerheim), Burma (Joshua), Bengal (Turner). The cells of the typical variety are often slightly larger and the spines are 5–20 μ long and conspicuously connivent. Turner's variety *r*, *minus*, from Bengal does not differ from var. *micracanthum* in the dimensions of the cells, but only by its spines being 5–6 μ long and connivent.

HYALOTHECA Ehrenberg.

119. *Hyalotheca dissiliens* (Smith) Brébisson.

Plate XIV, fig. 153 *a-c*, 154 *a-b*.

Cellulae in catenam taeniiformem, planam consociatae, breviter cylindricae, secundum anulum peripheralem inter se cohaerentes, superficie terminali paullulum concava, a fronte visae fere quadratae, paullo latiore quam longiore, in exemplaribus manipurensibus 9–15 μ longae, 12–21 μ latae; a vertice visae circulares; membrana laevi; chlorophoris atque pyrenoidibus in cellula binis.

As already mentioned before, the hyaline sheath of the specimens in Dr. Annandale's collection had evidently been caused to disappear under the action of the preservative medium.

The species has been reported from Europe including Spitzbergen and Novaya Zemlya, from the United States, Java, Ceylon, the Raniganj Coalfield, Siberia and Burma; we have also received specimens from Shillong.

De Toni, Chlorophyceae, p. 785, 786.

Ralfs, Brit. Desmids, p. 51, t. I, fig. 1.

Wolle, Desmids U.S., p. 22, t. I, fig. 3-5.

Turner, p. 151.

West, Fresh-water Algae of Burma, Ann. Bot. Gard., vol. VI pt. II, t. XII, fig. 11-15.

DESMIDIUM.

Desmidium Swartzii, Agardh.

Plate XV, fig. 155 a-h.

Plate XVI, fig. 166 a-b, fig. 167 a-p.

Cellulae in catenam taeniiformem, saepissime plus minusve tortam consociatae, a fronte visae 15-18 (10-15) μ longae, 24-31 (20-39) μ latae, circumscriptione aut inaequaliter hexagonae vel heptagonae, aut transverse fere oblongae, lateribus plus minusve profunde incisae, incisuris ad angulum internum subcirculariter modice dilatatis, deinde secus margines utrosque convexos vel subrectos atque divergentes ad orem usque conspicue ampliatis; semicellulis ambitu subtrapezoideis vel lineari-oblongis cum lateribus triangularibus, marginibus apicali et basali aut rectis aut cellularum intermediarum paullulum concavis ideoque perforationem angustissimum efficientibus; margine libero cellularum terminalium leviter concavo vel levissime cordato obcordatove; cellulae intermediae strato gelatinoso, tenui, lateraliter paullulum protruso inter se connexae; cellula a vertice visa triangularis, aequilatera, angulis rotundatis, lateribus rectis vel subrectis vel modice concavis; chlorophoris a vertice visis e ramis tribus a centro versus angulos cellulae radiantibus bifidis compositis, segmentis spatium vacuum inter se relinquuntibus.

In certain varieties from other parts of the globe the lateral lobes of the cells may be truncate or obtuse.

The species has been reported from various parts of Europe, from the United States, New Zealand, Africa, Siberia, Burma, Khasia, Northern India and Bengal.

De Toni, Chlorophyceae, p. 780.

Ralfs, Brit. Desmids, p. 61, t. IV, fig. a-f.

Wolle, Desmids, U.S., p. 26, t. II, fig. 1-6.

Delponde, in Memorie della Reale Accademia delle Scienze di Torino, serie seconda, tomo XXVIII, p. 68-72, t. II.

Turner, p. 145, t. XIX, fig. 7-8.

West, Freshw. Algae from Burma, p. 226.

120. **Desmidium Aptogonum**, Brébisson,
var. *tetragonum*, (Delponte).

Plate XV, fig. 156 *a-d*,

Plate XVI, fig. 170.

Cellulae in cateuam tortam, quadrilateram, elongatam, perforatam consociatae, forma parallelepipedii; a latere visae 16–20 μ longae, 20–24 μ latae, ad angulos longitudinaliter in processibus quattuor brevibus, subconicis, apice plus minusve truncatis, cum processibus cellulae vicinae coniunctis terminatae; versuris longitudinalibus medio paullulum protrusis et interdum modice incrassatis parte incrassata emarginata; perforationibus transverse elliptico-oblongis, polis rotundatis vel obtusis, axi maiori 9–10 μ , minori 3–4 μ longo; cellula a vertice visa quadrata, ad angulos incrassata; media parte superficierum lateralium cellularum paullulum elevata, ambitu transverse late elliptica; chlorophoro a fronte viso pyrenoides quattuor includente, a vertice viso quadrilobo, lobis divergentibus et pyrenoidem singulum includentibus; protoplasmate densissime granuloso.

The foregoing description refers only to the Loktak Lake form. It appears to agree entirely with Delponte's *Aptogonum tetragonum* (see *Memorie*, vol. XXVIII, p. 75, t. III, fig. 20–23).

W. West and G. S. West, in their account of the fresh-water algae of Ceylon (in *Transaction of the Linnean Society of London*, second series, vol. VI, Botany, p. 193) refer to Delponte's figure just cited as representing the true *Aptogonum tetragonum* of Delponte and their own *Desmidium Aptogonum*, var. *tetragonum*. They state that the tetragonal variety of *Desmidium Baileyi* occurs abundantly in Ceylon and that the two tetragonal varieties are very different plants; but unfortunately they do not figure the two varieties, but refer to the figures given by Delponte and Nordstedt respectively. For the literature relating to *Desmidium Aptogonum* and *D. tetragonum* see

De Toni, Chlorophyceae, p. 781 and 783.

Ralfs, Brit. Desmids, p. 64, t. XXXII.

Rabenhorst, Flor. Eur. Alg., III, p. 154.

Cooke, Brit. Desmids, p. 11, t.v. fig. 1.

Wolle, Desmids U.S., p. 27, t. II, fig. 6, 7.

Delponte, in Memorie della Reale Accademia delle Scienze di Torino, vol. XXVIII, p. 73, 74, t. III, fig. 20–23.

West and West, The Fresh-water Algae of Ceylon, in Transactions of the Linnean Society of London, 2nd series, vol. VI, Botany, p. 193.

GYMNOZYGA Ehrenberg.

121. **Gymnozyga moniliformis**, Ehrenberg.

Plate XV, fig. 157, *a-e*.

Cellulae superficiebus terminalibus planis in filum longiusculum arcte connexae, oblongo-doliiformes, 24–27 (20–30) μ longae, medio 15–21 (–23) μ diametro superficie

terminali circiter 12μ diametro, medio annulatim constrictae, constrictione minime profunda utroque latere carina singula, humili et angusta obtusaque marginata, cellulis ideo a latere conspectis medio quasi obtuse bidentatis; cellula a vertice conspecta suborbicularis vel breviter elliptica, membrana ad extremitates axis maioris plus minusve incrassata; massa protoplasmatica medio cylindricè constricta; pyrenoidibus in utraque semicellula singulis.

Professor Borge gives the dimensions of the Brazilian var. *maior* Raciborski as $38.5-48\mu$ in length, $25.5-29\mu$ in width, whilst the cells of var. *gracilescens* Nordstedt, reported from the United States and Brazil are stated to be $24-30\mu$ in length and $14-17\mu$ in maximum width.

Gymnozyga moniliformis has been reported from many places in Europe and the United States, from Brazil, the Sandwich Islands, New Zealand, Java, Burma, India, and Siberia.

De Toni, Chlorophyceae, p. 797, 798.

Hassall, Freshw. Algae, p. 343. t. LXIXIII, fig. 9.

Ralfs, Brit. Desmidiaceae, p. 58, t. III.

Wolle, Desmids U.S., p. 24, t. I, fig. 15-21.

Turner, p. 151.

West, in Ann. Roy. Bot. Gard., Calcutta, vol. VI, pt. 2, p. 226.

Borge, in Arkiv för Botanik, vol. XV, No. 13, p. 76, 77, t. V, fig. 38, t. VIII, fig. 14.

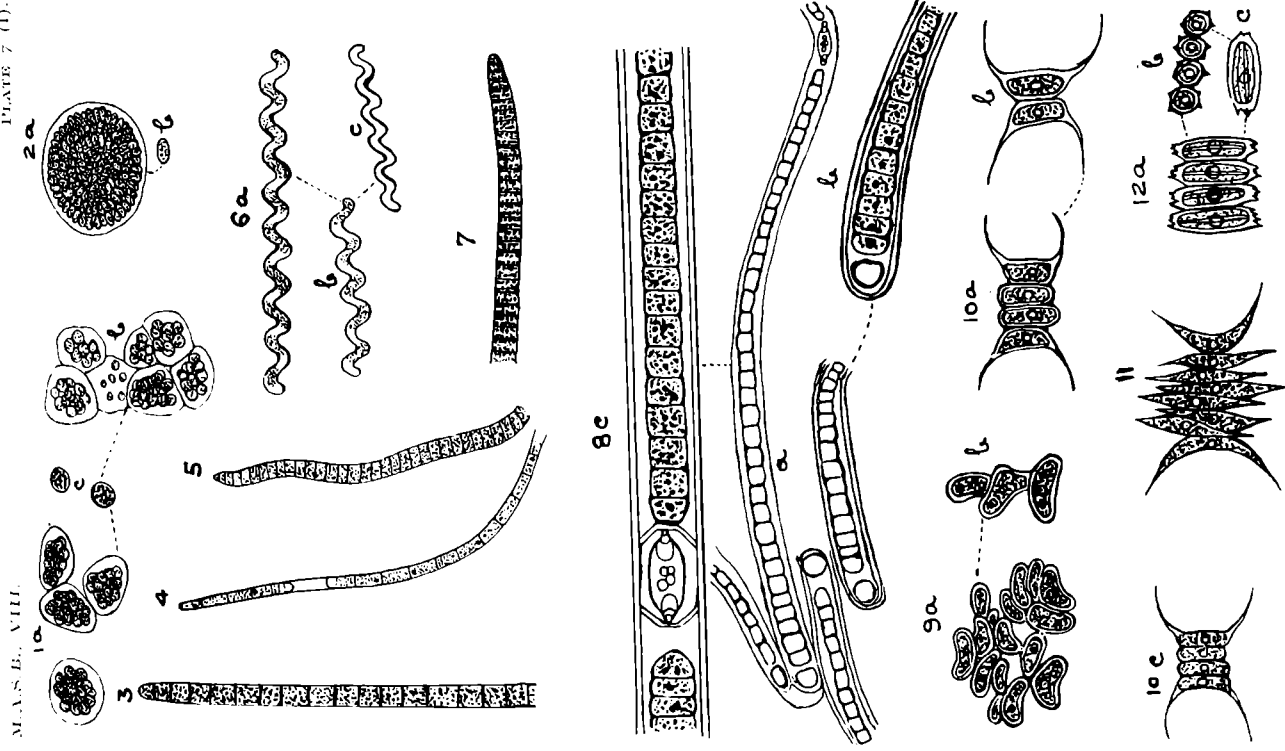
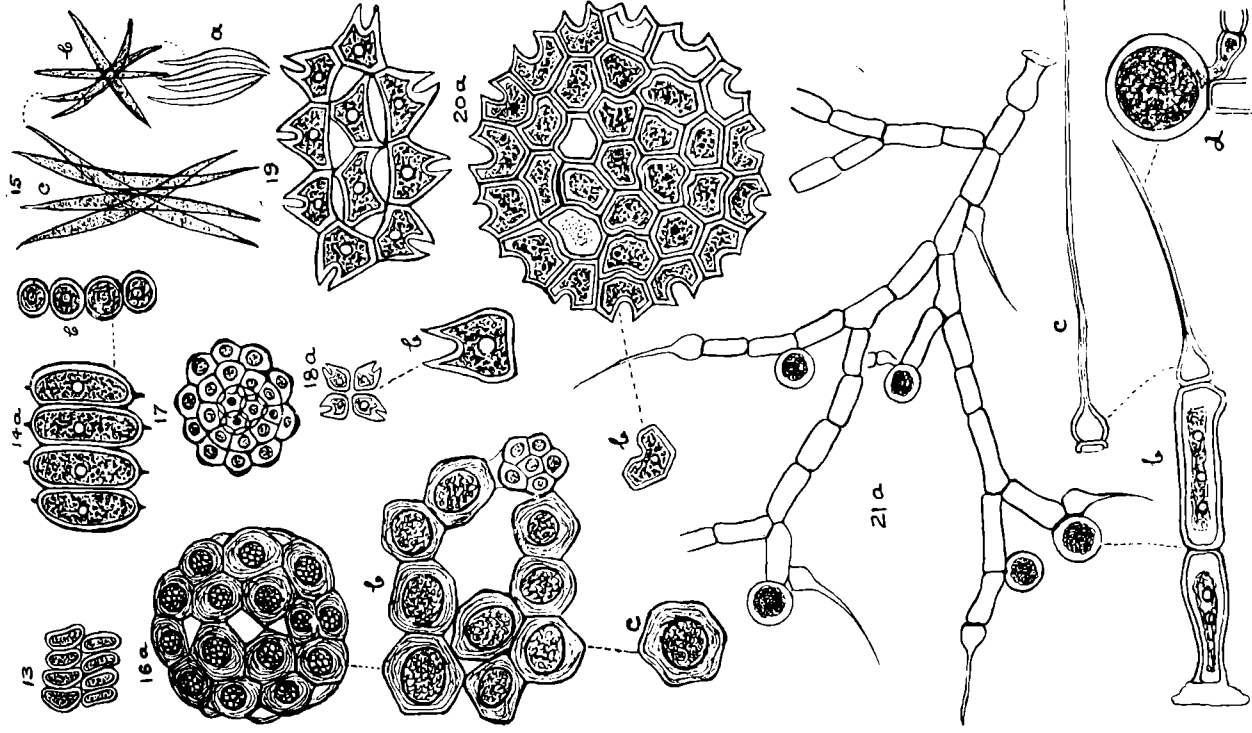
EXPLANATION OF FIGURES.

PLATE 7 (I).

- FIG. 1. *Microcystis flos aquae*,
 (a-b) colonies, $\times 500$,
 (c) single cells, $\times 850$.
- FIG. 2. *Microcystis elabens*.
 (a) colony, $\times 500$,
 (b) single cell, $\times 1,000$.
- FIG. 3. *Oscillatoria chlorina*, $\times 1,000$.
- FIG. 4. *Oscillatoria amphibia*, $\times 800$.
- FIG. 5. *Oscillatoria formosa*, $\times 650$.
- FIG. 6. *Spirulina maior*,
 (a-b) parts of filament, $\times 1,000$,
 (c) part of filament, $\times 500$.
- FIG. 7. *Oscillatoria tenuis*, $\times 800$.
- FIG. 8. *Microchaete loktakeusis* :
 (a) bunch of filaments, $\times 350$,
 (b) basal part of a filament, $\times 500$,
 (c) part of a filament with intermediate heterocyst, $\times 600$.
- FIG. 9. *Dimorphococcus lunatus*,
 (a) colony, $\times 550$,
 (b) single cells, $\times 650$.
- FIG. 10. *Scenedesmus quadricauda*, (a-c), $\times 500$.
- FIG. 11. *Scenedesmus acuminatus*, $\times 350$.
- FIG. 12. *Scenedesmus brasiliensis*, (a-b) $\times 1,000$,
 (a) four-celled colony,
 (b) top view,
 (c) a single cell, highly magnified.

PLATE 8 (II).

- FIG. 13. *Scenedesmus bijugatus*, $\times 500$.
- FIG. 14. *Scenedesmus Annandalei*, (a-b), $\times 1,000$,
 (a) a four-celled colony,
 (b) top view.
- FIG. 15. *Ankistrodesmus falcatus*, (a-b), $\times 500$, (c) $\times 850$.
- FIG. 16. *Coelastrum microporum* :
 (a) colony, $\times 350$,
 (b) an older colony with a daughter colony, $\times 400$,
 (c) a cell, $\times 500$.
- FIG. 17. *Coelastrum cambricum*, $\times 350$,
 var, intermedium.
- FIG. 18. *Pediastrum Tetras*,
 (a) four-celled colony, $\times 200$,
 (b) single cell, highly magnified.
- FIG. 19. *Pediastrum duplex*,
 var. *loktakense*, $\times 500$.
- FIG. 20. *Pediastrum duplex*,
 var. *laevigatum*,
 (a) colony, $\times 400$,
 (b) single cell, $\times 450$.
- FIG. 21. *Bulbochaete* sp :
 (a) part of the plant showing the nature of branching,
 $\times 200$,
 (b) spine with the base formed from a growing cell,
 $\times 400$,
 (c) single spine, $\times 550$,
 (d) oogonium with a dwarf male, $\times 500$.



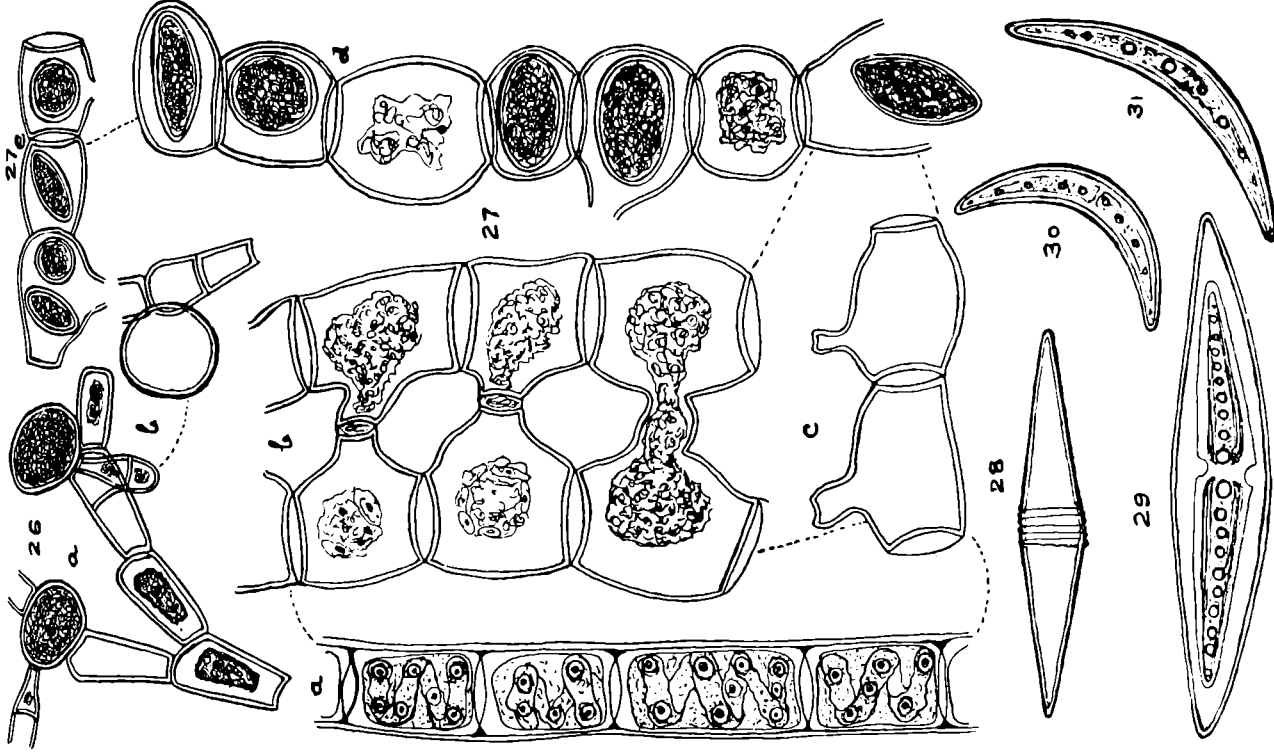
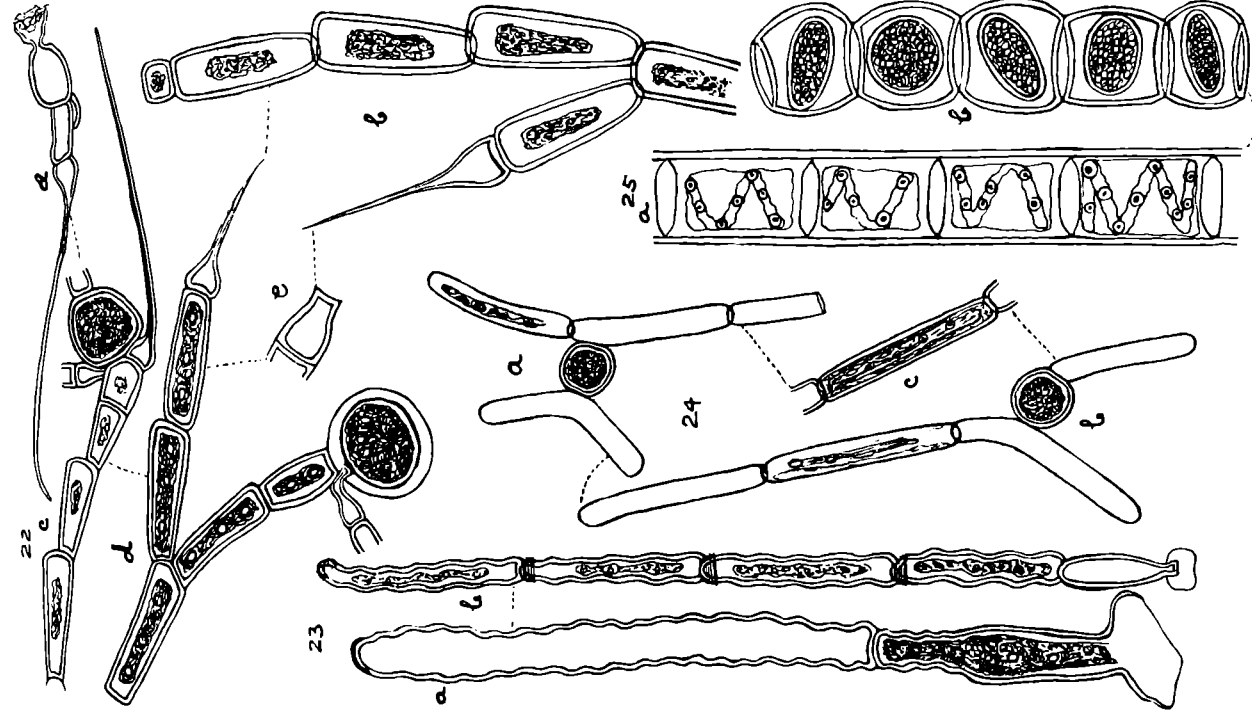
EXPLANATION OF FIGURES.

PLATE 9 (III).

- FIG. 22. *Bulbochaete* sp :
(a) a footcell showing the division of cell, $\times 250$,
(b), (c), (d) parts of filaments with sexual organs, $\times 400$,
(e) a dwarf male, $\times 550$.
- FIG. 23. *Oedogonium undulatum*,
(a) part of a filament with the foot cell, $\times 450$,
(b) part of a filament with shorter cells, $\times 400$.
- FIG. 24. *Mougeotia parvula*. $\times 450$.
- FIG. 25. *Spirogyra varians*,
(a) part of a filament, $\times 500$,
(b) part of a filament with zygotes, $\times 400$.

PLATE 10 (IV).

- FIG. 26. *Bulbochaete* sp.,
(a-b), parts of a filament with oogonia and dwarf males,
 $\times 550$.
- FIG. 27. *Spirogyra varians*,
(a) part of a filament with chlorophyll band. $\times 400$,
(b) conjugating filaments, $\times 500$,
(c) empty cells with conjugating tubes, $\times 350$,
(d), (e), parts of filaments with zygotes, $\times 450$.
- FIG. 28. *Penium Libellula*, $\times 300$.
- FIG. 29. *Closterium lanceolatum*,
var. *parvum*, $\times 450$.
- FIG. 30. *Closterium Venus*, $\times 1,000$.
- FIG. 31. *Closterium parvulum*, $\times 650$.



EXPLANATION OF PLATES.

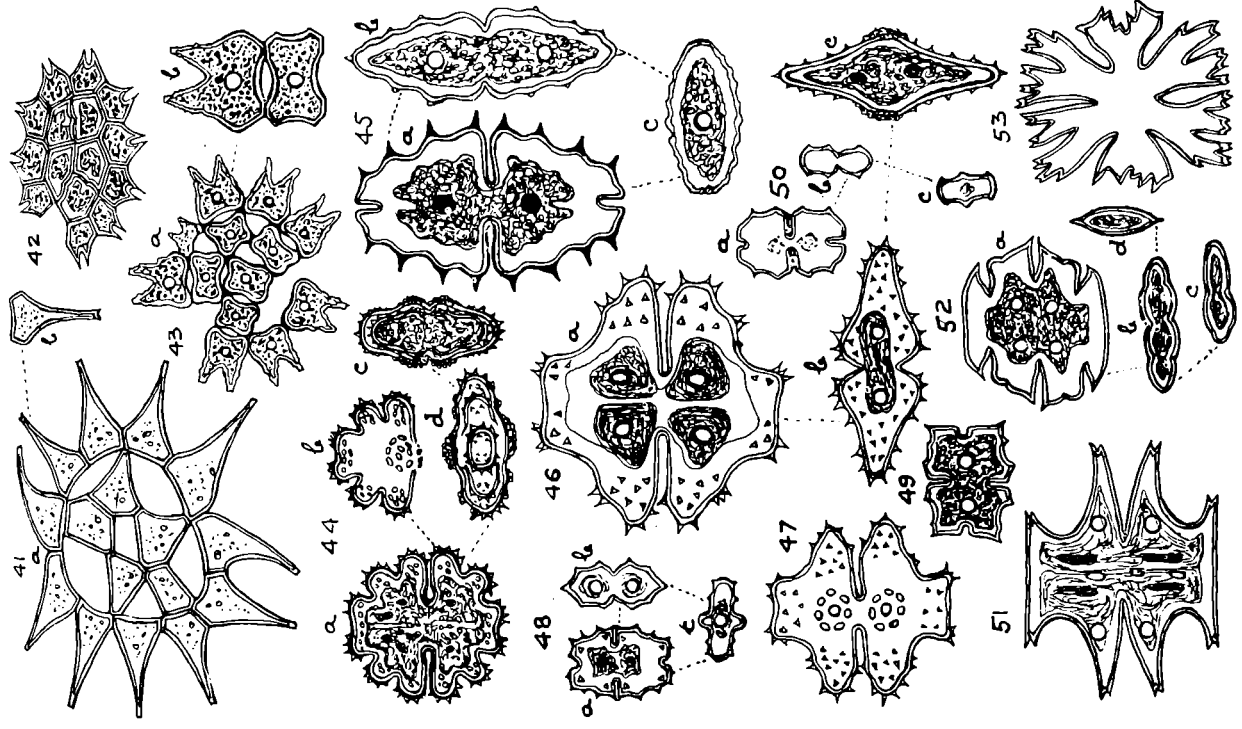
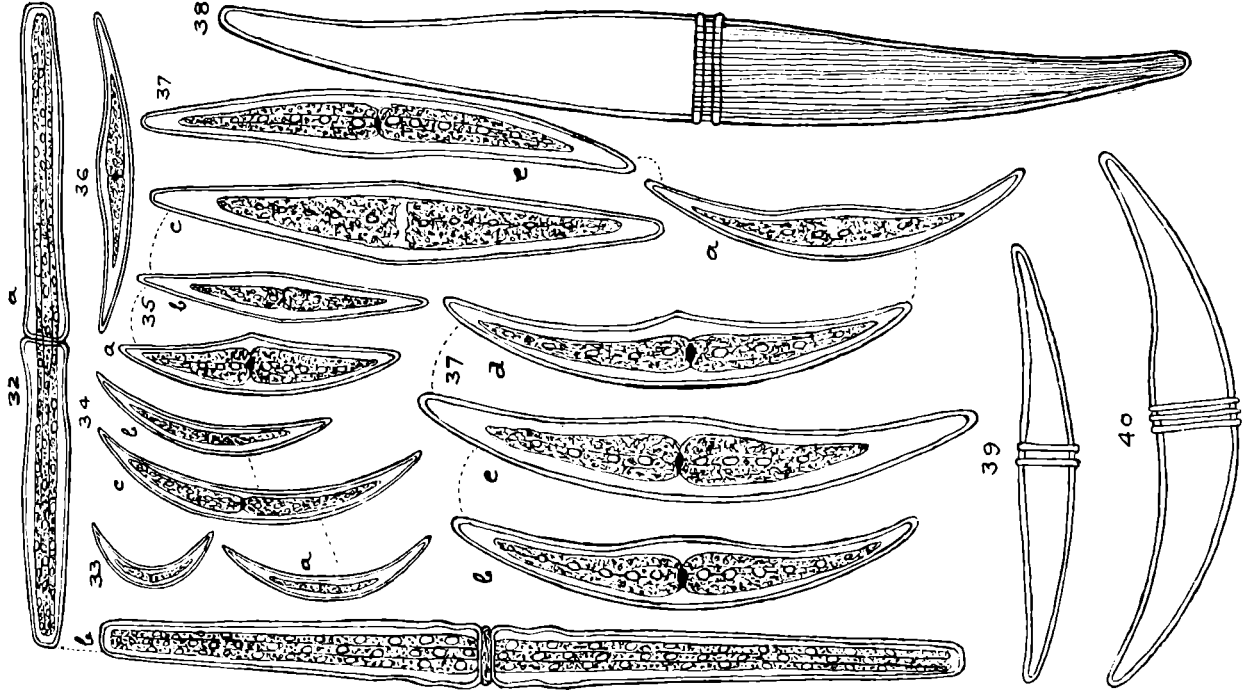
PLATE II (V).

- FIG. 32. *Docidium Baculum*, (*a-b*), $\times 400$.
 FIG. 33. *Closterium Venus*, $\times 550$.
 FIG. 34. *Closterium parvulum*, (*a*). $\times 450$, (*b*). $\times 500$, (*c*). $\times 400$.
 FIG. 35. *Closterium loktakense*, (*a*). $\times 350$, (*b*). $\times 300$, (*c*). $\times 600$.
 FIG. 36. *Closterium Leibleinii*, $\times 250$.
 FIG. 37. *Closterium moniliferum*. (*a*). $\times 300$, (*b*). $\times 350$, (*c*). $\times 350$.
 (*d*). $\times 350$.
 FIG. 38. *Closterium rostratum*, $\times 500$.
 FIG. 39. *Closterium Annandalei*, $\times 320$.
 FIG. 40. *Closterium manipurense*, $\times 320$.

EXPLANATION OF FIGURES.

PLATE I2 (VI).

- FIG. 41. *Pediastrum clatratum*,
 (*a*) single colony, $\times 300$,
 (*b*) one of the marginal cells, $\times 300$.
 FIG. 42. *Pediastrum Tetras*, $\times 100$.
 FIG. 43. *Pediastrum duplex*, var. *subgranulatum*,
 (*a*) single colony, $\times 350$,
 (*b*) one of the marginal and submarginal cells, $\times 1,000$.
 FIG. 44. *Euastrum inermius*, var. *burmense*, (*a-d*), $\times 450$,
 (*a*) front view of cell, (*b*) one of the empty semicells,
 (*c*) side view, (*d*) end view.
 FIG. 45. *Euastrum loktakense*, (*a-c*) $\times 700$,
 (*a*) front view of cell, (*b*) side view,
 (*c*) end view.
 FIG. 46. *Euastrum spiculatum*, (*a-c*), $\times 750$,
 (*a*) front view of cell, (*b*) side view,
 (*c*) end view.
 FIG. 47. *Euastrum spiculatum*, empty cell, front view, $\times 500$.
 FIG. 48. *Euastrum praepandum*, (*a-c*), $\times 650$,
 var. *eurysthmum*,
 (*a*) front view of cell, (*b*) side view,
 (*c*) end view.
 FIG. 49. *Euastrum praepandum*,
 var. *eurysthmum*, front view of cell— $\times 800$.
 FIG. 50. *Euastrum elegans*, var. *loktakense*, (*a-c*), $\times 550$.
 (*a*) front view of cell, (*b*) side view,
 (*c*) end view.
 FIG. 51. *Micrasterias pinnatifida*, front view of cell, $\times 500$.
 FIG. 52. *Micrasterias incisa*, var. *Wallichiana*, (*a-d*), $\times 450$.
 (*a*) front view of cell, (*b-c*) side view,
 (*d*) end view.
 FIG. 53. *Micrasterias foliacea*, front view of an empty cell, $\times 350$.



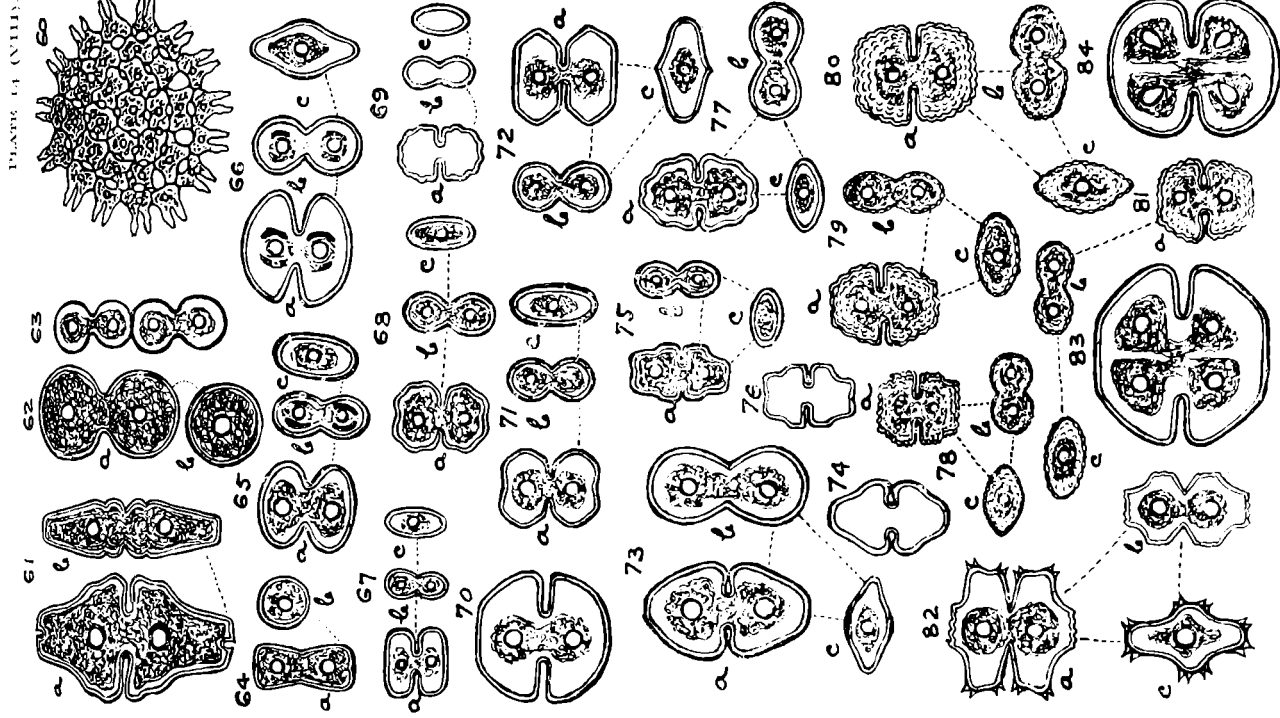
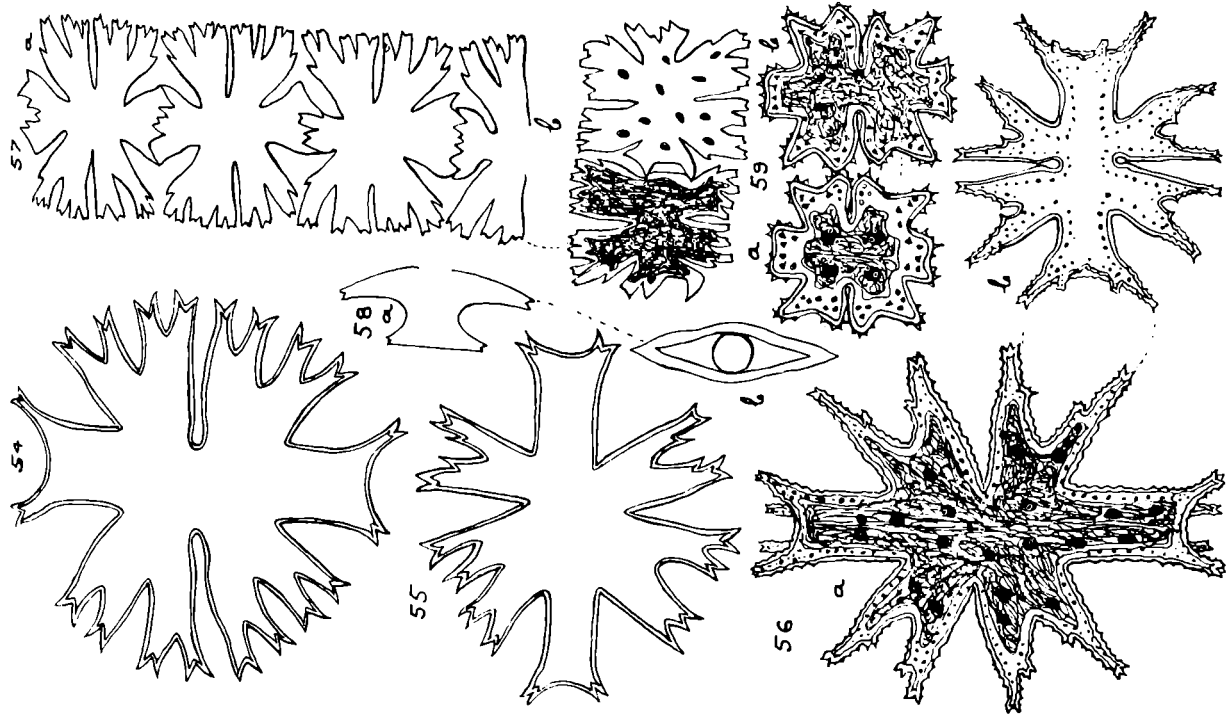
EXPLANATION OF FIGURES.

PLATE 13 (VII).

- FIG. 54. *Micrasterias radians*, $\times 400$.
 FIG. 55. *Micrasterias Crux-Melitensis*, $\times 400$.
 FIG. 56. *Micrasterias mahabaleshwarensis*,
 (a) Front view of cell with contents, $\times 250$,
 (b) Front view of empty cell, $\times 150$.
 FIG. 57. *Micrasterias foliacea*.
 (a) Front view of chain of cell, $\times 400$
 (b) Front view of cells with contents, $\times 300$.
 FIG. 58. *Micrasterias pinnatifida*,
 (a) Front view of empty semicell, $\times 400$,
 (b) Basal view of semicell, $\times 400$.
 FIG. 59. *Euastrum inermius*, var. *burmense*,
 (a-b), Front view of cell, $\times 550$.

PLATE 14 (VIII).

- FIG. 60. *Pediastrum duplex*,
 var. *genuinum*, $\times 500$.
 FIG. 61. *Euastrum ansatum*,
 var. *pyxedatum*,
 (a) front view of cell, $\times 500$, (b) side view of cell, $\times 500$.
 FIG. 62. *Cosmarium moniliforme*,
 (a) front view of cell, $\times 800$, (b) end view of cell, $\times 800$.
 FIG. 63. *Cosmarium moniliforme*, $\times 500$.
 FIG. 64. *Cosmarium biobconicum*,
 (a) front view of cell, $\times 750$, (b) end view of cell, $\times 750$.
 FIG. 65. *Cosmarium contractum*, (a-c), $\times 600$,
 var. *abbreviatum*,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 66. *Cosmarium pseudophaseolus*, (a-c), $\times 750$,
 (a) front view of cell, (b) side view of cell and (c) end view of cell.
 FIG. 67. *Cosmarium rotundatum*, (a-c), $\times 1,000$,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 68. *Cosmarium Meneghinii*,
 var. *loktakense*, (a-c), $\times 100$,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 69. *Cosmarium impressulum*, (a-c), $\times 500$,
 (a) front view of empty cell, (b) side view of cell, (c) end view.
 FIG. 70. *Cosmarium nitidulum*, $\times 600$,
 front view of cell.
 FIG. 71. *Cosmarium pseudo-hexagonoides*, (a-c) $\times 900$,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 72. *Cosmarium hexagonoides*, (a-c), $\times 950$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 73. *Cosmarium granatum*, (a-c), $\times 700$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 74. *Cosmarium granatum*, front view of empty cell, $\times 500$.
 FIG. 75. *Cosmarium octogibbosum*, (a-c), $\times 650$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 76. *Cosmarium octogibbosum*, $\times 650$,
 front view of an empty cell.
 FIG. 77. *Cosmarium laeve*, (a-c), $\times 650$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 78. *Cosmarium subprotractum*, (a-c) $\times 800$,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 79. *Cosmarium sexlaterum*, (a-c) $\times 600$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 80. *Cosmarium decacuminatum*, (a-c), $\times 550$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 81. *Cosmarium sexlaterum*, (a-c), $\times 600$,
 (a) front view of cell, (b) side view of cell, (c) end view of cell.
 FIG. 82. *Xanthidium loktakense*, (a-c), $\times 750$,
 (a) front view of cell, (b) side view of cell, (c) end view.
 FIG. 83. *Cosmarium bitrapezoideum*, $\times 350$,
 (a) front view of cell.
 FIG. 84. *Cosmarium Strabo*, $\times 250$,
 (a) front view of cell!



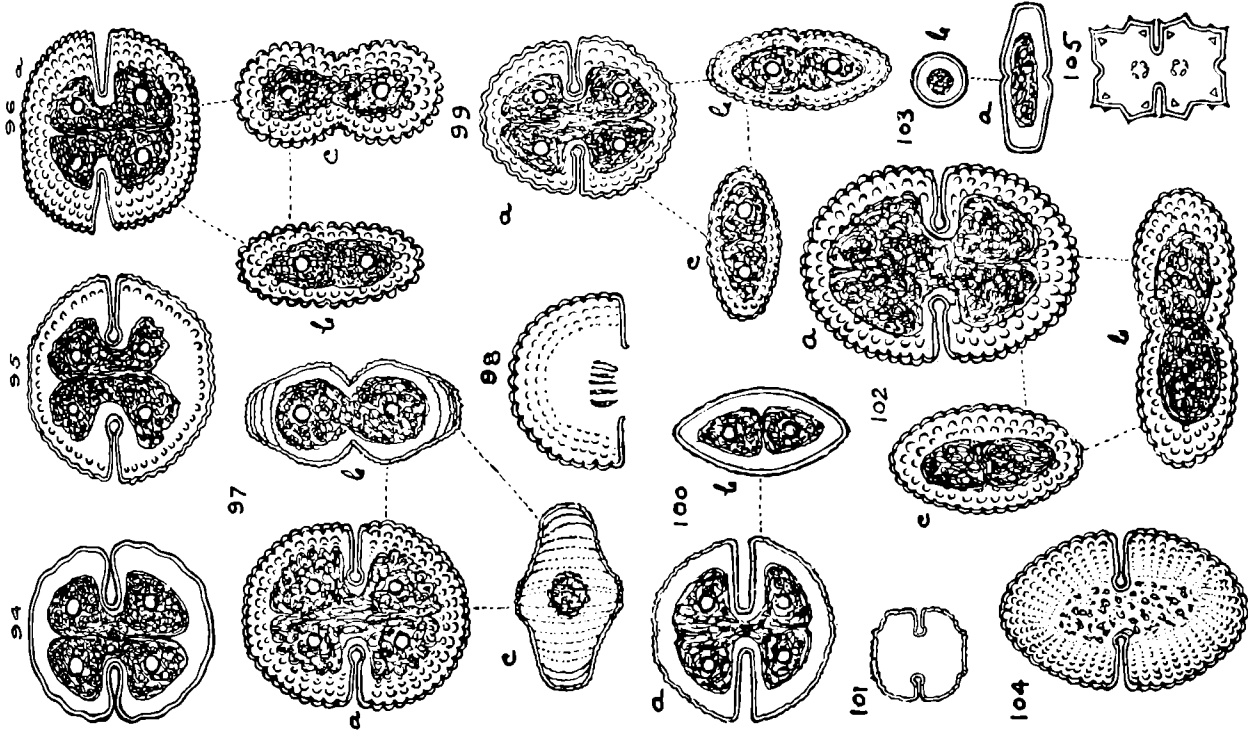
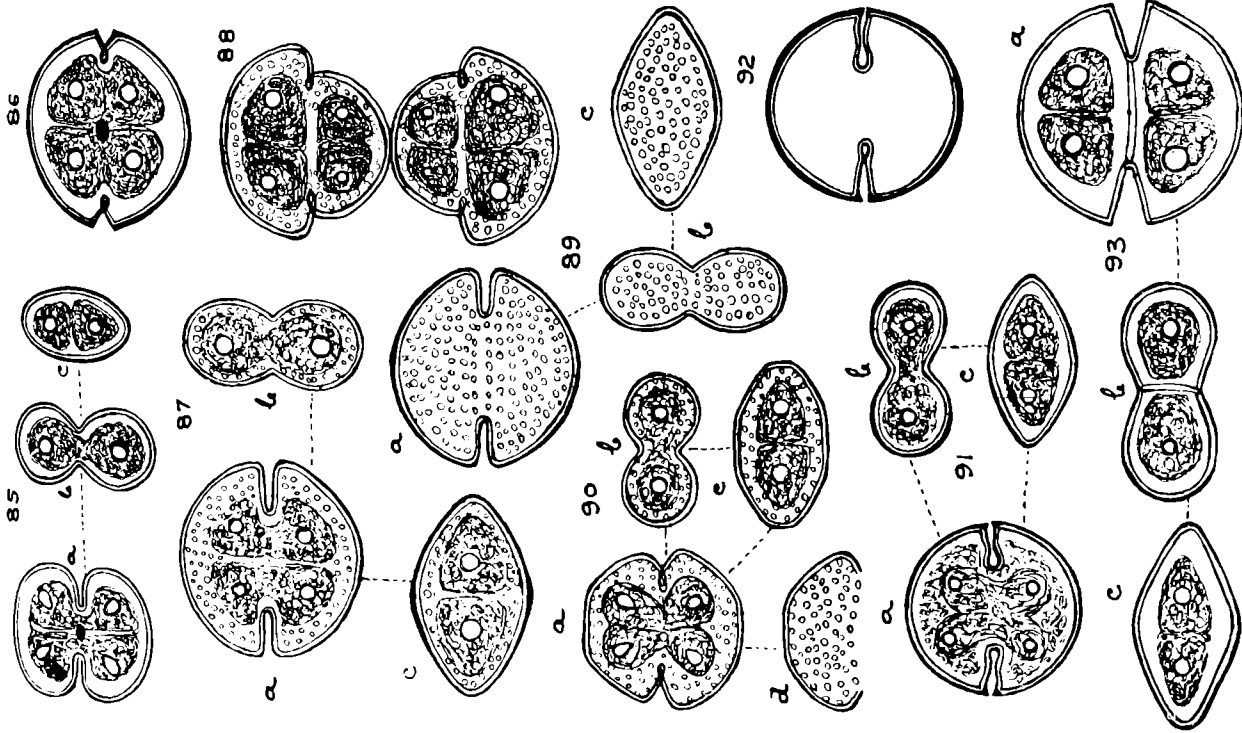
EXPLANATION OF FIGURES.

PLATE 15 (IX).

- FIG. 85. *Cosmarium Strabo*, (*a-c*), × 350
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view of cell.
- FIG. 86. *Cosmarium forceps*, × 400.
 front view of cell.
- FIG. 87. *Cosmarium circulare*, × 600,
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view of cell.
- FIG. 88. *Cosmarium circulare*, × 550,
 front view of cell showing vegetative division.
- FIG. 89. *Cosmarium circulare*, (*a-c*), × 600,
 (*a*) front view of an empty cell,
 (*b*) side view,
 (*c*) end view.
- FIG. 90. *Cosmarium Lundellii*, subsp. *corruptum*,
 (*a*) front view of cell,
 (*b*) side view, × 350,
 (*c*) end view,
 (*d*) front view of the upper part of semicell.
- FIG. 91. *Cosmarium obsoletum*, subsp. *palustre*, (*a-c*), × 400.
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view.
- FIG. 92. *Cosmarium obsoletum*, subsp. *palustre*, × 400,
 front view of cell.
- FIG. 93. *Cosmarium lacustre*, (*a-c*), × 500.
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view.

PLATE 16 (X).

- FIG. 94. *Cosmarium undulatum*, × 900.
- FIG. 95. *Cosmarium scutellum*, × 800.
- FIG. 96. *Cosmarium granulosum*, (*a-c*), × 950,
 (*a*) front view of cell,
 (*b*) end view of cell,
 (*c*) side view.
- FIG. 97. *Cosmarium manipurens*, (*a-c*), × 800,
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view.
- FIG. 98. *Cosmarium manipurens*, × 800,
 empty semicell.
- FIG. 99. *Cosmarium chondriophorum*, (*a-c*), × 750,
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view.
- FIG. 100. *Cosmarium scissum*, (*a-b*), × 850,
 (*a*) front view of cell,
 (*b*) end view.
- FIG. 101. *Cosmarium protractum*, × 850.
- FIG. 102. *Cosmarium ellipsoidale*, (*a-c*), × 400,
 (*a*) front view of cell,
 (*b*) side view of cell,
 (*c*) end view.
- FIG. 103. *Penium inconspicuum*, (*a-b*), × 500,
 (*a*) front view of cell,
 (*b*) end view.
- FIG. 104. *Cosmarium actinophorum*, × 500.
- FIG. 105. *Euastrum præpandum*,
 var. *euryisthmum*,
 front view of an empty cell, × 950,



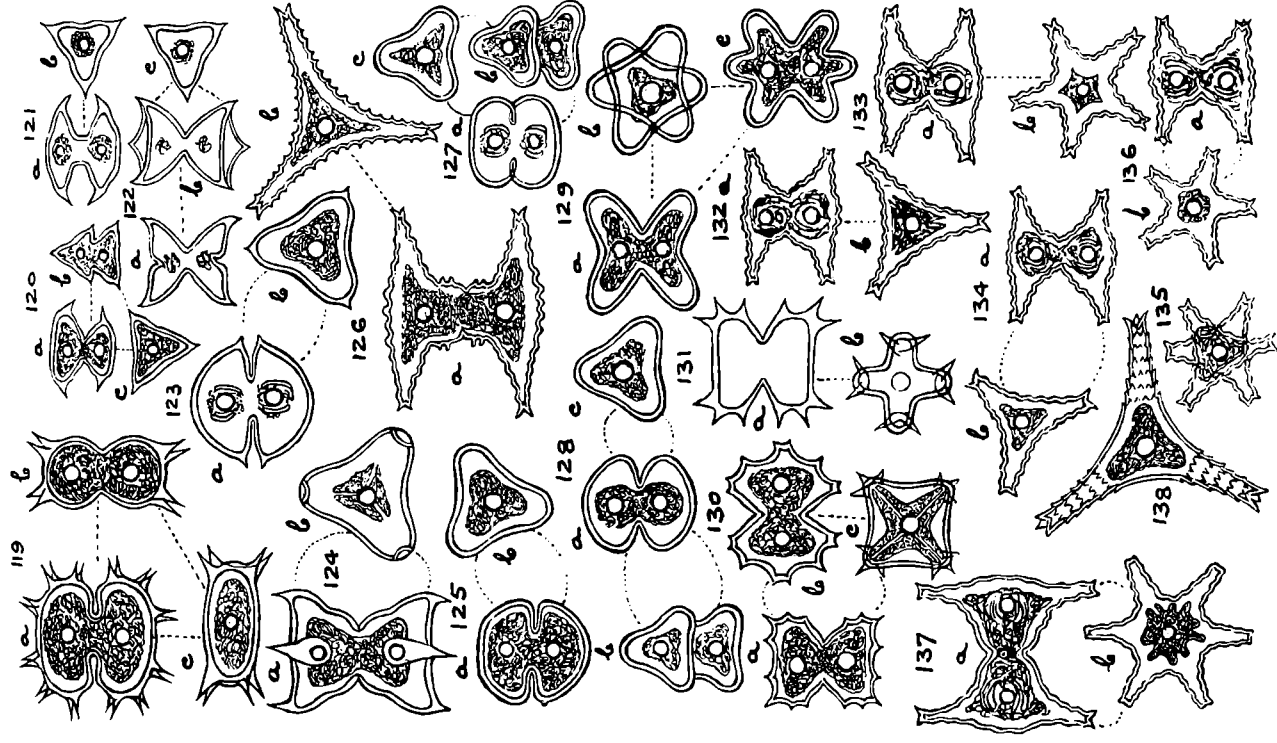
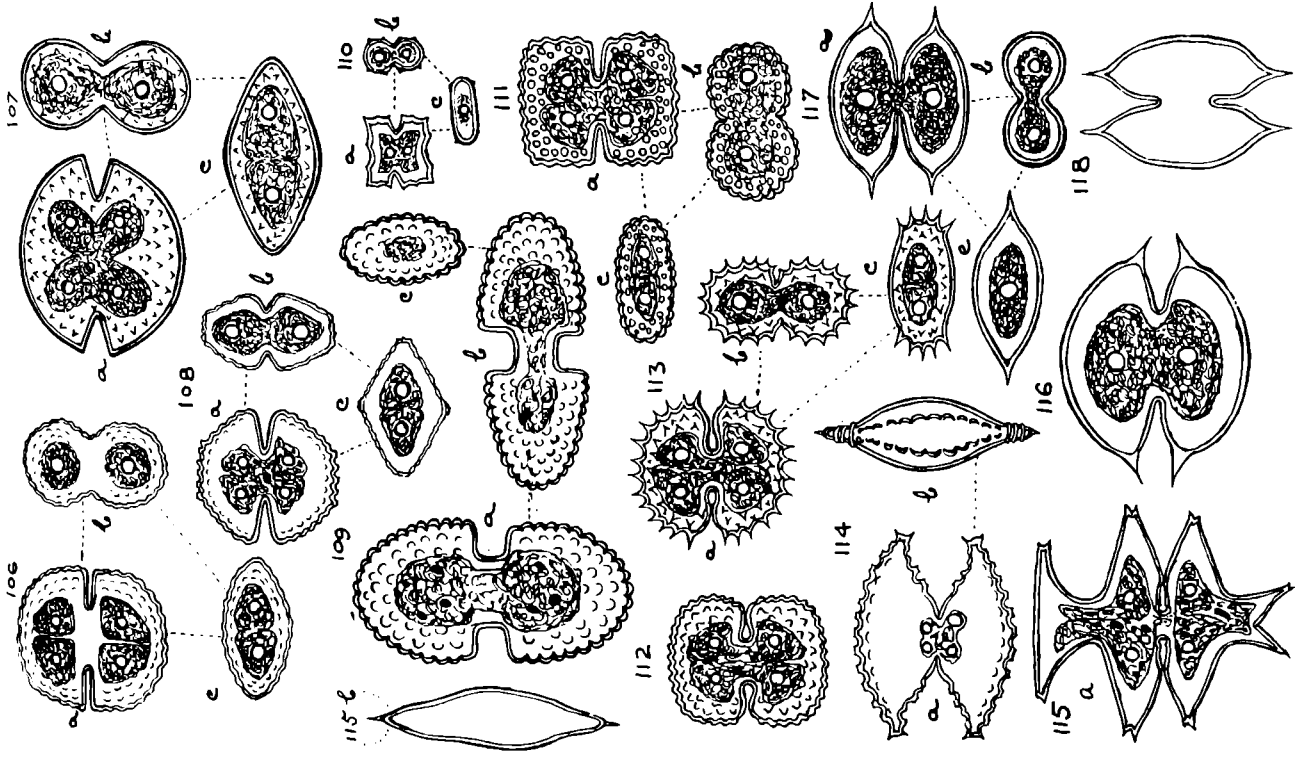
EXPLANATION OF FIGURES.

PLATE 17 (XI).

- FIG. 106. *Cosmarium thangaicum*, (*a-c*), $\times 500$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view.
- FIG. 107. *Cosmarium euryisthmum*, (*a-c*), $\times 480$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view.
- FIG. 108. *Cosmarium loktakense*, (*a-c*), $\times 600$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view.
- FIG. 109. *Cosmarium longicollum*, (*a-c*), $\times 370$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view.
- FIG. 110. *Cosmarium Regnesi*, (*a-c*), $\times 800$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view of cell.
- FIG. 111. *Cosmarium quadrilaterum*, (*a-c*), $\times 400$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view.
- FIG. 112. *Cosmarium pseudocoronatum*, $\times 400$.
- FIG. 113. *Xanthidium raniganjense*, (*a-c*), $\times 500$,
(*a*) front view of cell, (*b*) side view of cell,
(*c*) end view of cell.
- FIG. 114. *Staurastrum Prasadianum*, (*a-b*), $\times 500$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 115. *Micrasterias pinnatifida*, $\times 550$.
- FIG. 116. *Arthrodesmus convergens*, $\times 550$.
- FIG. 117. *Arthrodesmus convergens*, $\times 400$.
- FIG. 118. *Arthrodesmus convergens*, $\times 450$.

PLATE 18 (XII).

- FIG. 119. *Xanthidium fasciculatum*, (*a-c*), $\times 350$, [of cell.
(*a*) front view of cell, (*b*) side view of cell, (*c*) end view
- FIG. 120. *Staurastrum deiectum*, (*a-c*), $\times 400$, [of cell.
(*a*) front view of cell, (*b*) side view of cell, (*c*) end view
- FIG. 121. *Staurastrum deiectum*, (*a-b*), $\times 500$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 122. *Staurastrum deiectum*, (*a-c*), $\times 600$,
(*a*) front view of cell, (*b*) oblique side view of cell,
(*c*) end view of cell.
- FIG. 123. *Staurastrum Dickiei*, (*a-b*), $\times 600$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 124. *Staurastrum Annandaleanum*, (*a-b*), $\times 500$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 125. *Staurastrum orbiculare*,
var *depressum*, (*a-b*), $\times 1,000$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 126. *Staurastrum pseudosebaldi* (*a-b*), $\times 600$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 127. *Staurastrum thangaicum*, (*a-c*), $\times 600$, [of cell.
(*a*) front view of cell, (*b*) side view of cell, (*c*) end view
- FIG. 128. *Staurastrum muticum*, (*a-c*), $\times 750$, [of cell.
(*a*) front view of cell, (*b*) side view of cell, (*c*) end view
- FIG. 129. *Staurastrum triskeles*, (*a-c*), $\times 1,500$, [view of cell,
(*a*) front view of cell, (*b*) end view of cell, (*c*) oblique side
- FIG. 130. *Staurastrum Horae*, (*a-c*), $\times 650$,
(*a*) front view of cell, (*b*) oblique side view of cell,
(*c*) end view of cell.
- FIG. 131. *Staurastrum loktakense*, (*a-b*), $\times 800$,
(*a*) front view of empty cell, (*b*) end view of cell.
- FIG. 132. *Staurastrum manipurense*, (*a-b*), $\times 950$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 133. *Staurastrum manipurense*, (*a-b*), $\times 550$,
(*a*) front view of cell, (*b*) end view of cell,
- FIG. 134. *Staurastrum manipurense*, (*a-b*), $\times 950$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 135. *Staurastrum manipurense*, $\times 450$, end view of cell.
- FIG. 136. *Staurastrum manipurense*, (*a-b*), $\times 550$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 137. *Staurastrum dicodon*, (*a-b*), $\times 650$,
(*a*) front view of cell, (*b*) end view of cell.
- FIG. 138. *Staurastrum* sp. $\times 450$, end view of cell.



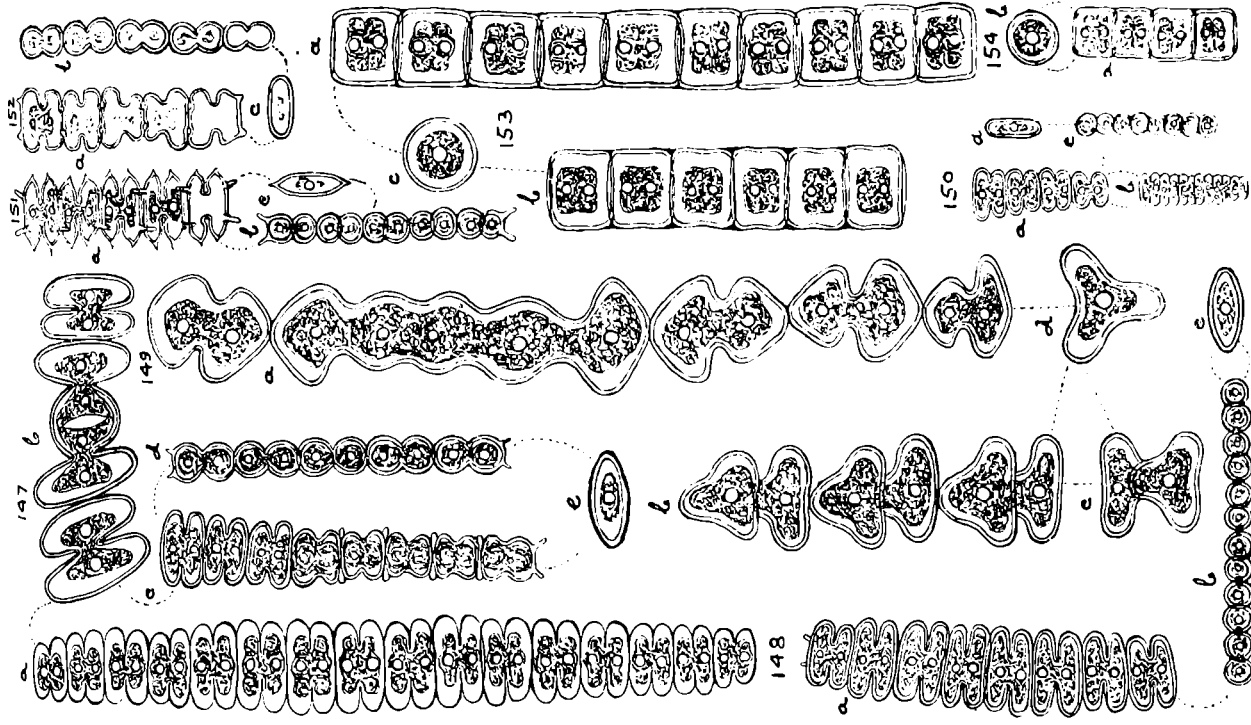
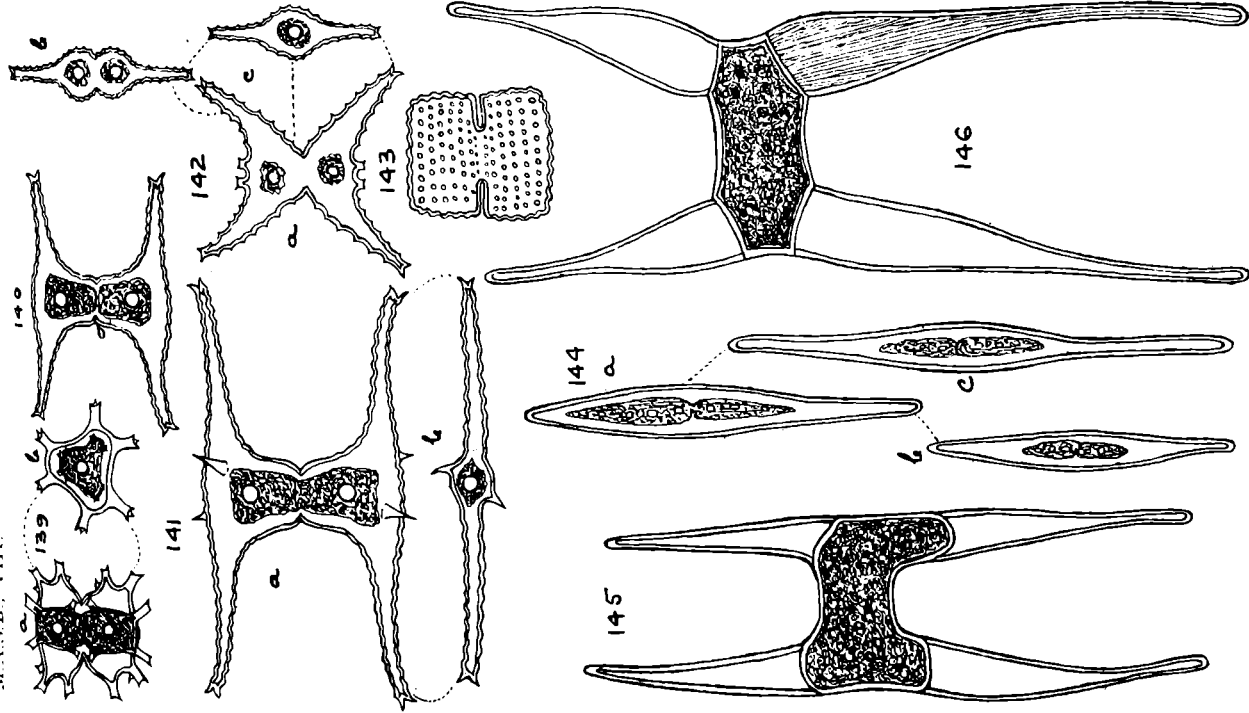
EXPLANATION OF FIGURES.

PLATE 19 (XIII).

- FIG. 139. *Staurastrum pansum*, (*a-b*), $\times 650$,
 (a) front view of cell,
 (b) end view of cell.
- FIG. 140. *Staurastrum leptocladum*, $\times 700$,
 front view of cell.
- FIG. 141. *Staurastrum leptocladum*, (*a-b*), $\times 650$,
 (a) front view of cell,
 (b) end view of cell.
- FIG. 142. *Staurastrum ascendens*, (*a-c*), $\times 1,400$,
 (a) front view of cell,
 (b) side view of cell,
 (c) end view of cell.
- FIG. 143. *Cosmarium quadrilaterum*, $\times 400$.
- FIG. 144. *Closterium rostratum*, (*a-c*), $\times 400$,
 young cells.
- FIG. 145. *Closterium rostratum*, $\times 300$.
- FIG. 146. *Closterium rostratum*, $\times 350$.

PLATE 20 (XIV).

- FIG. 147. *Sphaerosozma pulchrum*,
 subsp. *thangaense*, (*a-e*), $\times 800$,
 (a) front view of filamentous form of the plant slightly
 twisted at both ends,
 (b) part of the filament with the cells at the stage of
 division,
 (c) part of filament, twisted at one end,
 (d) side view of filament,
 (e) end view of cell.
- FIG. 148. *Sphaerosozma pulchrum*,
 var. *thangaense*, (*a-c*), $\times 450$,
 (a) part of front view of the filament,
 (b) side view,
 (c) end view of cell.
- FIG. 149. *Sphaerosozma trilobum*, (*a-d*),
 (a) front view of filament, $\times 650$,
 (b) lateral view of filament, $\times 550$,
 (c) lateral view of cell, $\times 550$,
 (d) end view of cell, $\times 550$.
- FIG. 150. *Sphaerosozma pygmaeum*, (*a-d*),
 (a) front view of filament, $\times 550$,
 (b) front view of filament, $\times 500$,
 (c) side view of filament, $\times 550$,
 (d) end view of cell, $\times 550$.
- FIG. 151. *Onychonema laeve*,
 var. *micracanthum*, (*a-c*), $\times 450$,
 (a) front view of filament,
 (b) side view of filament,
 (c) end view of cell.
- FIG. 152. *Sphaerosozma manipurensis*, (*a-c*), $\times 750$,
 (a) front view of filament,
 (b) lateral view,
 (c) end view of cell.
- FIG. 153. *Hyalotheca dissiliens*, (*a-c*), $\times 700$,
 (*a-b*) front view of filament,
 (c) front view of cell.
- FIG. 154. *Hyalotheca dissiliens*, (*a-b*), $\times 550$,
 (a) front view of part of filament,
 (b) end view of cell.



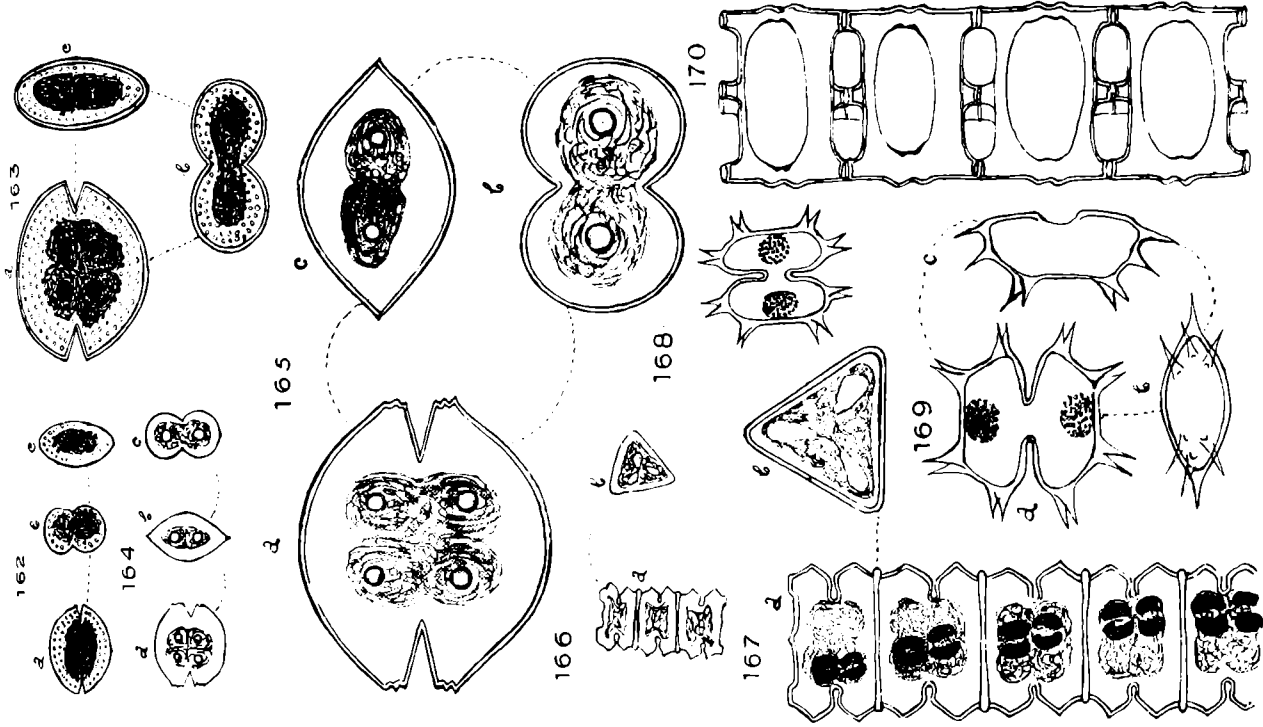
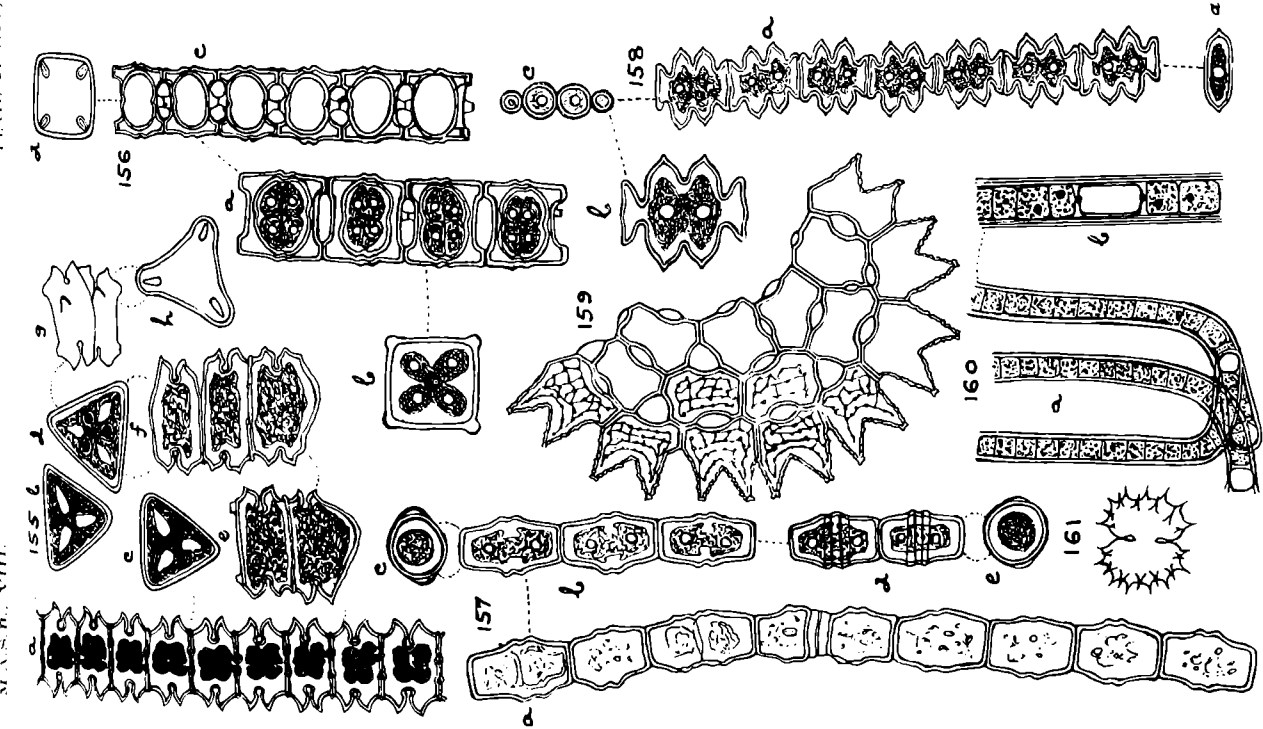
EXPLANATION OF FIGURES.

PLATE 21 (XV).

- FIG. 155. *Desmidium Swartzii*.
 (a) front view of cell, $\times 450$.
 (b-d) end view of cell with contents, $\times 450$
 (e-f) several cells with contents contracted and cells slightly twisted, $\times 550$.
 (g) a pair of twisted empty cell, $\times 500$,
 (h) end view of an empty cell, $\times 500$.
- FIG. 156. *Desmidium Aptogonum*,
 (a) front view of cells with contents, $\times 550$,
 (b) end view of cell, $\times 550$,
 (c) front view of empty cells, $\times 500$,
 (d) end view of an empty cell, $\times 500$.
- FIG. 157. *Gymnozyga moniliformis*,
 (a) front view of almost empty cells, $\times 500$,
 (b) front view of cells with contents contracted, $\times 600$,
 (c) end view of cells, $\times 600$,
 (d) front view of cells with median girdle, $\times 500$,
 (e) end view of cell, $\times 500$.
- FIG. 158. *Spondylosium loktakense*,
 (a) front view of cells forming the filament, $\times 400$,
 (b) front view of cell, $\times 650$,
 (c) side view of cell, $\times 400$,
 (d) end view of cell, $\times 400$.
- FIG. 159. *Pediastrum duplex*,
 var. *coronatum*, $\times 500$.
- FIG. 160. *Microchæte loktakensis*,
 (a) a bunch of the basal part of the filaments, $\times 300$.
 (b) part of filament with intermediate heterocyst, $\times 550$.
- FIG. 161. *Xanthidium raniganjense*, $\times 300$,
 front view of empty cell.

PLATE 22 (XVI).

- FIG. 162. *Cosmarium nanum*, $\times 450$,
 (a) front view of cell,
 (b) side view of cell,
 (c) end view of cell.
- FIG. 163. *Cosmarium nanum*, $\times 1,000$,
 (a) front view of cell,
 (b) side view of cell,
 (c) end view of cell.
- FIG. 164. *Cosmarium viride*, $\times 250$,
 (a) front view of cell,
 (b) end view of cell.
 (c) side view of cell,
- FIG. 165. *Cosmarium viride*, $\times 900$,
 (a) front view of cell,
 (b) side view of cell,
 (c) end view of cell.
- FIG. 166. *Desmidium Swartzii*, $\times 400$,
 (a) front view of part of the filament,
 (b) end view of cell.
- FIG. 167. *Desmidium Swartzii*, $\times 900$,
 (a) front view of part of the filament.
 (b) end view of cell.
- FIG. 168. *Xanthidium antilopaeum*, $\times 300$.
- FIG. 169. *Xanthidium antilopaeum*, $\times 350$,
 (a) front view of cell,
 (b) end view of cell,
 (c) semicell.
- FIG. 170. *Desmidium Aptogonum* $\times 1,000$.



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CHEMISTRY IN 'IRĀQ AND PERSIA IN THE TENTH
CENTURY A.D.

By H. E. STAPLETON, M.A., B.Sc. (OXON), *Principal, Presidency College,
Calcutta; the late R. F. AZO, Instructor in Arabic, Board of Examiners
Office, Fort William; and M. HIDĀYAT ḤUSAIN, Shams-ul-'Ulamā',
PH.D., F.A.S.B., Professor of Arabic, Presidency College.*

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CHEMISTRY IN 'IRĀQ AND PERSIA IN THE TENTH CENTURY A.D.

By H. E. STAPLETON, *the late* R. F. AZO, and M. HIDĀYAT HUSAIN.

I. INTRODUCTION.

I. PRELIMINARY REMARKS.

In three previous papers¹ the first steps were taken towards a systematic study of the alchemical knowledge that existed among Arabic-speaking peoples up to the fall of the 'Abbāsīd Khalīfate of Baghdād in the middle of the 13th Century. Owing to the death of one of the collaborators, the continued absence of another from all sources of reference, and, finally, the late war, little progress could be made in the study of the documents which it was hoped to utilise. Circumstances have now again enabled the work to be taken up: and in the present paper we publish annotated translations of three closely-related works of the 10th Century that will enable a clear idea to be obtained for the first time of the precise extent of scientific knowledge that then existed in 'Irāq and Persia—so far, at least, as the Substances and Apparatus used in alchemical operations were concerned. We refrain almost entirely, for the present, from anything more than the barest mention whenever necessary of the alchemical theories current at that time, or from any serious discussion of the scientific aspect of alchemical practice: for until Dr. Ruska's edition of ar-Rāzī's *Kitāb al-Asrār* is published and its contents studied in detail both from the alchemical, as well as the chemical, point of view, materials are too scanty to justify any considerable expenditure of time or paper on the former subject. Our aims are confined, in the first place, to supporting the thesis that in 900 A.D. such a degree of exact knowledge of chemical substances and apparatus was displayed that historians may henceforward be justified in antedating the birth of scientific Chemistry by—in all probability—at least 900 years: and, secondly, to indicating briefly the influences, both personal and racial, that appear to have controlled the development of Chemistry in the period under investigation.

2. THE DOCUMENTS TO BE STUDIED.

These are as follows:—

(1) The *Madkhal at-Ta'limi* (Instructive—or Practical—Introduction), the first of a series of Twelve Treatises on Alchemy by the celebrated Doctor, Muḥammad bin Zakariyā ar-Rāzī who—according to al-Bīrūnī, the Chronicler of Indian life and

¹ *Salammoniac: a study in Primitive Chemistry* by H.E.S. (Memoirs of the Asiatic Society of Bengal, I—1905—pp. 25-41); *Alchemical Equipment in the Eleventh Century A.D.* by H.E.S. and R.F.A. (*idem*, I, pp. 47-70); and *An Alchemical Compilation of the Thirteenth Century A.D.* by H.E.S. and R.F.A. (*idem*, III-1910—pp. 57-94).

thought, who lived 100 years later—died in 925 A.D. at the age of 60.¹ The unique Ms. of this work is included in a collection of alchemical treatises, now in the Library of His Highness the Nawwāb of Rāmpūr, which, in its original form, appears to have been made by a copyist travelling in Asia Minor and Mesopotamia in the year 1283 A.D.² Although only one copy of the Arabic text is at present available, it seems to be above the average in merit, and the reprint, which will be found at the end of the paper, has only needed very slight correction as the result of comparison with the other two treatises subsequently referred to. From the statement of Ibn Abī Uṣāibi'ah in his History of Physicians³ that ar-Rāzī studied Magic and Alchemy in his youth, i.e., before he seriously took up Medicine, we may fairly reasonably conclude that the Twelve Treatises, of which the *Madkhal* was the first, were published prior to 900 A.D. about which date he left his native place—the ancient Rhages, or Ray, which was situated a few miles to the south of the modern Teherān—and settled for the first time in Baghdād, to study medicine.

The contents of the *Madkhal* will be dealt with later in this paper: and it need only be stated in support of the authenticity of the text that (a) the *Madkhal* was the principal source of the information given, within 50 or 60 years of ar-Rāzī's death, by al-Khwārazmī in our third document, viz., the alchemical section of the *Maḡātib al-'Ulūm*; and (b) that it is directly mentioned as the source of several quotations from Ibn Wāfid's Book on Simples that are included in Ibn al-Baiṭār's work.⁴ Ibn Wāfid of Toledo died in 1068 A.D., so we are certain that the *Madkhal* was known in Spain in the middle of the eleventh century.

(2) Ar-Rāzī's larger Compendium on Alchemy, called the *Kitāb al-Asrār* (Book of Secrets), of which a translation is now given of the first two Discourses, dealing, respectively, with Substances and Instruments. This was necessary, not only because the notes to the *Madkhal* would otherwise have become too numerous, but also because a certain number of detailed preparations are given in both Discourses which throw considerable light on the actual chemical knowledge of the time. For the same reason we have added the translation of a certain number of other extracts from the Third, and final, Discourse.

The *Kitāb al-Asrār* is very probably the work referred to by Ibn Juljul (c. 1000 A.D.) as having been presented to Abū Ṣāliḥ Maṣṣūr bin Ishāq, the Samānid Prince of Sijistān, to whom ar-Rāzī had previously dedicated his famous medical treatise, the *Kitāb al-Manṣūri*. Ar-Rāzī was then living in Baghdād, where he had been brought during the Khalifate of al-Muqtafi (902–908 A.D.), to act as the Superintendent of the Hospital. As Abū Ṣāliḥ revolted against his cousin Naṣr II in 914 A.D. (not, as inadvertently stated by Brockelmann, in 924), and ar-Rāzī mentions in the preface to the *Kitāb al-Asrār*, that he only wrote this alchemical treatise as he was

¹ Vide Ruska's paper on al-Birūnī as a source for the Life and Works of ar-Rāzī (*Isis*, V, 1, No. 13, October 1922)—passage quoted on pp. 320-1, *infra*.

² See previous paper No. (3), *Memoirs A.S.B.*, III, p. 58.

³ *'Uyūn al-Anbā'* (Müller's ed., Vol. I, p. 313).

⁴ The *Jāmi' al-Mufradūt*, or Treatise on Simples, translated by L. Leclerc (Paris, 1877). Ibn al-Baiṭār, who was originally an inhabitant of Malaga, in Spain, was one of the greatest botanists of Muhammadan times. He travelled extensively in Northern Africa and the Near East, and died in 1248 A.D. at Damascus.

aware of the end of his days, and wished to prevent the loss of the knowledge he cherished by writing a book that would enable his readers to dispense with the other books he had written on the subject, we may safely assign the publication of the *Kitāb al-Asrār* to about 920 A.D. It may be added that a large portion of this work of ar-Rāzi was translated into Latin (*vide* Paris Ms. No. 6514 of the Bibliothèque Nationale, entitled *Liber Secretorum Bubacaris*), and that one or two of the extracts given later are also found (in a different Latin translation) included in the *De Anima*, of the Pseudo-Avicenna, which was printed at Basle in 1572.

(3) The Encyclopædia called the *Mafātīh al-'Ulūm* (Keys of the Sciences), written by Abū 'Abdallāh Muḥammad bin Aḥmad bin Yūsuf al-Kātib al-Khwārazmī. This work, which was dedicated to the Wazir of another Samānid King, Nūḥ II, who reigned over Khurāsān and Trans-Oxiana from 976 to 997, probably dates from about 980 A.D. An Arabic edition of the text was published by Van Vloten at Leyden in 1895, and an English translation of the Ninth Chapter of the Second Part, dealing with Alchemy, is now given—not only to prove what was indicated when the Rāmpūr Ms. was originally described,¹ viz., that the source of al-Khwārazmī's information was chiefly the *Madkhal*, but also because, embedded in the *Mafātīh al-'Ulūm* are found extracts from other treatises of ar-Rāzi—chiefly, in all probability, the Second of the Twelve Treatises, viz.: that variously called the *Madkhal al-Burhānī* (Demonstrative—or Theoretical—Introduction), or *Kitāb 'Ilal al-Ma'ādīn* (Treatise on the Diseases—or Causes—of the Minerals).

3. SUMMARY OF AR-RĀZĪ'S LIFE, WORK AND PERSONALITY.

In addition to a number of articles, one of which has already been referred to, Dr. Ruska is understood to be engaged on a volume which will deal exhaustively with ar-Rāzi's many-sided life and activities, so that we need only now give such a brief account of ar-Rāzi as will enable the personality of this eminent Persian Physician and man of science to be readily visualised.

Ar-Rāzi, according to al-Bīrūnī (*op. cit.*), was born in 866 A.D. at Ray, an ancient town on the southern slopes of the Elburz Range that skirts the south of the Caspian Sea. In his early youth he devoted himself to the study of Music, Literature, Philosophy, Manichæism, Magic and Alchemy, and it was only after his first visit to Baghdād, when he was at least 30 years of age, that he seriously took up the study of Medicine under the well-known doctor, Abū'l Ḥasan 'Alī bin Sahl bin Rabban². Ar-Rāzi showed such skill in the subject that he quickly surpassed his master, and Ibn Abi Uṣāibi'ah gives the title of no less than 100 medical books written by him. Besides these, al-Bīrūnī mentions 33 treatises on Natural Science (exclusive of alchemy), 11 on Mathematics and Astronomy, and more than 45 on Philosophy, Logic, and Theology. On Alchemy, in addition to his Compendium of

¹ Stapleton and Azo, *Mem. A.S.B.*, III, pp. 75 and 76.

² This doctor was a Jewish apostate to Islām, and belonged to the famous medical school of Ṭabaristān or Hyrcania—the strip of marshy country between the Elburz mountains and the Caspian that continued, far into Islāmic times, to be the stronghold of the original civilisation of Persia.

Twelve Treatises—the names of which will be found at the end of the *Madkhal at-Ta'limi* and the *Kitāb al-Asrār*, he wrote about a dozen other books, two of which were refutations of works by other authors in which the possibility of alchemy had been attacked. In spite of references in the *Kitāb al-Asrār* to the successful preparation of the Philosophers' Stone, it seems more than probable that ar-Rāzī was unsuccessful, e.g. the story of Ibn Juljul, quoted by Ibn Khallikān¹, of his being beaten by Maṣūūr for having hesitated to obey the order of Maṣūūr to prepare a sample of the Elixir, as well as certain statements in Ibn Abi Uṣāibi'ah: but, on the other hand, his life-long study of alchemy resulted in an even more important achievement, viz., the production of a series of treatises which—as any one may gather from a perusal of the *Madkhal* and *Kitāb al-Asrār*—were, in reality, scientific works in the modern sense of the word. For the first time in the history of the world we find a systematic classification of carefully observed and verified facts regarding chemical substances, reactions, and apparatus, described in language which is almost entirely free from mysticism and ambiguity.

As for the man himself—regarding whom an-Nadīm, the author of the *Fihrist*,² admirably declares that he acquired a knowledge of all the Sciences of the Ancients and was unique in his age and unequalled in his time—we will only quote, first, a vivid account of ar-Rāzī that some friend gave to an-Nadīm, and, then, the concluding remarks of al-Bīrūnī.

“Muḥammad bin al-Ḥasan al-Warrāq once told me (the following story): ‘One of the inhabitants of Ray, a very old man, of whom I once enquired about ar-Rāzī, told me that he recollected him as an old man, with a large square head. He used to take his seat in the lecture room, with his own pupils next him, and the pupils of these men behind them, and, behind these again, other pupils. Whenever anyone came with a question, he used first to ask the back row. If they could answer, he went away; but, if not, he used to pass on to the others, and they, in their turn, if they could give a correct answer, tried to satisfy him; otherwise ar-Rāzī would speak on the subject himself. He was a liberal and generous man, and so compassionate to the poor and sick that he used to distribute alms to them freely and even nurse them himself.’ The man also said: ‘Ar-Rāzī was ever reading or copying, and I never visited him without finding him at work on either a rough or a fair copy. His eyes were always watering on account of his excessive consumption of beans³, and he became blind towards the end of his life.’ ”

Al-Bīrūnī writes as follows⁴: “Ar-Rāzī was born at Ray on the 1st of *Shā'ban*, 251 A.H. As for his life, I have established little more than that he busied himself with *Kīmiyā'*; but at last his eye-sight failed, and this led him to a study of Medicine, in which he attained great eminence. The most powerful Kings brought him to their Courts and employed him as a Doctor. He was an earnest student, and had many

¹ *Biographical Dictionary*, De Slane's translation, Vol. III, p. 314.

² Completed in 988 A.D., i.e., about 60 years after ar-Rāzī died.

³ I.e., in disregard of one of the rules of Pythagoras, whose precepts—at all events in Alchemy—ar-Rāzī claimed to follow.

⁴ Ruska's translation, *op. cit.*, p. 32.

pupils. He used to put a lamp in a niche in the wall and stand near it, supporting the book against the wall in order that, when sleep overcame him, it would fall from his hand and awake him. This was one of the causes of the damage to his eye-sight, to which a contributory cause was also his fondness for beans. Finally he became quite blind in both eyes. One of his pupils came from Ṭabaristān to treat him. On the pupil telling him that he must be operated on for cataract, ar-Rāzī replied that the end of his life was near at hand and that it was unpleasant to be given pain at such a time. Soon after this, ar-Rāzī died at Ray on the 5th of Shah'bān, 313 A.H. (=October 26th, 925 A.D.), aged 62 lunar years and 5 days''¹.

4. CONTENTS OF THE DOCUMENTS FROM A CHEMICAL POINT OF VIEW.

These may be most conveniently dealt with under the following heads:

First, Substances (*'Aqāqir*) generally. These, in turn, were classified by ar-Rāzī into:

(a) Earthy: (b) Vegetable: and (c) Animal.

Earthy substances were, in their turn, divided into:

- | | |
|----------------|--------------------------|
| i. 'Spirits'; | iv. Vitriols; |
| ii. 'Bodies'; | v. Boraces; and |
| iii. 'Stones'; | vi. Salts ² . |

Secondly, Derivative substances.

Thirdly, Instruments and Apparatus; and,

Fourthly, Processes.

A(I). Classification of Earthy Substances.

I. Four 'SPIRITS,' viz., Mercury, Sal-ammoniac (Mineral, from Khurāsān: and also made by distilling Hair); Arsenic Sulphide (including our Orpiment, and Realgar); and Sulphur.

II. Seven fusible 'BODIES' or Metals, viz.: Gold, Silver, Copper, Iron, Tin, Lead and *Khārshīnī*.³

III. Thirteen 'STONES', viz.: *Mārqaṣhīshā* (Pyrites): *Maghnīsiyā* (various dark earthy minerals): *Dawṣ* (Iron quenched in water, or Iron Oxide): *Tūtiyā* (various light-coloured earthy minerals: or sublimates in metallurgical operations): *Lāzaward* (probably the Copper ore 'Azurite'): *Dahnaj* (Green Malachite): *Fairūzaj* (Turquoise): *Shādanj* (Haematite): *Shakk* (Arsenic Oxide): *Kuḥl* (Lead Sulphide): *Talq* (Mica and Asbestos): Gypsum: and Glass (which ar-Rāzī notes is made from Sand and *Al-Qilī*—Sodium Carbonate).

IV. Six 'VITRIOLS' (*Zājāt*), viz.: Black vitriol: Alum: *Qalqand*: *Qalqadīs*: *Qalqaṭār*; and *Sūrī*.

¹ I.e., 60 Solar years and 2 months.

² This is the order found in the *Kitāb al-Asrār*. In the *Madkhal* the order apparently was 'Bodies,' 'Spirits,' Salts, Boraces, Vitriols, and 'Stones.' The change in order may indicate that ar-Rāzī, as he gained experience, was induced to lay greater stress on 'Spirits' and 'Stones' from the point of view of their importance in alchemical processes than he had at first assigned to them.

³ This was possibly Zinc: see note on the subject, *infra*, pp. 405-407.

This is the classification found in the *Kitāb al-Asrār*. In the earlier *Madkhal*, they are classified as (a) White (including Alum: a variety of vitriol known as *Minjānī*: and, apparently, *Qalqadīs*), the test for this class being that, when moistened and mixed with gall-nuts, they were not blackened, or, in other words, they did not contain any iron: (b) Yellow, including 'Ink Vitriol,' 'Cobblers Vitriol,' and *Sūrī*: and (c) Green, i.e., *Qalqand*, the test of which was that when moistened and rubbed on iron, it turned the latter red, and hence contained Copper. *Qalqatār*, which is stated to be both yellow and red in colour, was apparently regarded as being similar to *Qalqand* as it answered to the same test.¹

V. Six 'BORACES,' viz., Bread Borax: *Natrūn* (Sodium Sesquicarbonate): Goldsmith's Borax: *Tinkār* ('both a borax and salt'); *Zarāwandī*: and *Būraq al-Gharb* (gum of the Willow or Acacia).

VI. Eleven 'SALTS': Sweet: Bitter (possibly some salt of Magnesium): *Andarānī* (including a red variety of Rock Salt out of which plates and dishes were made on a lathe): *Tabarzad* (probably because it was found in large crystals like sugar candy): Naphthie: Indian: Salt of Egg (or, 'smelling like a boiled Egg'). Salt of *Al-Qilī* (Sodium Carbonate): Salt of Urine (Microcosmic Salt): Salt of Lime (slaked lime): and Salt of Oak Ashes (Potassium Carbonate). The *Madkhal* also included, in the 'Salts,' Sal-ammoniac (under the name of the 'Eagle').

A(2). Vegetable Substances.

Ar-Rāzī notes in the *Kitāb al-Asrār* that these are seldom used, with the exception of the ashes of a plant called *Ushnān*, which was found in marshy places. He does not seem to have been understood that the product (Sodium carbonate) was the same as 'Salt of *Al-Qilī*' and as the product of heating *Natrūn*.

A(3). Animal Substances.

These numbered Ten, and included: Hair, Skulls, Brains, Bile, Blood, Milk, Urine, Eggs, Mother of Pearl, and Horn: the best—as a means of preparing the valuable reagent Sal-ammoniac—being, in order, Hair, Brains, Bile, Eggs, Skulls and Blood.

B. Derivative, or Artificial Substances.

Ar-Rāzī mentions Ten of these in the *Madkhal*, but refers students for details of their preparation to the Second book of the Twelve, viz: the *Kitāb 'Ilal al-Ma'ādin*, no copy of which appears to have survived. Fortunately, however, the author of the *Mafātih al-'Ulūm* seems to have had access to a copy of this work, as he describes the methods used in making them. Two or three other non-metallic artificial substances are mentioned in the *Kitāb al-Asrār* (besides five metallic alloys), while a few more are found mentioned in various other places in the same book. The following is a fairly complete list:—

¹ It is rather curious that ordinary Blue Vitriol is not specifically mentioned in either of ar-Rāzī's treatises. It is apparently, however, what is referred to as 'Cobblers' Vitriol' (cf. Pliny, *Natural History*, XXXIV. Cap. 12).

- (1) *Martak* or *Murdāsanj*. Lead Oxide, PbO, made by blowing air on to heated lead.
- (2) *Ustrunj*. Red Lead, Pb₃O₄, made by igniting lead till it becomes red.
- (3) *Isfīdāj*. Tin or Lead Oxide, made either by burning the metals, or, in the case of Tin, by soaking thin plates of the metal in vinegar.
- (4) *Zanjār*. Copper Acetate, made by soaking Copper plates in vinegar and scraping off the green product till the copper has all disappeared.
- (5) *Saktah* or *Rūsukhtaj*. As the meaning of the latter word shows (*Rūy*, Copper, or Copper alloy, and *Sūkhtah* 'burnt') this substance was probably Copper Oxide, CuO.
- (6) *Tūtiyā*. As this artificial form is defined as 'the Smoke of Copper and of *Kuhl*' (Lead Sulphide), it should be either Copper Oxide or Lead Oxide. If, however, the first phrase refers to the substance that collects in the flues of copper-smelting furnaces (as can be gathered from Ibn Wāfid's account: *vide* note 5, p. 350, *infra*) it may have also included Zinc, Bismuth, and Antimony Oxides.
- (7) *Za'frān al-Ḥadīd*. Ibn al-Baiṭār quotes the *'Ilal al-Ma'ādin* as stating that this is Iron Rust (Leclerc, I, p. 422). The process of making it that is referred to in the *Maḡātib al-'Ulūm* is given on f. 33r of the Escorial Ms. M of the *Kitāb al-Asrār*. 'Take filings of good iron and wash them with water and salt several times, so that their impurity may disappear; and having put them in a glass phial, pour over them wine vinegar, and shake the mixture several times a day. Whenever it becomes dry, add more vinegar till it becomes *Za'frān*.' This would result in the formation of iron acetate; but possibly the term was applied to any red combustion product of iron or its compounds. Another process mentioned in the same folio was, first, to act on iron filings with red Arsenic Sulphide, and then to break up the fusible Iron sulphoarsenide thus formed by heating it to dryness with vinegar containing one-fourth its weight of Vitriol (*Zāj*).
- (8) *Dawṣ*. Though said in the *Madkhal* to be the 'Water of Iron,' it is referred to in the *Kitāb al-Asrār* as a solid with two varieties—from *Iṣṭakhr*, and 'Irāq, respectively. Possibly it was the black Oxide of Iron produced by quenching red-hot iron in water.
- (9) *Zunjufr* (Cinnabar, HgS) made by heating Mercury and Sulphur in a bottle till combination was complete.
- (10) *Shakk*. Probably the white Arsenic Oxide, As₂O₃, obtained in the manufacture of silver from its ores. (The substance mentioned in the *Kitāb al-Asrār* as *Khubth al-Fiḍḍah*, 'Dross of Silver,' may be a synonym, as ar-Rāzī does not apparently mention *Shakk* in this work among the artificial substances: but, on the other hand, *Khubth al-Fiḍḍah* may be the Lead Oxide obtained in cupelling argentiferous lead.)

- (11) *Mashaqūniyā*, a refuse-product in the manufacture of glass. Possibly it was Calcium Silicate.
- (12) *Qalīmiyā* (otherwise, *Qalmiyā* or *Iqlīmiyā*) is defined as anything that separates from metals while they are being purified.
- (13) 'Salt of *Al-Qilī* and Lime' (Caustic Soda). This was prepared by boiling a mixture of ashes of sea plants (*al-qilī*) and lime with water, and after purifying the solution by decantation, evaporating till a solid separated out.
- (14) Red solution of Sodium Sulphide, formed by boiling a solution of *Al-Qilī* with Sulphur.
- (15) *Zād ar-Raḡwah*. This was a strong solution of Calcium Polysulphide, formed by heating a mixture of lime and sulphur with water, and then boiling till the liquid was reduced to one-half the original volume of the water.
- (16) Solution of Mercury-Ammonium Chloride, formed by dissolving Mercury in Sal-ammoniac solution. It is described by ar-Rāzī as a 'very strong water dissolving all calcined substances and filings.'
- (17), (18), and (19). *Shabah*, *Isfīd-rūyah* and *Tālīqūn*. Of the 5 alloys mentioned in the *Kitāb al-Asrār*, only the constitution of the first two has been traced with certainty. *Shabah* was an alloy of 4 parts of Copper and $1\frac{1}{2}$ parts of Lead: while *Isfīd-rūyah* consisted of 4 parts of Copper and 1 part of Tin. The etymology of the word *Tālīqūn* (from the Greek *Katholikon*) suggests that it was a multiple alloy of all the metals.

C. Instruments and Apparatus.

Ar-Rāzī divided these into two classes: (i) Instruments for melting the 'Bodies': and (ii) those for the manipulation (*tadbīr*) of substances generally.

In (i) were included the following:—

- (1) Blacksmith's Hearth (*Kūr*):
- (2) Bellows (*Minfakh*, or *Ziqq*):
- (3) Crucible (*Būtaqah*):
- (4) Descensory (*Būt-bar-būt*, literally 'crucible on a crucible,' the upper one having its bottom perforated with holes)¹:
- (5) Ladle (Pers. *Māshū*; Ar. *Miḡraḡah* or *Mil'aqah*).
- (6) Tongs (Pers. *Ambur*: Ar. *Māsik*: or *Kalbatān*—the last named being large blacksmith's pincers):
- (7) Shears (*Muqāṭṭi'*: or *Miqṭa'*: pl. *Maqāṭi'*):
- (8) Hammer, or Pestle (*Mukassir*).
- (9) File (*Mibrad*): and
- (10) Semi-cylindrical Iron Mould (*Rāt*: or *Misbakah*).

(ii) Instruments and Apparatus used in Alchemical Processes (*Tadābīr*):—

- (1) The Cucurbit (*Qar'*): and Alembic (*Ambīq*) with a delivery tube. Four kinds of *Ambīq* are mentioned. As we indicate later (*infra*, p. 362, note

¹ Used in the process of *Istinzāl*, for the details of which see *infra*, pp. 354 and 379-80.

- 6), the probable derivation of the alembic from the physicians' Cupping-glass is of considerable importance in understanding the magical environment of alchemy in its earlier stages of development.
- (2) Receiving flask (*Qābilah*).
 - (3) Cucurbit, and 'Blind Alembic' (i.e., an *ambiq* without any delivery tube).
 - (4) Aludel (*Uthāl*).
 - (5) Beakers (Ar. *Aqdāḥ*: sing. *Qadah*: Pers. *Jām*: arabised pl. *jāmāt*). A similar, though perhaps larger, vessel was called the *Bātiyah*.
 - (5a) Glass cups (*Kizān*: sing. *Kūz*).¹
 - (6) Bottles or Flasks (*Qannānī*: sing. *Qinnīnah*).
 - (7) Phials (*Qawārīr*: sing. *Qārūrah*).
 - (7a) Rose-water phials (*Mā'wardiyah*).
 - (8) Earthenware Jars (*Barānī*: sing. *Barnīyah*) with lids, in which substances were heated.
 - (9) Cauldron (*Mirjal*: or *Tinjir*), in which substances were dissolved.
 - (10) Earthenware Pots (*Qudūr*), glazed inside, for the Long *Uthāl* used in volatilising Tin; with corresponding covers (*mikabbāt*).
 - (11) 'Bain-marie': or sand-bath (apparently these had no special names beyond that of earthen Pot—*Qidr*).
 - (12-16) Various other forms of Furnace or Stove.
 - (12) *Tannūr*,² or large Baker's oven.
 - (13) *Mustauqad*, or *Mauqid*, a small cylindrical stove, used for heating the Aludel.
 - (14) *Atūn*, a small model of the potter's or lime-maker's kiln.
 - (15) *Tābashedān*, or *Kānūn*: brasier or chafing dish, similar to that used by food-hawkers, the glowing charcoal being contained in a tray on top of an oven.
 - (16) *Nāfikhu nafsih*—a stove with perforated sides, half-filled with charcoal, and mounted on 3 legs—in which the receptacle containing the substances to be calcined, or brought into combination, was placed. It appears to have been something like a navvy's fire bucket, but the top was closed with a cover.
 - (17) Mortar (Pers. *hāwan*: Ar. *mihrās*): and its Pestle (*nisāb*). The mortar was sometimes made of glass (cf. Ms. M., f. 79r).
 - (18) (a) *Ṣalāyah* (flat stone Mortar): and (b) *Fihir* (stone Roller, for use with the *Ṣalāyah*).
 - (19) *Durj*, or Clay box in which layers of substances to be calcined or treated were placed. After the box had been closed by a luted cover, fire was kindled over it to heat the contents.

¹ The best were made in 'Irāq; and Dozy and Engelmann (*Glossaire des mots espagnols et portugais dérivés de l'arabe*, p. 287) suggest that the industry was one handed down traditionally from Babylonian times.

² A composite word of Aramaic origin, meaning 'furnace of fire' (*idem*, p. 211). The first part of the word is the same as No. 14.

- (20) Round Mould (*Kurah*), in which filings, mixed with suitable reagents, were placed in order to subject the mixture to the action of fire.
- (21) A covered Iron pan (*miqlāt*: usual meaning 'frying pan') used for calcining Hair in the preparation of Sal-ammoniac.
- (22) Hair Cloth, in which substances were tied and left in a moist warm atmosphere, so that the substances slowly deliquesced and were removed in the form of a strong solution.
- (23) Glass Funnel (*Qim'*) in which the drippings from the hair cloth were caught. The funnel was inserted in the mouth of a glass bottle.
- (24) Sieve (*Minkhal*), of Hair or Silk.
- (24a) Filter (*Rāwūq*), of Linen cloth (*Khaiṣh*).
- (24b) Filter made of a cup (*kūz*) with perforated bottom, the holes being covered with a layer of pieces of hair or fibre. The whole apparatus was thus a curious anticipation of a Gooch's Crucible (*vide* Ms. M., f. 48r).
- (25) Dish, or Platter (*Sukurrujah*).
- (26) Basket (*Sallah*): or felt-covered Cage (*Qajaṣ*) used in the process of 'Inhumation' under Dung. They were inverted over the bottles, in the mouths of which funnels, containing the substances that it has intended to dissolve, had been placed, and the whole was buried in Dung.¹
- (27) Lamps (*Qanādil*: sing. *Qindil*), to impart a gentle heat.

Numbers (i) (9), and (ii) (10) and (22)–(24), have been added from the '*Ain aṣ-Ṣan'ah*,² in order to make the list of apparatus, used in the 10th century, as complete as possible. For details of making the composite pieces of apparatus, such as the Aludel, the Second Discourse of the *Kitāb al-Asrār* and the corresponding portion of the *Madkhal* may be consulted.

D. Processes followed in Alchemical Practice.

(i). Preliminary Remarks.

Before entering into these, a few words are desirable in explanation of the general theory of work that was adopted in alchemical operations. From ar-Rāzī's almost complete silence on the subject of the 'Mercury-Sulphur' theory of the metals in both the *Kitāb al-Asrār* and the *Madkhal*, it is possible that he did not accept the teachings of his Master Jābir bin Ḥayyān on this point³; but he certainly followed

¹ For illustration of the complete apparatus *vide* Plate 1, Fig. 5, *Memoirs*, I (1905). ² *Idem*, pp. 60 and 61.

³ *Vide* p. 56 of E. J. Holmyard's *Jābir bin Ḥayyān* (Proc. Royal Soc. of Medicine, Vol. XVI, 1923). It may be noted in amplification of Holmyard's account of Jābir's life that he may have been born about 722 A.D. at Tūs in Ḳhurāsān, being possibly the son of a druggist who was executed shortly afterwards for active complicity in the projected 'Abbāsīd revolt against the Umayyad dynasty (*cf.* pp. 334–336 of ad-Dinawari's *Kitāb al-Aḫḫbār at-Tiwāl*—Guirgass' edtion). Jābir, when he grew up attached himself to the *Shi'ah* Imām Ja'far aṣ-Ṣādiq and had compiled his principal works, the 'Book of the Hundred and Twelve' and the 'Book of the Seventy', before his master's death in 765 A.D. He was also a client of the powerful Barmacide family of Wazīrs, and may have survived, as Holmyard suggests, until the fall of the Barmacides in 803 A.D., but hardly longer (in spite of what al-Jildakī says), as even in 803 A.D. he would have

Jābir to some extent in the alternative form of the theory, whereby substances were looked upon as being composed of potentially active matter (*jasad*) in combination with various proportions of 'Spirit' (*rūh*) and 'Soul' (*nafs*). Believing, as he apparently did, that the essential substance (*jawhar*) of all matter is the same, all that was necessary to effect transmutation was to bring about various changes in the proportions of the ingredients of any substance—probably in the direction of increasing the proportion of 'Spirit' (or colouring principle) and 'Soul' (oily or combining principle). This, in ordinary language, may be interpreted as meaning the removal of the excess of any constituent which was regarded as an impurity, so that obviously the first step was to purify the substances which it was decided to use as materials for the preparation of the two precious metals, viz.: gold, the metal of perfect composition, and silver, which was only to a slight degree less perfect.

Then followed processes designed to reduce the purified substances to such a degree of disintegration and fluidity that their penetration into other bodies with which they were mixed was likely to be facilitated: the admixture of the substances, thus disintegrated, in the proper proportions: and finally the removal from the mixture of dissolved, or 'cerated,' substances of the excessive amount of moisture, or the element of water, which they had temporarily acquired, so as to bring them back again to the solid state.

Hence we find ar-Rāzī's entire scheme of work to be approximately as follows¹:—

- (1) Cleansing and Purification of the substances to be employed by means of (a) Distillation, Decantation or Filtration (*Taqīr*): (b) The use of the Descensory (*Istinzāl*): (c) Assation (or Roasting—*Tashwīyah*): (d) Coction (or Digestion—*Tabkh*): (e) Amalgamation: (f) Lavation: (g) Sublimation: and (h) Calcination: the last-named being used only in the case of Metals and 'Stones.' Calcination included Rusting: and another process—allied apparently to both Calcination and Lavation—was *Taṣwīl* (a word which may be translated by Lixiviation).
- (2) Having freed the crude materials from their impurities, the next step was to reduce them to an easily fusible condition. This was done by a process known as Ceration (*Tashmī'*), which resulted in a product which readily melted, without any evolution of fumes, when dropped on a heated metal plate.
- (3) The next step was to bring the Cerated products to a further state of disintegration by the process of Solution (*Hall*).
- (4) Solutions of different substances, suitably chosen in proportion to the amount of 'Body,' 'Soul' and 'Spirit' they were supposed to possess, were brought together by the process of Combination (*Tamzīj*). Sometimes,

been more than 80 years old. The connection of ar-Rāzī with Jābir is discussed later in Section 5 (A and B) of this Introduction.

¹ Vide translation of the *Kitāb al-Asrār*—Introductory paragraph, describing what is contained in the Third Discourse; and corresponding note (see *infra*, p. 369).

however, admixture of solutions was replaced by Trituration with various liquids, followed by either Assation or Ceration: but ar-Rāzī expressly mentions that combination of Solutions is the best.

- (5) Finally the combined Solutions underwent the process of Coagulation ('*Aqd*'), the product which resulted¹ being the Elixir. This was a substance of which a small quantity, when projected (*tarḥ*) on a larger quantity of baser metal, was believed to be capable of converting it (by a process analogous to Fermentation) into silver, or if silver was used, of converting it into gold.

According to a quotation from some work of Jābir bin Ḥayyān given in the pseudonymous mediæval Latin work '*Liber Secretorum Calidis filii Iazichi*' (= Khālid bin Yazīd: *Artis Auriferæ*, 1592 ed., p. 346), Jābir believed that there were five essential processes in alchemy (i) Fugation, i.e., the putting to flight and removal of the blackness from the 'Spirit' and 'Soul' of a substance: (2) Liquefaction of the purified 'Body': (3) Ceration, or subtilisation, of the 'Body': (4) Albification, or quick fusion—particularly of the 'Body': (5) Solution: (6) Coagulation, or reunion of the 'Body' with the prepared 'Soul.'

Similarly, in the edition of Jābir's 'Book of Pity' by his pupil Abū 'Abdallāh Muḥammad bin Yaḥyā (Berthelot and Houdas., *La Chimie au moyen âge*, III, p. 186), the work is said to be comprised in four chapters, or processes:—

- (1) Purification of the substances used from their impurities, blackness, shadow, unctuosities and humidities ;
- (2) Disaggregation of the corporeal residues left at the bottom of the apparatus, until they acquire the nature of volatile 'Spirits' ;
- (3) Fixation (or coagulation) of the 'Spirits' by the corporeal residues ; and
- (4) Combination of the moistened products and subsequent removal of superfluous humidity.

The procedure of Jābir did not therefore differ in any marked degree from that of ar-Rāzī.

(ii). Notes on the Various Processes.

(1) Purification by—

(a) DISTILLATION (*Taqīr*) using the Cucurbit and Alembic, and catching the distillate as it fell drop by drop (*qaṭara*) in a Receiver (*qābilah*). This word *Taqīr* was used with reference both to the removal of excess of moisture from a mixture or solution, as well as for the actual distillation or decantation of liquid substances. Sometimes, apparently, it even included filtration as well.

(b) *ISTINZĀL*, the process of purifying substances by use of a Descensory (*Būt-bar-būt*). The substance was placed in the upper of two crucibles, which had holes in its base. When heated, the substance fused and dropped through the holes into the lower one, leaving the dross and impurity behind. Details will be found in the Instrument Sections of both the *Madkhal* as well as the *Kitāb al-Asrār* of the

¹ Or, more probably, 'which it was hoped would result.'

use of this process in 'melting' iron by converting the metal into a fusible Arseno-sulphide (*infra*, pp. 354 and 379-80).

A variation of this process was termed *Tajsīd*, by which was apparently meant giving the substance under treatment a purified 'Body' (*jasad*). The only metal that was made to undergo this process was Iron¹: and the only 'Stones,' *Mārqa-shīshā*, *Maghnīsiyā*, *Dawṣ*, Glass, *Talq* and Gypsum. The process with iron was practically identical with that of *Istinzāl* just referred to. The final product, when mixed with lead (*usrubb*) and a little White Elixir, was said to turn into pure silver.

(c) ASSATIION (or Roasting—*Tashwiyah*). The substance was moistened with water on a *ṣalāyah*, and then transferred to a luted bottle or cup. The latter was hung in another vessel, which was placed on a fire. After, apparently, the excess of moisture had been driven off by heat, the mouth of the inner vessel containing the substance was closed, and heating continued till the process was believed to be complete. The process is interesting for its recognition of the use of the air-bath in obtaining a moderate degree of heat.

(d) COCTION (or Digestion—*Tabkh*) was another form of *Tashwiyah*, conducted generally in the presence of excess of moisture.

(e) AMALGAMATION (*Talghīm* or *Ilghām*). Admixture of metals with mercury was often employed as a preliminary step in the processes of both Sublimation and Calcination. The root meaning of these Arabic words is 'to put in a cavity.' Possibly its transference to mean the formation of an alloy of metals with mercury was due to the method adopted for this process in (and before) the 10th century: cf., e.g., the following account from the *Kitāb al-Asrār* (*Ms. cit.*, f. 11 v). "Fuse the two Leads together in an iron ladle (*miḡhrāfah*), and put it aside (to cool). When they are almost solidified, press the pestle (*nisāb*) of a mortar into the ladle, and having prepared the mercury by tying it up in a woollen rag, saturated with olive oil, place it in the middle of the ladle. This is repeated until it (the mercury) turns into a stone." ²

(f) LAVATION (or Washing—*Ghasl*). This was apparently another preliminary to Sublimation. One method was to mix and heat the substance that was being treated, with salt. After heating, the substance was washed with water on a filter, and was then believed to be ready for sublimation.

(g) SUBLIMATION (*Taṣ'īd*), conducted by means of the *Uthāl*, or Aludel. The word is sometimes used almost synonymously with *Taqīr*. Detailed description of how to make the *Uthāl*, which the alchemists obviously regarded as their most important piece of apparatus, will be found in both the *Madkhal* (*infra*, pp. 356-7) and *Kitāb al-Asrār* (*infra*, pp. 382-3) ³. For the method of carrying out the

¹ Cf. Aristotle's remark that iron differs from the other five metals in possessing a preponderance of earth (*Meteorologica*—Webster's trans.—§. 389^a).

² The word 'amalgam' is probably derived from the past-participle *al-mulgham*, i.e., 'the substance that has been subjected to this process.'

The process here given for making a lead amalgam seems to be the source of the passage given under para 143 on p. 189 of Duval's translation of the Syrio-Arabic Ms. (*La Chimie*, II).

³ Vide also the '*Ain aṣ-Ṣan'ah* (Stapleton and Azo, *Mem. A.S.B.*, I, pp. 62-64).

actual operation, the translation of the account of subliming Mercury—which apparently was derived, through Jābir, from some pre-Muhammadan alchemical authors (probably Greeks)—may be consulted (*infra*, pp. 385–7).

A simpler form of sublimation, in which flasks (*qannānī*) were used, was termed *Takhniq* (Constriction; or Strangulation), or *Tarkhīm* (Incubation). The substance either by itself—or mixed with oil, if the ‘essence’ of the substance was required—was placed in the flask, heated gently to remove any moisture or oilness, and, finally, after the mouth of the phial had been sealed, heated strongly until the substance sublimed into the neck of the flask.

(h) CALCINATION (*Taklīs*). This was a similar process to *Tashwiyah*, but the luted vessels were placed directly in contact with the fire, and the heating continued until the substance was reduced to an almost impalpable powder.

The following quotations from the *Kitāb al-Asrār* will throw more light on the details of this important process, as carried out by ar-Rāzī (in addition to indicating the need for chemists to antedate the origin of the Phlogiston theory by at least 750 years):—

“Calcination can be performed with ‘Bodies’ (*aḥsād*, i.e., metals), ‘Stones’, ‘Salts’, ‘Dregs’ (not in Ms. M), Egg-shells, (and Mother of Pearl) ¹. It is the destruction of their ‘Bodies’ (or ‘inert matter’) ², the burning of the sulphurs and oils they contain, and their reduction to white lime, whose parts cannot be further divided. With the fusible ‘Bodies’ it is of three kinds, one by Burning, another by Rusting ³ and the third by Amalgamation. With all other things, it is by burning alone” (Ms. M., f. 26 r).

“Calcination of Silver by Burning. Take 10 *dirhams* of silver and feed it with half a *dirham* weight of fused yellow sulphur ⁴. Then pour it on to a *ṣalāyah* and after trituration it thoroughly, give it to drink of the water of salt, and having trituated for some time until it becomes dry, throw it into a luted cup (*kūz*) which is then placed in an *atūn* (furnace). Then remove the cup, and when it is cool, take out its contents. These are trituated and washed, and the process is repeated, until the substance becomes a white powder that cannot be further divided” (*idem*, f. 28 r). The final product is apparently Silver Chloride.

As regards RUSTING (*Taṣḍiyah*), the following extracts from the *Kitāb al-Asrār* will give some idea of the chemical processes included under this name:—

(a) “Calcination of Gold by Rusting. Take filings of gold, as much as you desire, and triturate on the *ṣalāyah* with an equal quantity of Sal-ammoniac, mixed with distilled wine vinegar, till the gold becomes rusted ⁵, even though it has to be done 30 times” ⁶ (*idem*, f. 27 r).

(b) “Calcination of Silver by Rusting. Take filings of silver, as much as you

¹ The word *Aḥḍāf* (Oyster shells, or ‘mother of pearl’) is omitted in the Escorial Ms, but is supplied from the Leipzig and Lucknow Mss.

² *M aḥsād*: Lg and Lw *aḥsām*.

³ I.e., chemical change brought about by treatment with some reagent.

⁴ Corrected from Mss. Lg and Lw. The Escorial Ms. omits to mention the weight of the sulphur.

⁵ Or ‘turned into dust.’ following the Lucknow and Leipzig Ms.

⁶ Ms. Lg: ‘for 30 days.’

desire, and a similar weight of Sal-ammoniac, and moisten them with water. Shake them with water three times, and when they become dry, add more water till the silver becomes white impalpable ¹ *Zanjār*. Then wash it, and assate it with water and salt, and repeat the assation till it becomes white lime (*nūrah*)” (*idem*, f. 29 r). The product in this case is evidently Silver Chloride.

(c) “Calcination of Copper by Rusting. This is to turn it into *Zanjār*. Take Copper plates, and plunge them into cooked ² vinegar, and put them on a bamboo lattice-work, placed in the top of a vessel (or jug, *bāṭi’ah*), in which there is Vinegar, so that the copper may turn into *zanjār*. Whenever it becomes *zanjār*, scrape it and repeat the process till all (the copper) is turned into *zanjār*.”

“Another better process. Take for each *ratl* of filings of Copper, 1 ounce of Sal-ammoniac, and cover it with wine vinegar, and shake it several times a day till it becomes *zanjār*. Whenever it becomes dry, add more vinegar, till it is completely turned into *zanjār*.”

“Another better process. Take 1 *ratl* of fine *rūsukhtaj* (‘burnt copper,’ i.e., Copper Oxide), and after trituration it thoroughly, add 1 ounce of Sal-ammoniac. Then take 2 *ratls* of good wine vinegar, and add to it a further ounce of Sal-ammoniac. After letting it stand for one night, filter it ³, and feed it with the triturated *rūsukhtaj* on the *ṣalāyah*. Triturate it during the day, and leave it exposed during the night, adding more vinegar whenever it becomes dry, until the whole is turned into *zanjār*” (*idem*, f. 31 r).

The product in each of the above three processes will be Copper Acetate. The third process is specially interesting, as showing that ar-Rāzī realised that the final product could be obtained indirectly, from the calcined metal, as well as from the metal itself.

(d) In the case of Iron, the process was generally that of actual rusting into Iron Oxide (*Za’frān*) by the action of air in the presence of ordinary water, or water mixed with salt and vinegar. Another interesting method was the one already mentioned on p. 323, viz., to decompose the iron arseno-sulphide (formed by heating iron filings with Arsenic Sulphide), with vinegar containing vitriol, and then to heat the product, till it became red dust (*idem*, f. 33 r).

The only other process that needs to be referred to in concluding this section on Purification is *Taṣwīl*, which we find mentioned in the Third Part of the *Maḥāṭih al-‘Ulūm*. The original meaning of the word appears to be Lixiviation: but the process (which was intended to reduce the substance to such fine particles that it would float on water) involved calcination.

(2) CERATION (*Tashmī’*). After the substance to be treated had been freed from the excess of impurity that it contained by one or more of the processes that have just been described, it was subjected to the process of Ceration. Ar-Rāzī states

¹ Lit. ‘*Zanjār* which has no parts.’

² Or ‘concentrated’ (*ghāliq*), following Lucknow Ms. The Leipzig Ms. says ‘fresh milk’: which may be an alchemical phrase for ‘Vinegar.’

³ Reading, from I.w. Ms., *ṣifhu*; instead of *di’hu* (‘keep it’).

in the *Kitāb al-Asrār* (*Ms. cit.*, f. 41 *r et v*) that four classes of substances—'Spirits,' 'Bodies,' 'Calces,'¹ and 'Stones' are capable of undergoing this process: and that it is brought about by four groups of reagents—'Spirits,' 'Salts,' Oils, and Boraces.

'Spirits' are cerated by salts, oils, and boraces: 'Bodies' by 'spirits,' salts, and boraces: 'Stones' by salts, and boraces: while Salts are cerated only by oils. The product will melt when dropped on a plate of heated silver or copper, and penetrate into the metal. Cerated substances are also stated to have been capable of imparting to metals some degree of colour.²

It is impossible to give any general statement of what these cerated products were, as in all probability they were a very miscellaneous collection of fusible substances. We will only quote two methods of cerating Gold, the first because of its obvious affiliation with the methods employed by Greek alchemists for preparing substances for alchemical operations: and the second as indicating the possibility that ar-Rāzī succeeded in preparing a fusible double chloride of Gold.

'Ceration of Gold with Spirits. Take as much as you desire of Red Gold and make into thin leaves. Take also a luted pot, and place in it fragments (or layers, *ṣaf*) of volatilised sulphur in which there is no blackness, and add pieces of the thin gold leaves till they are finished and then fill up the pot with vitriol (*Zāj*). Place a cover on it and close the joint. Then put it on a fire of medium intensity, viz., a fire of dung, in a stove (*tannūr*). Take it out when it is cool. (Continue to) do this until it is melted and flows, if it be the will of Allāh!' ³

'Ceration of Gold with Salts. Take calx of powdered gold⁴ and drench it with dissolved Sal-ammoniac, sufficient to unite all the parts, and triturate till it is dry. Then place on an uncovered charcoal fire in a luted dish (*sukurrujah*) and, when the face of the mixture begins to perspire, raise the cover, and leave it for sometime till it becomes cold. Then close it. Do this 10 times, and triturate it and drench it with the dissolved water of Sal-ammoniac, and repeat the process 10 times till it becomes a deliquescent salt' (*idem*, f. 42 *r et v*).

(3) SOLUTION (*Hall* or *Tahlīl*). The root meaning of the Arabic words is the

¹ Or 'Salts' (*vide* 3 lines later).

² According to Jābir, in one of the treatises of the 'Book of the Seventy,' Ceration consisted in returning to the treated substance, the 'Soul' and 'Spirit' that had previously been separated from it (Berthelot, *Archéologie*, p. 313). This probably supplies the source of the following statement of ar-Rāzī regarding the Third, or Perfect, method of combination that is found on f. 60v of Ms. M. of the *Kitāb al-Asrār* "Cerate (first) the 'Spirit' separately, and dissolve it. Then cerate the 'Soul' separately, and dissolve it. Then cerate the 'Body' separately, and dissolve it. Unite all three waters in equal amount and bury them for 40 days, until they are purified and each has entered the others in such a way that they cannot be separated."

For the Ceration of Salts by oils, i.e., to form soap, *vide* later, p. 393.

³ *Ms. cit.*, f. 42r. Cf. Zosimus to Theodorus, referring to the ceration of the Etesian stone (Chrysolith or Cadmia) "If it is burnt two or three times with sulphur, according to these writings, and digested for some time in dung, one then obtains 'transformed and solidly yellow colours'" (Berthelot and Ruelle, *Collection des anciens alchimistes grecs*. II., p. 208).

In the example given the vitriol will be converted into sulphides of iron and copper which may then form double salts with the Gold Sulphide simultaneously produced.

⁴ One process for calcining gold was to heat it with one-fourth of red Arsenic sulphide on a strong fire in a luted bag. The mixture when cool was triturated, washed with salt and water, and heated in a luted cup with an equal quantity of salt. After doing this 5 times, the product is said to have been a white calcined dust (*Ms. cit.*, f. 26r).

same as that of 'Solution,' viz., 'loosening' or 'disintegration' of the particles of a substance, and indicates a further physical change in the substance that was undergoing treatment beyond what had already occurred in the process of Ceration. We shall not, however, be very wrong in usually translating *Hall* by 'Solution,' as even in early Arabic writers the word had begun to acquire the modern significance of the English word.

Ar-Rāzī describes in the Fourth Section of his Third Discourse (Ms. M, ff. 55r.—60r.) the following eight methods of subjecting substances to the process of *Hall*:—

(a) By 'Sharp Waters' (*al-Mīyāh al-hāddah*).

These were a curious collection; and apart from miscellaneous liquids obtained from urine, as well as from inorganic substances, included Vinegar; Caustic Soda (mixed with some sal-ammoniac); a strong solution of Ammonia (made by distilling a mixture of sal-ammoniac and copper oxide, but afterwards mixed with sal-ammoniac and colocynth pulp); Calcium Sulphide (called *Zād ar-Raghwah*); and a solution of Mercury in Sal-ammoniac, which was used, in particular, to dissolve calcined substances. Although Beckmann and others have ascribed to ar-Rāzī the discovery of the so-called 'mineral' acids—possibly on the basis of certain interpolated passages in the *Liber Bubacaris*,—the only prescription in this section that suggests that he was acquainted with any of them is the following, which may be explained as a primitive method of obtaining Hydrochloric acid.

Section on the Solution of the Seven Salts.

'Take equal parts of sweet salt, Bitter salt, *Tabarzad* salt, *Andarānī* salt, Indian salt, salt of *Al-Qili*, and salt of Urine. After adding an equal weight of good crystallised Sal-ammoniac, dissolve by moisture, and distil (the mixture). There will distil over a strong water, which will cleave stone (*sakhr*) instantly.'¹

Nitre was not apparently differentiated in the time of ar-Rāzī from other salts, so we could not expect the isolation at this period of Nitric acid.² As regards sulphuric acid, although ar-Rāzī subjected vitriols to dry distillation (*vide infra* pp. 334 and 393) he appears only to have done so with the idea of separating their 'Souls' or 'Spirits,' and as, in accordance with the same mistaken theory, he subsequently returned the distillate to the residue in the alembic, he seems to have altogether failed to notice that the distillate was a particularly powerful solvent.

(b) 'Solution in Dung,' by deliquescence and digestion, the square flask containing the substance being buried in Dung (*vide infra*, pp. 388-9, for detailed account of the process).

¹ *Ms. cil.*, f. 56r. The Leipzig Ms., f. 52r, substitutes *talq* for *sakhr*.

² Laufer (*Sino-Iranica*, p. 555) states: "In the 13th century the Arabs became acquainted with saltpetre, which they received from China; for they designate it as *Thalj as-šini* (Chinese snow)." We cannot, however, follow him in this argument as Ibn al-Baitār equates this substance with *Asiyūs* (or stone of Assos: mentioned by Dioscorides and Galen) and adds that it is known in Morocco (which he visited in 1220 A.D.) as *bārūd* (Leclerc, I., pp. 71-73 and 333). Some substance with the latter name seems to have been known also to Jābir (*Book of Balances*—Berthelot and Houdas—*La Chimie*, III, p. 155).

(c) 'Solution by Moisture.' This is also by deliquescence, the flask being kept in moistened Sand.¹

(d) 'Solution in the *Dann*.' This is stated by ar-Rāzī to be a broad-mouthed vessel of 30 *dauraqs*² capacity, two-thirds of which was filled with vinegar. The substance to be dissolved was hung in a loose piece of rag from a handle on the interior of the cover of the *dann*, and is said to have been heated by a lamp (*qindīl*), hung at 4 fingers distance below the rag: but as the cover was firmly closed, and the exterior of the *dann* was smeared with a mixture of animal and pigeon dung mixed with carrot juice, the lamp must have been so quickly extinguished that very little heating could have taken place. Hot water was poured over the cover twice a day until the substance was dissolved. The process is said to have been found of special use in dissolving hard calces.

(e) 'Solution in the Cauldron' (*Mirjal*). This was filled with a mixture of water and, either bran, or chopped lamb's wool and pigeon's dung. The flask was placed in this mixture and the cauldron heated until the substance had all been dissolved by deliquescence.

(f) 'Solution in the 'Blind (Cucurbit, or Alembic) by Sharp Waters.' Details of the process, as given in the section of the *Kitāb al-Asrār* on Instruments, will be found on pp. 381-2 *infra*. The name '*Ḥammām*' there given to it is, however, assigned, in this section on Solution, to the 'Solution in the Cauldron.'

(g) 'Solution by Parsley (*Karafs*) in the *Sirdāb*' (?). It is not clear what form of apparatus was meant by *Sirdāb* (or *Sabdān*). The former word means a 'cool room' or 'ice-box.' As in previous cases, the substance, mixed with parsley, was placed in a flask hung from a handle on the interior of the cover of the apparatus, and when the cover had been fastened on, and covered with a linen cloth (*khaish*), water was sprinkled over it from time to time, until the substance had all dissolved.

(h) 'Solution by Distillation (*Taqīr*). This is said to have been specially used for salts and vitriols. The substance was moistened, and left over-night in the open air. The next morning it was distilled. The residue was twice moistened with water and allowed to dry, after which the distillate was returned to it. The process was repeated 'as long as it (? the distillate) increased in weight by distilling'; and came to an end as soon as it began to decrease in weight.

(4) COMBINATION (*Tamzīj*: or *Mizāj*)³. Ar-Rāzī gives three methods of bringing this about, only the third giving rise to perfect combination:

- (a) by Trituration, followed by Assation:
- (b) by Trituration, followed by Ceration:
- and (c) by the Combination of Solutions.⁴

¹ Reading, with the Leipzig Ms. (f. 57v), *raml*, for the *zibl* (dung) of the Escorial and Lucknow Mss.

² According to the '*Ain as-San'ah* (*Mem. A.S.B.*, I, p. 62) a *dauraq* of water weighed 1040 *dirhams*. Taking 128 *dirhams* as equal to 1 lb. and 10 lbs. to the gallon, the capacity of the *dann* used by ar-Rāzī—if the figures of the Mss. are correct—was no less than 24 gallons.

³ Properly speaking, *Mizāj* should be used with reference to the essential quality of the final product of the process of *Tamzīj*: but ar-Rāzī apparently regarded the two words as synonymous.

⁴ *Vide supra*, p. 332, note 2.

(5) FIXATION (or Coagulation—'Aqd'). This, which was the final process in making the Elixir, was performed either (a) by Assation; or (b) in the 'Flask and Pot'; or (c) by Inhumation (*Dafn*: i.e., burying in Dung): or (d) heating in the 'Blind' (Alembic).

5. THE SOURCES OF AR-RĀZĪ'S KNOWLEDGE.

A. The Writings of Jābir bin Ḥayyān.

The perusal of what has already been summarised in this Introduction, as well of the documents with which it deals, will probably have left the reader as much amazed at the scientific spirit displayed by ar-Rāzī, as were the present writers when they first took up the study of his works. Here, 750 years or more before Robert Boyle's epoch-making book saw the light in Europe, is to be seen living and working in two of the most ancient towns of the Near East a 'Sceptical Chymist' whom Boyle would have welcomed as a scientist after his own heart. What was the explanation of the sudden appearance of this clear-headed thinker and experimenter among the crowd of mystical alchemists who both preceded and continued to succeed him for so many years? Did ar-Rāzī suddenly invent a new science, or, if not, by whom was he inspired?

To enable an answer to be given, let us consider what ar-Rāzī himself states in the preface to the *Kitāb al-Asrār*.

"Know that I have compiled this book out of the Secrets of the experiments in this Art, so that it may be a guide to be followed and an authority (*dastūr*-Persian) to be referred to...I have described in it so much of the knowledge of the Art that you will not require any of my (other) books on this subject. . . . Allāh has been our helper in the description of the processes, and towards Him is our hope for completing what we have intended. . . . Verily we have explained in this book what the ancient Sages, viz: Ghādhimūn (Agathodemon), Hurmus (Hermes), Anṣūs (or Aṣṣūs), Balinās (Apolonius), Aflātūn (Pseudo-Plato), Jālinūs (Galen), Arasṭāṭālīs (Aristotle), Fithāghūras (Pythagoras), Buqrāṭ (Hippocrates; or Pseudo-Socrates), Sarjis (Sergius),¹ Hiraql (Heraclius), Mariānus, Khālīd bin Yazīd, and my Master, Jābir bin Ḥayyān (May Allāh illuminate his face!), have concealed. It is a summarised account according to Ghādhimūn, Hurmus, Arasṭāṭālīs and Astabālīs (? Ostanēs). If I was not aware of the end of my days and the nearness of my death and the fear of the loss of what I cherish, I would not have compiled all these things in one Book and made this Complete Summary. And Allāh is the Guide!"

A full discussion of the authorities mentioned in this quotation from the *Kitāb al-Asrār* may be left till we are able to edit ar-Rāzī's historical compendium, the *Shawāhid*. Reference to the quotations given from three of these alchemists in the abstract published in the *Memoirs of the Asiatic Society of Bengal* for 1910 (Vol. III, pp. 68-73), will sufficiently demonstrate that in these cases at least the subject

¹ The well-known priest, doctor, and philosopher of Rās al-'Ain in northern Mesopotamia who died at Constantinople c. 535 A.D. (*Mem. A.S.B.*, III—1910, p. 71, note 5).

matter is so mystical that it is difficult to imagine that ar-Rāzī could have been inspired to base on their writings a matter-of-fact treatise on Chemistry. Mariānus and Khālid were equally impossible, judging from the samples of their work translated into Latin, or, in the case of Khālid, still surviving in Arabic¹: and we have to fall back on the writings of Jābir bin Ḥayyān as a possible source of inspiration for ar-Rāzī. The small number of works of Jābir published by Berthelot in the 3rd volume of *La Chimie au moyen âge* are not very promising: but Holmyard's essay on Jābir, published in the *Proceedings of the Royal Society of Medicine* for 1923, indicated, as the result of an examination of others of Jābir's writings, that this author had by no means deserved the sweeping condemnation passed on him by Berthelot. Holmyard omitted, however, to deal with a much more scientific work of Jābir, the 'Book of the Seventy,' partially preserved in the mediæval Latin translation which was published by Berthelot in 1906 at the end of his *Archéologie et Histoire des Sciences*, and a comparison of this with the *Kitāb al-Asvār* soon showed that the latter could be copiously annotated from the former. The substances, apparatus, and processes mentioned by ar-Rāzī are, almost without exception, found in the 'Book of the Seventy,' and, in certain cases,² it is practically certain that ar-Rāzī must have had this book of Jābir in his possession when he was writing the *Kitāb al-Asvār*.

The mention, in the second treatise of the Latin translation of the 'Book of the Seventy,' of another treatise by Jābir called the 'Book of the Secrets' also enables us to suggest with a considerable degree of probability that the title of ar-Rāzī's Compendium was copied from that of the 46th treatise of Jābir's 'Book of the Hundred and Twelve' that preceded the 'Book of the Seventy' and of which the first two treatises are Parts I and II of the *Kitāb Uṣṭuqūs al-Uss* that will be mentioned later. Further search through the list of Jābir's works mentioned in the *Fihrist*, as well as those found elsewhere, showed that this was not an isolated example of borrowing, but that ar-Rāzī made free use of his master's titles when publishing his own works. It may ultimately be found that in some, or all, of these treatises the corresponding treatise of Jābir was explained, just as ar-Rāzī says the seventh of his 'Twelve Treatises', the *Kitāb al-Tartīb*, was an explanation of the *Kitāb ar-Rahmah*. The following is a full list of actually, or apparently, corresponding titles that have been noted, roughly in the order of ar-Rāzī's works as given in the *Fihrist*.

JĀBIR.

1. (a) *K. Taqdimat al-Ma'rifah.*
- (b) *K. al-Madkhal ila' ṣ-Ṣan'ah.*
2. (a) *K. al-Burhān.*
- (b) *K. 'Ilal al-Ma'ādin (Fihrist*
has wrongly *K. Kimān al-M.).*

AR-RĀZĪ.

1. *K. al-Madkhal at-Ta'limī.*
2. *K. al-Madkhal al-Burhānī; or K.*
'Ilal al-Ma'ādin.

¹ E.g., described in the paper referred to in the last note.

² E.g., (a) description of Aludel (pp. 356 and 382 *infra*); (b) the preparation of *Ustrunj* and *Murdāsanj* (pp. 365-6); and, in particular, (c) the preparation of Sal-ammoniac by the distillation of Hair (p. 390.).

JĀBIR.

K. al-Rukn (Pillar). Holmyard notes also a *K. al-Arkān* and a *K. al-Arkān al-Arba'a*.

3. *K. Naqḍ 'ala'l Falāsifah*.
4. (a) *K. al-Aḥjār* (22 books).
(b) *K. al-Ḥajar al-Ḥaqq al-A'zam*.
(c) *K. al-Ḥajar* (Bombay lithograph-collection of 11 of Jābir's works).
(d) *K. Nār al-Ḥajar*.
5. *K. Tadbīr al-Ḥukamā' al-Qudamā'* (mentioned by Jābir in his *K. al-Mulk*).
6. *K. Khawāṣṣ al-Iksīr adh-Dhahab* (Paris Ms. translated by Holmyard).
7. *K. at-Tadābīr ar-ra'īyah* (Theoretical Operations).
Second *K. at-Tadābīr*.
8. *K. al-Miḥnah* (the Test).
9. Many books on *Ḥiyal* (Devices).
10. *K. al-Asrār*.
11. (a) *K. as-Sirr al-Ghāmiḍ*.
(b) *K. Sirr al-Asrār* (Ms. in British Museum).
12. *Kutub al-Mulk*.
13. (a) *K. al-Khawāṣṣ*.
(b) *K. al-Ashjār*.
14. *K. al-Ḥāwī*.

AR-RĀZĪ.

K. al-Arkān (Book of the Pillars), the name ar-Rāzī either alternately designated the two *Madkhals*, or applied to some other book of his (*vide* Ms. M, f. 83 r).

3. (a) *K. Ithbāt aṣ-Ṣan'ah wa'r Radd 'alā munkirih*.
(b) *K. ar-Radd 'ala'l-Kindī fī Raddihi 'ala's-Ṣan'ah*.
4. (a) *K. al-Ḥajar*.
(b) *K. al-Ḥajar al-Aṣḥar*.
5. *K. at-Tadbīr*.
6. *K. al-Iksīr*.
7. *K. at-Tadābīr* (which included a theoretical portion).
8. *K. al-Miḥan* (Tests).
9. *K. Sirr al-Ḥukamā' wa Ḥiyalihim*.
10. *K. al-Asrār*.
11. *K. Sirr al-Asrār*.
12. *K. Rasā'il al-Mulūk*.
13. *K. Khawāṣṣ al-Ashjār*-(properties of trees: Brockelmann No. 11).
14. *K. al-Ḥāwī* (Ar-Rāzī's greatest medical work: known in Latin as 'Liber Continens').

Of the works of Jābir enumerated above, 12 are from the 'Book of the Hundred and Twelve'; 21 (including 20 on Stones) from the 'Book of the Seventy'; and 3 from the 'Book of the Seventeen.' The last-named volume is stated on the last page but one of the Latin version of the 'Book of the Seventy' to have dealt with 'Corpora,' 'Compositiones' and 'Preparationes'; and it is of particular interest from the chemical point of view, owing to its having included a treatise on how to identify substances by Testing.

We trust that this brief survey will at least establish the desirability for a careful study of the possible indebtedness of ar-Rāzī to Jābir whenever further works of either author come to light. The results of a study of one of these already known will be found in the next section.

B. Jābir's *Ustuqus al-Uss* ;

with special reference to ar-Rāzī's classification of Substances.

It has already been stated (*supra*, p. 321) that ar-Rāzī first divided all substances (a) Earthy, (b) Vegetable and (c) Animal: while the first class, viz. Earthy substances, were in turn subdivided into six groups, 'Spirits,' 'Bodies,' 'Stones,' Vitriols, Boraces and Salts.

Vitriols, Salts and Boraces are mentioned in the 31st treatise of the 'Book of the Seventy'¹ and although 'Spirits,' 'Bodies' and the 'Stone' are also mentioned at the end of this book of Jābir,² as well as elsewhere in the same series of treatises, we thought it desirable to make a further search in order to be certain of the true origin of ar-Rāzī's classification. The original source is undoubtedly to be found in the first treatise of Jābir's other great work, the 'Book of the Hundred and Twelve,' called *Kitāb Ustuqus al-Uss al-awwal*, "The First Book (called) 'The Element of the Foundation,'" which was written for his patrons, the Barmacides.³ This work has been preserved in a small lithographed volume of 11 of Jābir's treatises published some 25 years ago in Bombay, while we have also obtained another Ms. copy from Teherān. A very slight study of the work showed that it well deserves to be published in its entirety, and we trust that the publication by Holmyard of the three sections of the *Ustuqus*, as well as the remaining eight treatises in the Bombay booklet, will not be long delayed. The book is, however, very difficult to understand; and we take the opportunity of acknowledging the assistance given to one of us⁴ by his late Father, Shams al-'Ulamā' Vilāyat Husain (then Head Maulavi of the Calcutta Madrasah), in making the rendering from which the selections given later in the present paper are taken. We quote two series of passages, the first dealing with the classification of the substances used in alchemy, and the other with the sources of the 'Stone,' i.e., those things out of which the Elixir could be made. Both are extremely important for the true understanding of alchemical theory.

From the former it will be seen that Jābir primarily classified substances into Animal, Vegetable and Mineral. The Mineral in turn were divided by him into 'Spirits,' *Ajsām* (substances not possessing the power of either combination or volatilisation), 'Souls' and 'Bodies.'

The Spirits are at first stated to be six in number, viz. (1) the Sulphurs; (2) the Arsenic Sulphides; (3) Sal-ammoniac; (4) Camphor; (5) the Oils; and (6) Mercury: but when Jābir passes on to an extremely interesting discussion of the difference between 'Spirit' and 'Soul,' the former being stated to be (alchemically) an 'active Tincture,' while 'Soul' means 'the unctuous quality that brings about combination,'

¹ Berthelot, *Archéologie*, p. 341.

² Cf. p. 368 *infra*.

³ Cf. *Fihrist* (Flügel's ed., p. 355).

⁴ M H.H. in 1904, while in receipt of a Research scholarship from the Government of Bengal.

he proceeds to re-classify Sulphur, Oil and Arsenic Sulphide as 'Souls,' while the remaining three, Mercury, Sal-ammoniac and Camphor are still classed as 'Spirits.' He adds, however, in the case of Mercury a proviso that with 'Spirits' it behaves as a 'Spirit,' and with 'Souls' as a 'Soul,' and that some alchemists also believe—though he does not—that Camphor and Sal-ammoniac can also impart colour, and, hence, should be reckoned as 'Souls.' All this betrays some degree of uncertainty; and it is noteworthy that by the time he wrote the first treatise of his subsequent work 'The Book of Seventy,' Jābir apparently had altogether dropped the term 'Soul,' as well as the inclusion in the simple volatile substances of Oil and Camphor, and had arrived at the same classification as we find in the *Kitāb al-Asrār*, viz. that there are four 'Spirits'—Mercury, Sulphur, Arsenic Sulphide and Sal-ammoniac. It is probable, therefore, that ar-Rāzī in his own writings directly adopted Jābir's later classification of simple volatile substances.

Metals are termed by Jābir *Ajsād* (plural of *jasad*), and are defined as those fusible substances in which the amount of 'Soul' and 'Spirit' bears a definite relationship to the amount of potentially active matter (*jasad*, in contradistinction to inert matter, *jism*).¹

The term *Ajsām* (plural of *jism*) does not apparently occur in the two treatises of ar-Rāzī dealt with in this paper, and in the *Ustuqus* it is only used in passing reference to those substances which, owing to lack of oilness and capacity for union, find no place in the art of alchemy. He instances, as examples, Glass, Ruby, *Talq* and Diamond, as well as other substances 'formed from water only.' He adds, however, that certain other substances, such as *Maghnāsiyā* and *Mārqashīshā*, possess both *jasad* and *jism*, so that it is easy to understand why ar-Rāzī discarded the term and preferred to call such substances by the simple title of 'Stones.'

The second short collection of extracts from Jābir's *Ustuqus* deals with *al-Hajar*—the 'Stone,' by which, as the author of the *Mafātīḥ al-'Ulūm* says, is meant those things out of which the Elixir can be made. Jābir begins by stating that primarily *al-Hajar* is a part of man's body, by which the other parts are kept in adjustment and equilibrium, and he endorses the opinion of those who believe that it is either Yellow Bile, or Hair. Those who consider that the Elixir can be made from Urine, Blood, Excrement, or Eggs are less trustworthy: nor is he any more enthusiastic in endorsing the views of those who believe in the efficacy of Vegetable substances. It should be noted, however, that Jābir is stated in the *Fihrist* to have included treatises on Urine, Blood, Milk and Eggs (two) in his 'Book of the Hundred and Twelve,' while towards the end of the Latin translation of the 'Book of the Seventy' is found a short treatise called *Liber Pinguedinis* devoted entirely to explaining how an unctuousness can be extracted from various plants from which, in turn, Sal-ammoniac can be obtained by distillation. Similarly the *Liber Indicum* is a treatise on Blood, explaining how yellow Sal-ammoniac can be obtained by distilling it, just as happens with plants and hair: while at least five other of the treatises found in the

¹ The same idea is found in Muḥammad bin 'Abd al-Malik's statement that the Elixir consists of one part of 'Spirit,' two parts of 'Soul' and one part of 'Body' (cf. Stapleton and Azo, *Memoirs*, A.S.B., I, p. 54).

Latin translation deal with Trees and Vegetables. Possibly, therefore, Jābir kept an open mind as to whether the Elixir could be obtained from other organic substances besides Bile and Hair.

As regards the Metals and 'Spirits,' Gold, Iron, Copper, Lead and Sulphur are recommended for making the Red Elixir, and Silver, Tin and Arsenic Sulphide for the White¹. Mercury was useful for both. Jābir adds that Lead is often included by alchemists among the substances used for making the White Elixir, and not among those for making the Red.

C. The Chaldaean element in ar-Rāzī's Chemistry :

as indicated by the inclusion of *Khārṣīnī* in the list of Metals.

The opportune publication last year of Campbell Thompson's *Chemistry of the Ancient Assyrians* would in any case have enabled us to suggest that much of ar-Rāzī's Chemistry may ultimately be traced back to Assyrian and Babylonian sources. The mention, however, of *Khārṣīnī* as one of the Metals affords a still more certain clue, and we will now endeavour to summarise the facts that can be gathered from a consideration of the meaning and history of this curious word.

The metallurgy of *Khārṣīnī* has already been dealt with by De Sacy,² Dozy and Engelmann³ and others, but no one appears to have previously drawn attention to the historical implications of the true meaning of the word, viz. 'barb of China,' or 'arrowheads' (a wound from which was mortal), or to the fact that, in all probability, the metal referred to by the name *Khārṣīnī* passed into Arabic Alchemy through the influence brought to bear on ar-Rāzī by the ancient civilisation of Mesopotamia that still survived in his time at Ḥarrān—the ancient capital of the province that occupied the great bend of the Euphrates to the east of Aleppo. As soon as we consulted the second volume of Chwolsohn's great work *Die Ssabier und der Ssabismus* and realised the importance to chemical and, indeed, world history of the use of *Khārṣīnī* in Ṣābian (Ḥarrānian) ritual, we hastened to make the précis of the religious beliefs and practices of the Ṣābians that will be found as the sixth section of this paper. To this subsequently was added a table, compiled from Muḥammad Ḥusain's *Makḥzan al-Adwiyah*, which clearly proves how the ideas of the ancients have survived in Muḥammadan pharmacology even down to the most recent times. Finally, our work was completed by a further note containing a brief discussion of the Chemistry of *Khārṣīnī*, as well as of the alloys with which it was connected and often—especially in later times—confused.

Prior to the time of ar-Rāzī, *Khārṣīnī* may also have been known to Jābir, as one of a collection of Arabic Treatises on the metals found in MS. No. 2606 of the Bibliothèque Nationale, ascribed to Jābir, is called the *Kitāb al-Khārṣīnī*.⁴ If so,

¹ For an explanation of why no mention is made of the most important reagent, Sal-ammoniac, *vide infra*, p. 394. note (4).

² *Chrestomathie Arabe*, III, pp. 452-464.

³ *Glossaire*, p. 252.

⁴ Holmyard's *Jābir*, p. 53. We have not as yet been able to secure photographs of this Ms., but intend to take up the question further when these are available.

this may afford one reason why ar-Rāzī included this rare metal in his list as the Seventh metal, in preference to Jābir's strange choice of Glass. To a man of ar-Rāzī's temperament and possessing a mind sufficiently critical to reject everything in the teaching of his Master that could not be classed as an experimentally proved fact, this would hardly have been sufficient to induce him to add *Khārṣinī* to the previously universally accepted list of six simple metals: Gold, Silver, Tin, Lead, Iron, and Copper. The true explanation can, we venture to think, be deduced from a consideration of the following facts. To begin with, the first two Sages ar-Rāzī mentions in his preface to the *Kitāb al-Asrār*, are the Prophets from whom the Ḥarrānians claimed to have derived their civilisation and religious ideas. Secondly, the names of the metals given in the *Madkhal* list are those of the Ṣābian deities, or planets. Thirdly, the authority most copiously quoted by ar-Rāzī in the *Shawāhid* is a Ṣābian called Sālim al-Ḥarrānī.¹ Fourthly, Muḥammad Ḥusain, the author of the *Makḥzan al-Adwiyah*, supplies, on p. 80 of his preface, some extremely valuable items of traditional information regarding the influence and origin of the Medical School of Ḥarrān. The earliest doctor he mentions, in tracing the customary pedigree of his medical teachers, is one Mīrzā Muḥammad Masīḥ who, he states, learnt from the physicians both of Ṭabaristān (from whence came ar-Rāzī's own teacher 'Ali bin Rabban) as well as of Khūzistān, i.e., the famous medical school of Jund Shāpūr (120 miles N.-N.-E. of the modern Baṣra), which was founded by Nawshīrwān, the greatest of the Sāsānian Kings, about the middle of the sixth century. Muḥammad Ḥusain further states that *both these schools professed to have drawn their knowledge from the physicians of Ḥarrān, and that the latter, in their turn, acknowledged the Greek physicians of the Hippocratic School to be their masters and teachers.* Last but not least, as we learn from Chapter 64 of the *Murūj adh-Dhahab* of al-Mas'ūdī—the 'Herodotus of the Arabs'—whose testimony can be implicitly accepted,² ar-Rāzī actually wrote a book dealing with the religion of the Ḥarrānians. All these items of evidence appear to point clearly to Ḥarrān as another and most important source of ar-Rāzī's knowledge, and we are therefore led to the final conclusion that ar-Rāzī relied mainly on the temple science of the Ṣābians of Ḥarrān for materials whereby he could check and, where necessary, modify the statements of his Master Jābir bin Ḥayyān.³

If this thesis be accepted, and if, moreover, we recall the meaning of the word *Khārṣinī* (Arrowheads of China, otherwise known as *Ḥadīd aṣ-Ṣinī*, or Chinese Iron) we may further visualise Ḥarrān—the ancient Carrhae, and traditional birthplace of

¹ The quotation from Sālim al-Ḥarrānī occupies more than one-fifth of the entire treatise.

² Apart from the fact that he was travelling in Persia in 915 A.D., i.e., some years before the death of ar-Rāzī, and the strong probability that he knew the author personally as he was born in Baghdād, al-Mas'ūdī states that he had himself read the book in question.

³ The suggestion of d'Herbelot (*Bibliothèque Orientale*, 1637 ed., p. 387) that Jābir was himself a Ṣābian seems to be only based on a guess that he may have been the father of the famous astronomer Muḥammad bin Jābir al-Battānī, who was a Ṣābian of Ḥarrān. As, however, the latter made most of his observations of the stars in the last 20 years of the ninth century, and died in 929 A.D., while Jābir can only have survived till, at the latest, the first decade of the ninth century, there is no probability of any relationship between these two famous writers.

the ultimate founder of three of the world's greatest religions—as the focus at which had collected, and from which was again disseminated, all the knowledge of the ancient East. Lying as it did on the direct road between Syria and the Far East, as well as being the spot where the high road from Asia Minor, through the Hittite frontier-outpost Carchemish, joined the Damascus-Nineveh road, it is easy to understand how, on the one hand, it may, as the name *Khārsīnī* indicates, have had, at some period of its history, an intimate connection with China, while, on the other, as the cult of Hermes and Agathodemon indicates, Ḥarrān certainly established a close relationship with both Greek as well, probably, as the most ancient Egyptian civilisation. As two of us pointed out in a previous paper¹ the very name in Chaldaean was taken, in the time of the tenth century bibliographer an-Nadīm, to indicate that Hermes was the High Priest of the Temple of Mercury in Babylon; while he was believed to have subsequently moved to Egypt where he died and was buried under the Great Pyramid, after revealing to mankind the Art of Alchemy. We need not enter into a discussion as to the precise truth of this attribution of the original civilisation of Egypt to early Mesopotamian (i.e. Sumerian) civilisation, though it more or less agrees with the present views of Egyptologists.² The main point to emphasize is that, in all probability, Ḥarrān was the meeting place of all the civilisations of the ancient world, Greek (and even Minoan), Hittite, Egyptian, Mesopotamian, Persian and Chinese, and that, ultimately, through Ḥarrān, this synthetised knowledge passed on to the Arabs, and thence into the ken of the modern world.

6. SUMMARY AND CONCLUSIONS.

We will now bring this somewhat lengthy introduction to an end by a brief summary of the conclusions that appear to follow from the study of the materials that have been dealt with in this paper.

(1) To begin with, we believe we may safely claim that henceforward ar-Rāzī must be accepted as one of the most remarkable seekers after knowledge that the world has ever seen—not only 'unique in his age and unequalled in his time,' but without a peer until modern science began to dawn in Europe with Galileo and Robert Boyle. The evidence of his passion for objective truth that is furnished by almost every page of the *Kitāb al-Asrār* and *Madkhal at-Ta'limī*, as well as the genius shown by the wide range of books he wrote on other subjects than *Kīmiyā'*, force us indeed to the conclusion that—with the possible exception of his acknowledged Master, Jābir bin Ḥayyān—ar-Rāzī was the most noteworthy intellectual follower of the Greek philosophers of the seventh to the fourth centuries B.C. that mankind produced for 1,900 years after the death of Aristotle.

(2) Ar-Rāzī's supreme merit lay in his rejection of magical and astrological practices, and adherence to nothing that could not be proved, by experiment and test, to be actual fact. In alchemical practice he tore away the veil of mysticism

¹ S. and A., *Memoirs, A.S.B.*, Vol. III, p. 70.

² King and Hall: *Egypt and Western Asia in the light of Recent Discoveries* (1907 ed., pp. 34 seq. and 134).

with which even Jābir had continued to conceal from public view the mass of chemical facts that had gradually accumulated in the Near East up to the middle of the eighth century A.D.

(3) As regards the actual amount of credit that may be due to ar-Rāzī for checking, or extending, the knowledge of his predecessors, nothing can be certainly stated until the works of Jābir, as well as those of still earlier alchemists, such as Zosimus, the Persian Jāmāsp, Agathodemon, and Hermes, are thoroughly studied and discussed. It is almost impossible, however, to believe that without many years of arduous experiment ar-Rāzī could have been able to formulate two such wonderful collections of scientifically arranged facts as are presented to the world in the *Madkhal* and the first two sections of the *Kitāb al-Asrār*. But even if he is ultimately found to have done little more than restate, in coldly scientific language, the mystically-tinged and hence, almost unavailable, knowledge of his master, these two treatises will alone be sufficient to ensure for ar-Rāzī a permanent and distinguished place in the history of scientific thought.

(4) Apart from the question of the relative credit due to ar-Rāzī and Jābir, or of how much each of them actually added to the sum-total of human knowledge in the sphere of Chemistry, the existence of these writings of ar-Rāzī (as well as of their predecessor, the 'Book of the Seventy') is sufficient to prove that, so far as Chemistry is concerned, what we have hitherto rather proudly referred to as 'Modern Science' had already been born at least 900 years before the time of Robert Boyle.

(5) In addition to the Greek knowledge of Chemistry, which reached him through Jābir, ar-Rāzī also drew—in all probability through the Temple-priests of Ḥarrān in northern Mesopotamia—on the considerable body of knowledge at the disposal of the ancient Babylonian and Egyptian priests.

(6) The former inhabitants of Mesopotamia, in their turn, *may* have drawn on China for their knowledge. Whether this be the case or not, it is certain from a study of Ko-Hung's *Pao po tsz'* that Greek and Chinese alchemy must have had some common source of origin: and as the Chinese could hardly have drawn directly on Greek (or Egyptian) sources for this knowledge, China must either have discovered the facts for herself, and passed them on to some intermediary, like Babylonia, or acquired the knowledge from the same (or some other) intermediary.

(7) With regard to the extent and influence of Indian alchemy, previous association with Sir P. C. Rāy as our valued colleague would alone have led us to extend our enquiries in the hope of supporting his views on the subject. We regret, however, that we have been forced to conclude, from a comparison of the facts that are brought to light in this paper with those given in the two volumes of his 'History of Hindu Chemistry,' that the earlier, and possibly autochthonous, system of Indian alchemy based almost entirely on the use of vegetable juices, was superseded sometime between 500 and 1000 A.D. by a system of external origin which was primarily based on the use of Mercury. Far from discovering any corroboration of the theory that Indian thought radically influenced the development of

Western alchemy, we find ar-Rāzī—who was acquainted with both *Susruta* and *Caraka*, and, possibly, even made use of them in his medical works—curtly dismissing the possibility of Vegetable alchemy in the sentence ‘The Sages paid very little attention to vegetable substances and very seldom used them (in alchemy).’ We believe that when all the facts have been reconsidered—particularly those in relation to the now-proven use of mercury in the religion and alchemy of Mesopotamia and China from at least the beginning of the Christian era to the time of ar-Rāzī—it will be necessary to admit that most of the knowledge regarding metallic and inorganic Chemistry that has been so carefully collected by Sir P. C. Ray from Indian treatises on alchemy actually originated from outside India.

(8) We would only desire, finally, to emphasize that the publication of ar-Rāzī’s two treatises furnishes an accurately dated *corpus* of carefully tabulated chemical facts that not only is likely to be of the utmost assistance in all subsequent discussion of mediæval alchemy but—most important of all—will also furnish a scientific basis for the systematic investigation of Mesopotamian Chemistry and Pharmacology that has been so ably initiated during the last few years by Campbell Thompson.

We cannot conclude without a few words of cordial acknowledgment for the great assistance that Prof. B. B. Dutta of Presidency College has given us, both in the analysis of various samples of inorganic substances as well as by his thoughtful criticism. Our thanks are similarly due to Dr. A. Duc, of the University of Calcutta, for help in consulting German literature on the subject of our paper. We would also express our indebtedness to the Government of Bengal for having assisted us at the beginning of our work by a grant that enabled us to procure photographs of the Escorial Ms. of the *Kitāb al-Asrār*, as well as copies of the *Liber Bubacaris* (from Paris) and several of Jābir’s works (from Persia).

PRESIDENCY COLLEGE,
CALCUTTA.

(Received June 24th, 1926.)

II. AR-RĀZĪ'S *AL-MADKĪHAL AT-TA'LIMI*, OR 'INSTRUCTIVE INTRODUCTION.'

(FROM ALCHEMICAL MANUSCRIPT NO. 17 OF THE RĀMPŪR LIBRARY,
INDIA, LABELLED

'A Collection of Treatises by *ash-Shaiḫ ar-Ra'īs* and others).'

In the name of Allāh, the Merciful, the Compassionate! (Accord) Thy Help, O Gracious One!

Know that for each Art there are Instruments, and those Instruments have names which the people of the Art know, but others are ignorant of.

Now for the Art known as *Al-Kīmiyā'* there are Instruments and Substances ('*aqāqīr*'), and these have names which its followers know and others are ignorant of. Anyone who desires to study it to any extent must needs be acquainted with their names, and characteristic appearances ('*ain*'), and whether they¹ are good or bad (for the work). All this if the student can ever learn, it will only be after a long time, and thorough investigation of their essences (*jawāhīr*), and of their [reactions²] in this (Art.)

I have here gathered together such an account of these things, as will enable a student who masters it to be as one of them (i.e. the adepts of the Art) and to understand them. And Allāh is the Giver of Success by His favour and power!

The first substances of this Art (to be mentioned) are those which they call *Ajsād* ('Bodies'). They call them by this name, i.e., 'Bodies', because substances are of two kinds, some of them passing off in vapour,³ and flying away on coming into contact with fire, while others remain fixed and inert. The followers of the Art call the inert (substances) 'Bodies', because of the grossness and earthliness of the 'Body'⁴; while they call those that fly away *Arwāḥ* ('Spirits') on account of the ethereal character (*luṭf*) of the Spirit.

The 'Bodies' are the Sun, the Moon, Jupiter, Saturn, Mars, Venus⁵ and *Khārṣīnī*. Tin (*al-Qal'ī*) can undergo change, but Black Lead cannot.⁶ *Khārṣīnī* is a rare metal which is almost unprocurable.⁷

¹ Probably only the substances are referred to: *vide* the next sentence.

² Reading *Af'āliḥā*. ³ *Yatabahḥkharu*. ⁴ As compared with the 'Soul', or 'Spirit.'

⁵ I.e., Gold, Silver, Tin, Lead, Iron and Copper: *cf.* the *Maḥāliḥ al-'Ulūm*; Second Section—*infra*, p. 363. There is, however, some slight possibility that by Jupiter, Copper was meant, and by Venus Tin (*idem*, Note 4.)

⁶ This sentence may be a gloss. Even down to the Middle Ages in Europe, as well as in Arab times, Tin was regarded as a form of Lead, and the two metals were often classed together as *Raṣāṣain*—the two varieties of Tin (*cf.* later in the *Madkhal*, p. 355). In referring to them separately, Tin was called *ar-Raṣās*: or *ar-Raṣās al-qal'ī*, or (as here), simply *al-Qal'ī*: or *al-Qaṣḍīr*,—the latter being possibly a word of Chaldaean origin (Berthelot, *Collection*, I, p. 81): while Lead was differentiated as *Raṣās al-Uṣrub*: or (as here), *al-Uṣrub al-aswad*: or, simply, *al-Uṣrub*: or *al-Ānah*: or, finally, *al-Abar* (which was also apparently a Chaldaean word). For a discussion of the origin of the word *Qal'ī* (either from the Malay *Kelang*, or, possibly from *Qal'ah*—the name of a place which S. Laue Poole in his 1889 edition of Laue's *Arabian Nights*, III, pp. 181-182, identifies with Banca), *cf.* Dozy and Engelmann, *Glossaire* p. 245: and also Berthelot, *La Chimie*, I, p. 367.

⁷ *Shabīḥ bi'l ma'dūm*, lit. 'resembling the non-existent'; though Van Vloten (*op. cit.*, p. 358) translates 'quod caret colore', i.e., 'colourless.' For a discussion of the significance of *Khārṣīnī*, *vide infra*, pp. 405-410.

The 'Spirits' are *Nār* and *Farrār* ('Fire' and 'The Fugitive,' i.e., Sulphur and Mercury), *Zarnīkh* (Arsenic Sulphide), and *Nūshādūr*¹ (Sal-ammoniac). All these fly away when placed on the fire, and for this reason they have called them 'Spirits.' Among them are two which fly away but undergo no other change²; while the other two fly away and undergo transformation.³ The two that undergo no change, but fly away are *al-'Uqāb* ('The Eagle'—i.e. Sal-ammoniac) and 'The Fugitive,' (Mercury)⁴; and the two that catch fire and fly away are Sulphur and Arsenic Sulphide.

All those watery elements⁵ and Humidities that fly away over fire they call 'Spirit', and everything that is heavy and gross and withstands fire is called 'Body'.⁶

Among their substances is SALT. It is of several kinds. One (variety) is sweet. One is bitter. One is (called) *Andarāni*.⁷ One is (called) *Naḥḥī*.⁸ One (kind) is (called) *Baiḍī*. One (kind) is (called) *al-'Uqāb* (the Eagle). One is Salt of

¹ For a discussion of the derivation of *Nūshādūr*, vide Stapleton, *Mem. A.S.B.*, I, pp. 40 and 41. To the original Chinese, or (as Laufer—*Sino-Iranica*, p. 506—prefers to think) Sogdian word *Naušhā*, has been suffixed in Persian, the word *Dārū*, medicine. The name was then apparently perverted by popular etymology into *Nūsh dārū* 'life-giving medicine'; vide the story in Firdawsī's *Shāhnāma* of the attempt of Rustam to obtain *nūshdārū* from King Kaikā'ūs to restore his son Suhrāb to life. The Sanskrit word for Sal-ammoniac, *navāsar*, is a simple adaptation of the Chinese or Iranian word, without the Persian suffix. The inclusion of *nūshādūr* (or *al-'Uqāb*) by ar-Rāzī on the one hand among the 'Spirits' and on the other (later) among the pungent-tasting salts, seems clearly to point to its being our Ammonium Chloride. This is confirmed by the preparation of white Silver Chloride by triturating silver filings with *nūshādūr*, cf. *supra*, p. 331). For the preparation of Sal-Ammoniac from Hair, cf. *K. al-Asrār*, *infra*, p. 390.

The 'Stone Book', of the pseudo-Aristotle notes that it was used as a flux, to bring about combination, as well as for fixing colours (Ruska, *ed. cit.*, p. 118).

² Lit. 'are not burnt.'

³ Lit. 'are burnt.'

⁴ Both these terms are given as synonyms of Sal-ammoniac and Mercury respectively in the Xth cent. Syrio-Arabic compilation (Berthelot and Duval, *La Chimie*, II, pp. 159 and 160). Sal-ammoniac was also known as the 'Bird of *Khurāsān*', as it came from there, (vide next page: as well as Leclerc's trans. of Ibn al-Baiḥār, III, p. 380).

⁵ Lit. 'waters.'

⁶ Cf. the Syrio-Arabic Ms. (*op. cit.*, p. 159): 'Bodies' are those things that fire liquifies without causing them to disappear, while Spirits are volatilised by fire and do not remain fixed.' The following extracts from the *Speculum Naturale* of Vincent de Beauvais (*fl. c.* 1250 A.D.) which are said to be quoted from some work of Ibn Sīnā throw further light on the importance attached to these volatile substances in the period we are dealing with. "They are called Spirits because the penetration of a Spirit into a Body is necessary to bring about its union with the Soul.. Nothing can be sublimed without co-operation of a 'Spirit'. The 'Stone' cannot be sublimed by itself: but 'Spirits' sublime by themselves. ...are dissolved, and bring about the dissolution of other substances" (Berthelot, *Collection*, I, p. 248: cf. also Stapleton and Azo, *Memoirs, A.S.B.*, I, p. 54, n. 4.)

⁷ In order to check as far as possible the identity of the individual substances mentioned by ar-Rāzī, Qhulām Quddūs, a well-known Mubammadan 'Aṭṭār (druggist) of Calcutta, was asked to supply samples of as many as he could. The *Andarāni* thus obtained was found to be pure salt, with traces only of K_2SO_4 .

There seems some doubt as to the meaning of the word. Leclerc, in a note at the end of Ibn al-Baiḥār's section on Salt (III, p. 338) says: 'On dit qu'il provient d'une localité du nom d'Andera, aux environs d'Alep .. on lit en effet dans le *Morched* de Temimy (Abū 'Abdallāh at-Tamīmī: flourished at the end of 10th Century A.D.). "Il y a aussi une espèce de sel appellée *andarany* et qui porte en Irak le nom de *taberzed*. On dit qu'il vient d'un village en Syrie appellé El-Andera." Lane, on the other hand, states that the word is a vulgar corruption from *ḥarāni*, which is derived from *ḥar* 'whiteness.' The Syriac lexicographer Bar Bahlūl says it came from Cappadocia (Berthelot and Duval, *op. cit.*, II, p. 137). For the Red *Andarāni*—*alias Namah Lāhūrī*—mentioned at the end of the paragraph, vide *infra*, p. 375, Note 3.

⁸ The specimen supplied by the 'Aṭṭār was Common salt, of a blackish colour, due to iron. Pliny (*Nat. Hist.* XXXI, Chap. 7) alludes to this kind of salt as being found in Babylon. The 'Stone Book' states that salt from Naptha wells has a specially powerful effect in alchemical operations (Ruska, *op. cit.*, p. 102).

*al-Qili*¹ (Soda). One is Salt of Urine.² One is Salt of *Nūrah* (lime). One, Salt of Ashes.³ One, Indian Salt.⁴ One *Ṭabarzad*.⁵ One also is (called) Red *Andarānī*, and from this plates and trays are turned.

Sweet Salt is that which serves for food. Bitter salt is that with which goldsmiths polish silver. The *Andarānī* is that which is transparent. The *Naftī* is that which has the smell of Naphtha. It is of the same hardness as the *Andarānī*, but is somewhat black, and has a smell [because it is found?] in the salt marshes near naphtha wells. The *Ṭabarzad* is hard and impure. The Red is hard, and (clear) red (in colour). The Indian is a black salt, as hard as *Ṭabarzad*, and is not transparent. The *Baidī* emits the smell of boiled eggs (*baid*). As for the '*Uqāb* (Sal-ammoniac), the best kind of it is white, and pure. It is (found) in pieces, and is of two kinds. (One kind of) it is brought from *Khurāsān* and *Samarqand*. This is so pungent that it burns the tongue. The other kind is artificial, viz., '*Utārid ash-Sha'r* (Mercury of Hair).

Of these (salts), the salt of *Al-Qili* is made by a special process. So also are the salts of Urine, Lime, and Ashes. Their properties and preparation are (kept) concealed from all but the followers of the Art and the experts in it.⁶ The '*Uqāb* is of two kinds; one being that which we have (already) mentioned, the other made from Hair, and its properties⁷ will not be given here.

Among their substances are the BORACES.⁸ They are of several kinds. One is *Būraq al-Khubz* (Bread Borax).⁹ It is (found in) white pieces. One is that called

¹ From *qilyūn*, the ashes of certain plants, such as the 'glasswort', a seashore plant of the spinach family, and the prickly 'Salsola Kali'. The word *qili* was at first thought to be derived from the Arabic verb, *qalā*, to fry: but it may go back to the Assyrian *ukhulu*, the soda lye obtained from the ashes of certain plants growing in salt marshes near the sea (cf. Campbell Thompson, *Chemistry of the Ancient Assyrians*, p. 12).

² Microcosmic Salt (Na H NH₄ PO₄. 4H₂O), so called because it was derived from the human body. For its preparation, cf. the *K. al-Asrār* trans., *infra*, p. 377.

³ Impure Potassium Carbonate, made from Oak ashes: for its preparation cf. the *K. al-Asrār*, *infra*, p. 376.

⁴ The salt now known in India as *kālā namak* ('black salt'), which is used as a digestive. It is prepared by heating common salt with impure sodium carbonate and certain dried fruits, and is apparently now confused by Muhammadan druggists with *Naftī*, as the 'Aṭṭār first supplied it under the latter name. The sample tasted of sulphuretted hydrogen and contained traces of iron (cf. Rāy's *Hindu Chemistry*, p. 134: and Watt's *Dictionary of Economic Products of India*, II, pp. 395 and 415).

⁵ A word derived (according to a certain As-Sijistāni, quoted by Ibn al-Baiṭār, *trans. cit.*, II, p. 402) from *ṭabar*, Persian for an 'axe', and *zad* 'struck.' As-Sijistāni says it was applied to sugar-candy because it requires an axe to break it: but a simpler explanation would seem to be that sugar-candy, when crystallised on a string, looks as if it had been chopped with an axe.

⁶ These processes will be found given at length in the *K. al-Asrār* (see *infra*, pp. 376 and 377).

⁷ Or 'by a method which.' This tautological sentence seems to be a gloss. Four methods for making Sal-ammoniac from Hair will be found in the *Kitāb al-Asrār* (see *infra*, p. 390). Salt of Lime is not, as Bertbelot suggested in note 9, p. 146, of Vol. II of *La Chimie*, impure caustic potash, but simply slaked lime. The preparation of caustic soda from *al-qili* and quicklime was, however, known to ar-Rāzi, and a translation of two accounts from ff. 55 v and 75 v of the Escorial Ms. will be found later on pp. 391 and 392. It is described as the strongest 'sharp water.' From ar-Rāzi, through the Latin translation found in *Bibl. Nat. Ms. No. 6514* (f. 110), the knowledge of both caustic soda, and Ammonia (from Sal-ammoniac), passed into Europe.

⁸ The Arabic word *Būraq* is probably derived from the Persian *Būrah*. The *Buwāriq* apparently included all readily fusible salts, as well as certain gums. The 'Stone Book' notes the use of both borax and *natrūn* as purifying fluxes, and adds, in the case of *natrūn*, that it is useful in bringing about combination (Ruska, *op. cit.*, p. 118).

⁹ So called either because it was used to sprinkle over a loaf to produce a shiny exterior, or else (as in Pliny) to

Natrūn.¹ It is red : and is better than Bread Borax. One is (called) *Būraq aṣ-Ṣāghah* (Goldsmiths' Borax).² It is white and resembles the efflorescence (*sabkḥah*) which appears at the bottom of walls. One is (called) *Zarāwandī*³, and it is the best of all. Its colour inclines to redness and is dusky. One (kind) is the Borax of the *Ḡharb*⁴ (willow). It is found in willow trees. And one is *Tinkār*, which is artificial.⁵ The method of making it is written in the books on the Art.⁶

Another (class) of their substances are *Az-Zājāt* (VITRIOLS). They are of several kinds, *Akhḍar*, *Aṣṣar* and *Abyad*.⁷

The last named is of two kinds. One is called *Minjānī*. It is that in which there are green veins. It is called *Minjānī* because it is brought from *Minjān*, a town in Jabal.⁸ The other kind is called *Shabb*⁹ (alum): this is of a pure white colour. One (variety) is hard, and one soft. The test (*miḥnah*) for it is that if you

help rising. If the latter, this sort of borax must have been a carbonate. It was possibly Trona, a naturally occurring mineral of the formula $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$, which gives up water and CO_2 on being heated.

¹ The 'Aṭṭār's sample was the ordinary Indian salt *Reh* (chiefly sodium sulphate). *Natrūn* is the 'Natron' (or hydrated Sodium carbonate) of the salt lakes of Egypt, and is also found as an efflorescence on the soil of many dry regions of the globe.

² The Goldsmith's Borax from the 'Aṭṭār was a fibrous powder mostly consisting of Calcium borate, i.e., probably natural 'boracite.' The substance referred to by ar-Rāzī seems to have been either $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$, the final product in drying 'Natron,' or ordinary Nitre, (KNO_3) which is almost identical in crystalline form with $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$.

³ The word is not derived from the plant *Zarāwand* (the aristolochy), but from the name of a river in Armenia otherwise called the *Wādī al-Kurd*, where this sort of borax is found (Yāqūt's *Mū'jam al-buldān*, Wüstenfeld's ed., II, p. 922). The *Qānūn* of Ibn Sīnā (Rome 1593 ed., p. 141) does not mention *Zarāwandī*, but says the best sort of borax is the Armenian. In mediæval Latin treatises on Alchemy constant reference is made to Armenian Borax, e.g. the pseudo Avicenna's *De Anima, passim*, especially pp. 139 and 218 (*Artis Chemicæ Principes*, Basle ed., 1572).

⁴ Forskål, *Flora Aegypti Arab.* (p. LXV), states that the *asphodelus fistulosus* is known about Cairo as *Būraq*. On the other hand (p. 199) among the indeterminate plants (LII) he mentions the *Ḡharib al-Bakī* which he found in Jabal Ḥasnain near Abū Arīsh on the coast of the Red Sea, North of Ḥudaidah. He describes it as: 'Arbor lachrymans: avibus visitata, quae succum stillantem excipiunt.'

⁵ For method of preparation *vide infra*, *K. al-Asrār* trans., pp. 374-5. The 'Aṭṭār's sample was chiefly Sodium Borate. In spite of Leclerc's protests (Ibn al-Baiṭār, I, p. 319), *Tinkār* is almost certainly the χρυσοκόλλα (Gold solder) of the Greeks (Berthelot, *La Chimie*, II, p. 130). The 'Stone-Book' makes the following remarks regarding *Tinkār*. 'It is a kind of salt, with a taste of borax, but more bitter. It is found on the margins of salt marshes. It is useful in fusing gold. It also removes bad breath, and strengthens the gums' (*op. cit.*, p. 123).

⁶ This passage (omitting the references to *Būraq al-Khubz* and to *Sabkḥah*) is quoted almost *verbatim* by Ibn al-Baiṭār, quoting in turn from Ibn Wāfīd of Toledo (author of *al-Adwiyah al-mufradah*—Book on Simples: A.D. 997-1068). Ibn Wāfīd actually states he is quoting from ar-Rāzī's *Al-Madkḥal al-Ta'limī* (Leclerc's trans., I, p. 289).

⁷ I.e., Green, Yellow and White; but apparently class names, as the classification by no means follows these colours. Ibn Sīnā says that the vitriols were originally liquid bodies which were subsequently solidified. They all dissolve readily when warmed with water except the *Sūrī* which is a very dense substance (*Qānūn*, ed. *cit.*, p. 167). The 'Stone Book' says the vitriols blacken the 'Bodies' and act (in medicine) as a styptic (*op. cit.*, p. 119).

⁸ Yāqūt (De Meynard's translation, p. 545) says Minjān was a town of the province of Iṣfahān. Jabal was the mountainous district between Baghdād and Iṣfahān.

⁹ The inclusion of Alum amongst the Vitriols is noticeable. *Shabb* is possibly derived from the Arabic verb *Shabba*, 'to brighten the colour' of anything, from its cleansing power: (but see also next page—end of note 2). The continuance to the present day of a belief in its magical properties is shown by the custom in Jerusalem of carrying a piece of *shabb* in the pocket to guard against the evil eye. Its gradual disappearance is considered to be due to the Jinn feeding on the *shabb* instead of on the person who carries it. Even in Calcutta, Musalmans use amulets containing alum, camphor and pepper to protect themselves from attack during a cholera epidemic.

The 'Stone Book' (besides noting the use of alum by dyers as a mordant and fixer of dyes) says that if rubbed on a person suffering from quartan fever, he will be cured (*ed. cit.*, p. 119).

The 'Aṭṭār's *Shabb* was a sample of Potassium Alum.

moisten it with water and rub it on gallnuts, it will not turn black. Whatever does not turn black is White *Zāj*.¹

The *Aşfar* is of several kinds. One is *Zāj al-Hibr*² (Ink Vitriol). It is that (variety), the pieces of which resemble gum. It is the best of vitriols. Another, which has jewelled eyes, is *Zāj al-Asākifah* (Cobblers' Vitriol). This varies in quality.³ Another (kind), which is (called) *Sūri*, is reddish. It is of excellent quality, and rare, (being found only) in small quantities.

The *Akhḍar* is that (variety) which is called *Qalqand*. Its test is that when moistened, and rubbed on Iron, it turns the latter red.

Al-Qalqatār is yellow and red. It acts in the same way as *Qalqand*.

Al-Qalqadīs is white alum,⁴ like (i.e., of the colour of) ashes. It is formed from *qalqand*, which (in course of time) changes into *qalqadīs*. It is the best (variety).

Another of their substances is *Mārqashīthā* (MARCASITE).⁵ It is of different colours and forms. Among (the varieties of) it, some (in shape) are like the

¹ I.e., it must not contain any iron, or, in other words, should be pure aluminium sulphate or potassium alum.

² The *Misu* of the Greek alchemists: cf. the following quoted by Berthelot (*La Chimie*, II, p. 131) from Bar Bahlūl's Syriac Dict.: 'Gabriel [Boktiyishu, † c.800 A.D.] a dit que le vitriol noir s'emploie pour l'encre noir. et est appelé *misu* en grec. Galien a dit que le vitriol noir se trouve sur la calcidis, comme la rouille sur le cuivre.' He identifies *Misy* also with the next variety, 'Cobbler's *Zāj*.' As regards the third variety, *Sūri*, he says it is *Zāj* which changes after some time into *Qalqadīs*. Berthelot suggests that both *Sūri* and *Misy* were basic sulphates of iron, resulting from the spontaneous decomposition of pyrites. The 'Aṭṭār, for 'Cobbler's *zāj*,' produced Roman Alum. As for *Sūri*, Potassium Bichromate (!) was first sent, and, after protest, a slightly pink Potassium Alum.

Ar-Rāzī in the *K. al-Asrār* (*infra*, pp. 370 and 373) names only six vitriols—Black: Alum (chiefly white): *Qalqand* (green): *Qalqadīs* (white): *Qalqatār* (yellow): and *Sūri* (red); and apparently regards Ink Vitriol as synonymous with 'Cobblers vitriol,' and *Minjāni* with Alum. It is of course possible that ar-Rāzī's differentiation of the vitriols, both in the *Madhhal* as well as in the *K. al-Asrār*, only depended on tradition, but we may note that in the Indian process of making alum from weathered pyritous shale, the first substance that crystallises out when the mother liquor from 5 or 6 cwt. of the shale is blue *Copper Sulphate* (8 or 9 lbs.). Then, after the addition of Nitre (KNO₃) and further concentration, 8 or 9 lbs. of Alum are obtained: while the final product from the evaporation of the mother liquor is impure green *Ferrous Sulphate* (44-45 lbs.). Vide Brooke, *J.A.S.B.*, XXXIII (1864), p. 527.

Campbell Thompson (*loc. cit.*, p. 111) suggests that the word *Sūri* is derived from the Assyrian *shūru*, a synonym of *shūbū*, and identifies it with Pliny's *Chalcanthum* (from Gr. *χαλκανθος*, flower of Copper), which, it is thought—from the description of its preparation from pyrites—included both Blue Vitriol (copper sulphate), and Green Vitriol (ferrous sulphate). As, however, *Sūri* was also known to Zosimus (*La Chimie*, II, pp. 221 and 298) this would lead us either to believe that Zosimus drew on Assyrian (or Harranian) sources for some of his chemical knowledge, or else that there may have been actual affiliation between the chemical knowledge of the Assyrian and Egyptian priests. It is at all events possible that the Assyrian word *shūbū* may be the origin of the Arabic *shabb*, in which case the verb *shabba* would be derived from *shabb*, and not *vice versa*. A connected word may be *shabah*, the name of the Copper-Lead alloy mentioned in the Section on Artificial substances in the *K. al-Asrār*.

³ Or 'is of various kinds' (*fiḥ tajāwat fi ajnāsihī*.)

⁴ In the *K. al-Asrār*, *Qalqadīs* is called White *Zāj*, so that the term *Zāj* and *Shabb* were evidently synonymous for what we now call Aluminium Sulphate (or else Potash Alum). The 'Aṭṭār's *qalqadīs* was simply Alum, while for *qalqatār* he produced Ferrous sulphate. The three substances mentioned in the text are the Greek *χαλκανθος*, *χαλκηράριον* and *χαλκίτις* (cf. extracts from Bar Bahlūl's Dictionary, Berthelot and Duval, *La Chimie*, II, p. 123).

⁵ Otherwise *Mārqashīshā* or *Mārqashīthā*—the final *thā* being a feminine Syriac termination. It is what was known to the Greeks as *πυρίτης*. In the 10th century Syriac-Arabic Mss. translated by Duval, in one place (*La Chimie*, p. 161) it is said to be one of the seven stones that contain 'Spirits'; and in the introductory list of substances (pp. 12 and 17) it is classified under the Zodiacal sign of the Ram (evidently as masculine) with seven species, apparently allied with the metals, and included among the 12 + 7 stones that impart colour. Its astrological associations were thus fully

weights coins are weighed against¹; some are round, like sling-stones²; while some are (found as) large or small pieces of stones, without definite shape. In all these varieties, there are different classes. One (kind) is yellow, like gold, and (this) is called *Dhahabī*; and another white, called *Fiddī* (silver); and another is red, which is called *Nuhāsi* (copper coloured). They are not of the nature of stones, but resemble metals.

Another of their substances is *MAḠHNĪSIYĀ*,³ and it is of several kinds. One is (called) *Turbah* (Dust). It is black, with white eyes of great brilliancy. One kind is (found) in pieces, with similar eyes. One kind is like iron. One is red.⁴ And other kinds closely resemble these.

Another of their substances is *TŪTIYĀ*⁶ which is a stone. One kind is (called)

recognised about the time of ar-Rāzī. The 'Stone Book' says that, if calcined to a fine powder, it is useful in alchemy. A little mixed with sulphur purifies fused gold. Fire is also produced if iron is pounded with *Mārqaṣhīhā* (Ruska, *ed. cit.*, p. 112). It was used by alchemists owing to the idea that it contained Gold (*vide* the alternative name 'Iqlimiya of Gold' used by Muḥammad bin 'Abd al-Malik al-Kāthī—Stapleton and Azo, *Mem. A.S.B.*, I, p. 56). In addition to the three classes here given by ar-Rāzī, Ibn Sinā, in the *Qānūn*—quoting possibly from the *K. al-Asrār*—adds 'Mārqaṣhīhā of Iron,' and that each kind of *mārqaṣhīhā* resembles in colour the metal to which it is assigned. The latter remark explains the last sentence of the *Madhhal* account 'but resemble metals' (*jawāhir*). The *Dhahabī* (golden) variety was probably Iron Pyrites (FeS₂): the *Fiddī* (silvery) Mispickel (FeAsS): and the *Nuhāsi* (copper-coloured) Bornite, Cu₃FeS₃.

The word appears to be of Assyrian origin—ultimately derived from *Markhashī*, the name of the country from which it was then obtained, which may have been the Zagros Mountains to the N.E. of Assyria (*cf.* Thomson, *op. cit.*, pp. 119 and 120).

¹ *ka annahu sanjāt ad-darāhim*. *Sanjāt* is Arabicised plural of the Persian *sanj*, a weight. From the translation of the *Mafāliḥ al-'Ulūm* (*infra*, p. 364) it will be seen that the author of that work took this sentence to mean 'square.'

² *Banādiq*, pl. of *bandūq*.

³ *Maghnisiyā* is classified, like *mārqaṣhīhā*, with seven varieties in the Syrio-Arabic Mss., and as one of the seven stones containing 'Spirits.' It was placed under the sign of the Bull, and believed to be chiefly earthy. It is also stated to have been used as a tinctorial agent in all alchemical operations for imparting colour. As *Maghnisiyā* is also said to have been indispensable for glass making, Leclerc (*op. cit.*, III, p. 329) is probably right in suggesting that, at all events, the black, or 'male' form was an ore of Manganese, *viz.*, Pyrolusite. The red or 'feminine' form may have been an oxide of iron. As *Maghnāḥis* (Magnetic Iron ore—the *magnes* of Pliny) is omitted, both in the *Madhhal* as well as the *K. al-Asrār*, ar-Rāzī probably included it among the *Maghnisiyās*. It is possible that *Maghnisiyā* was first employed in alchemy owing to its connection with glass making, as glass was regarded by the Greeks and Egyptians as one of the metals. It may be noted that the word *maghnisiyā* was also used by alchemists to indicate the medium in which 'spirits' (in the alchemical sense) were imprisoned in order to be subjected to the influence of fire (*vide* Ibn Khaldūn's *Prolegomena*—De Slane's trans., III, p. 225, quoting from a pamphlet by Ibn Baṣhrūn—early 10th century—who, in turn, is probably quoting from a certain Sālīm al-Ḥarrānī: also Stapleton and Azo, *Mem. A.S.B.*, I, p. 57, note 1).

⁴ This account is quoted by Ibn al-Baiṭār without mentioning from which book of ar-Rāzī it is taken (Leclerc, *op. cit.*, III, p. 329).

⁶ The following account of *Tūtiyā* is quoted by Ibn al-Baiṭār from Ibn Wafīd (*op. cit.*, c. 1050 A.D.). "*Tūtiyā* is found sometimes in mines and sometimes, like cadmia, in furnaces where copper is being melted. It is what is called in Greek *Pompholyx*. There are varieties of mineral *tūtiyā*, white, green, and yellow mixed with red. Mines of it are found on the shores of the Indian Ocean. The best is the white which is solid: then comes the yellow. The Green is heavy and spongy, and is imported from China. The white is the lightest sort, and the green, which is that produced in furnaces, is the heaviest." According to Muḥammad Ḥusain of Oudh, the author of the celebrated *Makḥṣan al-Adwiyah* (a *Materia Medica*, written in Persian in 1771 A.D.) the name is a corruption of *Dūdiyā*, the Persian word for 'smoke'; and the author adds that he believes all the *tūtiyās* are really artificial, just as the *Kirmāni* is formed in the preparation of Lead (*surb*) and Tin. Rāy (*Hindu Chemistry*, p. 39) identifies *tūtiyā* with the Indian mineral *rasaha* which is first mentioned (in 3 varieties) about 1200 A.D., and of which one variety seems to have been the zinc ore 'calamine', as it was used to make brass and even zinc itself (*Jasada*). The Arabic mineral *tūtiyās* probably represent some of Pliny's *terrae* or *orelae*, while the artificial is Dioscorides' *Cadmia*. For a further suggestion as to the derivation of the word, as well as some notes on the history of brass, *vide* later, p. 408, note 4.

Akhdar; and another, which resembles eggshells, is (called) *Aşfar*. There are several varieties of it. One, (called) *Hindī*, is white; it is rare. Another is yellow, and this is (called) *Khazarī*.¹ Another is green and this is (called) *Kirmānī*. And another kind (of *tūtiyā*) is called *Mahmūdī*; and there are, besides, other kinds, bearing special names. The *Hindī* variety is artificial.

Another of their substances is *DAHNAJ* (MALACHITE).² It is a green stone which is used for signet rings and beads. A similar substance is *FAIRŪZAJ*³ (TURQUOISE) but it is less green than *Dahnaj*.

Another (substance) is *LĀZAWARD*⁴ (AZURITE, or LAPIS LAZULI). It is a blue stone which has brilliant eyes, and beads are made out of it.

Another (substance) is *TALQ* (MICA and, sometimes, ASBESTOS). There are several kinds of it, such as *Bahrī*, *Yamānī* and *Jabalī*. When hammered, it separates into thin white plates of brilliant and glittering appearance.⁵ It enters into the composition of *Dukhnaḥ Maryam* (Incense of Mary).⁶

Another (substance) is *JIBSIN* (GYPSUM). It is a white stone obtained in mountains.⁷

Another (substance) is *SHĀDHANAH*. (Haematite, or Iron Oxide). It is a red stone. (One kind is) the '*Adasī* (shaped like a lentil or lens);⁸ while another [*the Khalūqī*] colours gold red,⁹ because it is the essence of copper.

¹ I.e., from the Caspian Sea.

² Basic Carbonate of Copper— $2\text{CuO} \cdot \text{CO}_2$. The 'Stone Book' states that it is only found in Copper mines. It hardens gold, and is an antidote to poison and the stings of scorpions and bees (Ruska, *ed. cit.*, p. 104).

³ Greek (*F*) ἀερίφωσα (connected, according to Curtius, with ἔπεω, ἐίρηκα 'I said,' and Latin 'Verbum'). In Arabic times it was mined near Nishābūr (Leclerc's Ibn al-Baiṭār, III, p. 51).

⁴ The 'Stone Book' (*ed. cit.*, p. 107) notes that if *Lāzaward* is dropped on heated charcoal a tongue of fire of the colour of *Lāzaward* will come out. This—the first suggestion of Blowpipe analysis—shows that the *Lāzaward* of the Greeks must have been a Copper compound—i.e., probably Azurite (copper carbonate). The Arabs also seem to have believed that *Lāzaward* contained copper as (a) we have noted, in the Ms. of an alchemical treatise of Ibn Sinā, a gloss stating that the Copper, derived from it, produced a better Calx (for making Gold and Silver) than ordinary Copper: and (b) ar-Rāzi in the *K. al-Asyār* (*vide infra*, p. 372) explains that *Lāzaward*, as well as Malachite, Turquoise, and Haematite were used in alchemy 'as they colour Gold red because they contain the essence of Copper'. Our own Lapis Lazuli is a complex of aluminium silicate and sodium polysulphide, and contains no copper. It may be added that Peters (*Nippur*, p. 77) states that the mines in Bactria from which the Lapis Lazuli of the Babylonians was obtained are still worked: and that Malachite, Turquoise, and Lapis Lazuli have always been valued gems in the East (*cf.* for the last named, the head of some goddess with eyes of Lapis-Lazuli recently discovered by Woolley at Ur of the Chaldees).

⁵ This account is quoted *verbatim* by Ibn al-Baiṭār (Leclerc, II, p. 414).

⁶ Unless a gloss, this may refer to some preparation mentioned by Mary, the Alchemist. We have not been able to trace any further reference to this preparation in the *K. al-Asyār* or elsewhere. That one variety of *Talq* was Asbestos is shown by Ibn al-Baiṭār's quotation from some work of ar-Rāzi (who, in turn, probably drew on Dioscorides) to the effect that *talq* is used in cauterisation, to protect the vicinity of the wound from the effect of the fire (i.e., the hot iron). Dioscorides states that this variety of *talq* came from Cyprus (*loc. cit.*, II, pp. 414 and 415).

⁷ Gypsum was used for making images in ancient Babylonia (*cf.* the ram-headed figures recently found by Woolley at Ur.)

⁸ The modern 'lenticular iron ore,' or clay iron stone.

⁹ Lit. 'reddens and colours gold.' *Shādhanaḥ* was otherwise known as *Hajar ad-Dam* (blood-stone), or, in Persian, *Shādanj*. Its composition is evident from Dā'ūd al-Anṭākī's statement (copied from the *Qānūn* of Ibn Sinā) that the artificial sort (i.e., probably the *Khalūqī*) was made by burning Magnetic iron ore (Leclerc's Ibn al-Baiṭār, II, p. 315). Its red colour (or impurities) may have led ar-Rāzi to think that it contained copper. The word *Khalūqī* should probably be inserted in the text, as otherwise it is not clear why it is found in the *Mafātiḥ al-'Uṭūm*, which is derived from the *Madkhal*. The word *Khalūq*, which means a semi-solid per-

Another (substance) is *KUHL* (Galena). It is not a stone like (ordinary) stone, but metallic in appearance. It is the stone from which lead is obtained.¹

(Another substance is) *MASHAQŪNIYĀ*.² It is a thing that comes out from glass. It resembles salt, being hard, fusible, white and potent, and it possesses the strength of dryness.

(Another substance is) *SHAKK* (Arsenic Oxide)³ which is of two kinds, Yellow and White. It comes from the silver mines of *Khurāsān*. [It is also artificial (?)] and it is the Smoke of Silver.

(Another substance is) *DAWS*. It is the 'Water of Iron'⁴.

(Another substance is) *SAKTAH*⁵ (Copper Oxide). It is a stone used by copper-smiths.

fume or unguent, suggests that the artificial sort was made into a paste, which may have been used as a remedy for bleeding. It is also found in the Syrio-Arabic treatise (*La Chimie*, II, p. 176) where it is described as 'red dust.' *Shādhānah* is the Assyrian *Shādānu*, or 'mountain stone'—the commonest material from which seal cylinders were made in Assyria and Babylon. It came from the mountainous region to the north of Mesopotamia, and was supposed to have very potent magical properties (Thompson, *op. cit.*, pp. 122-126).

¹ Lit. 'It is not a stony stone, but like metals. It is the stone of lead.' Another possible reading is that found in both the *Mafātih al-'Ulūm*, as well as the *K. al-Asrār*, viz.: *Jawhar al-Ushrubb*. 'It is the essence of lead.' *Kuhl* was otherwise known as *Ithmid* (cf. *infra*, *K. al-Asrār* trans., note 8, p. 372), which, in turn, was the *stimmi* of the Greeks. *Kuhl* was almost certainly Lead sulphide, and not Antimony sulphide, as is shown by ar-Rāzi's remark that lead is obtained from it. Even at the present day it is only Galena; e.g. (a) in Algeria (Prax: quoted by Dozy and Engelmann, *Glossaire*, p. 92); (b) in India ('Surma'—Dutt's *Hindu Materia Medica*, p. 73); and (c) a sample brought from Mecca some years ago by a pilgrim, proved, on examination, to be only lead sulphide. *Kuhl* appears to be derived from the Assyrian *Gukhlu* (Thompson, *idem*, p. 43).

² Sandiver or 'Glass Gall' of the glass factory, which chiefly consists of potassium and sodium sulphate and chloride. Its association with glass, and the idea that it had great drying properties, probably accounts for its use in alchemy. In Arabic times, the word *Mashaqūniyā* was also apparently used (a) to denote a green glaze for pots: and as a synonym for *Shahirah*, a mixture of salt and brick dust used in purifying gold (Ibn al-Baitār, *trans. cit.*, III, p. 320). The sample supplied by the 'Atţār was Calcium Silicate. Prof. Dutta suggests that this Arabic word may be the same as the doubtful *mashhantu* which occurs frequently in the Assyrian accounts of glass-making (cf. Thompson, *op. cit.*, pp. 30 and 76).

³ The similarity of *Shakk* to *Shenko*, the common Bengali word for white arsenic, led us to enquire whether there was any etymological connection between the two, and if so, whether the Bengali word could be traced to a Sanskrit root. The late M.M. Satiśa Candra Vidyābhūṣaṇa kindly investigated the point for us and reported that the word *Shankha*, from which *Shenko*, is supposed to be derived, only possesses in Sanskrit the meaning 'conch-shell', and is never applied to a poison. He concluded that *Shenko* is an alien word and very possibly an adaptation of the Perso-Arabic *Shakk*. Ibn al-Baitār (Leclerc, II, p. 341) gives the following account—chiefly from other books of ar-Rāzi—which supplements what is found in the *Madkhal*. "It is the Earth that kills' (*al-turāb al-hālik*) of the inhabitants of 'Irāq. It also has the name 'Rat poison' (*Samm al-fār*)... Ar Rāzi in his 'Book of Properties' (says): 'Arsenic Oxide is a substance that come to us from *Khurāsān*, where it is obtained from silver mines. It is of two kinds, a white and a yellow. If mixed with dough and left about in a house, the rats will die if they happen to eat it. Even other rats that only smell the odour of the dead bodies will also die. This is actual fact which I have proved'. Both varieties of *Shakk*, yellow and white, supplied by the 'Atţār, proved to be Arsenic Oxide.

⁴ Cf. Leclerc's translation of Ibn al-Baitār (I, p. 432), where the same statement is quoted from ar-Rāzi's *Kitāb 'Ilal al-Ma'ādīn*. It is, however, clear from ff. 51v and 64r of Ms. M. that the *Iṣṭakhrī* variety of *Daws* used by ar-Rāzi was a solid. *Daws* is a Persian word, and the substance it represents was probably first introduced into alchemy owing to the world-wide and very ancient belief in the magical properties of Iron (*vide* also Pliny, *Natural History*, XXXIV, 15, for the medicinal use in the 1st Cent. A.D. of both iron and iron oxide). Ibn al-Baitār, in the same article, also quotes ar-Rāzi as stating that Iron is an aphrodisiac, and that any one who carries iron filings on his person will be prevented from snoring (!)

⁵ It is not quite certain what substance is referred to under the name *Saklah*. The Ms. first reads *Shaknah* and, later, the impossible *Shakandaq*. The *Sh* in both places is probably due to the propinquity of the word *Shakk*, but the inclusion of the name in the list of derivative substances shows that the word cannot be (as Van Vloten suggests)

(Another substance is) *RĀTINAJ* (colophony).¹ It is the gum of the pine-tree. Another of their substances is *ZARNIKH* (Arsenic Sulphide)).² It is three kinds—red, yellow, and green. The best of them is that which can be laminated and which painters use, and the worst is the green.

Some of their substances are derivatives (viz., those) which are not original. They are *MARTAK*³ (Litharge, or Lead Oxide—PbO), *MURDĀSANJ*,³ *ZA'FRĀN AL-ḤADID* (Ferric Oxide), *ZANJĀR* (Copper Acetate), *USRUNJ* (Red Lead—Pb₃O₄), *ZUNJUFR* (Mercuric Sulphide), *ISFIDĀJ* (Lead or Tin Oxide), *DAWṢ*, *SHAKK* (As₂O₃), *SAKTAH* (CuO) and *TŪTIYĀ*. We have mentioned the method of their preparation in⁴ the *Kitāb 'Ilal al-Ma'ādīn* (Book of the Causes or Diseases—of the Minerals), which is the book next following this. Reference may be made to it.

AN ACCOUNT OF THE INSTRUMENTS.

As for the better known Instruments of this Art, some of them are instruments for melting the 'Bodies' and Stones, while others are instruments for their manipulation (*tadbīr*).

The Instruments of fusion are:—

<i>Kūr</i>	(Furnace) ;
<i>Būtaqah</i>	(Crucible) ;
<i>Māshū</i>	(Ladle) ;
<i>Rāt</i>	(Iron Mould, shaped like a half-reed) ; ⁶
and the <i>Ziqq</i>	(Bellows, by which it (the fire) is blown).

a corruption of *Sakta*, 'jet'. As, however, it is stated in our text to have been used by coppersmiths, and its place in the *K. al-Asrār* list of artificial substances is apparently taken by *Rūsukhtaj*, (i.e., Burnt Copper) we may conclude that *Sakta* means Copper Oxide. (cf. Ibn al-Baiṭār quoting al-Qhāfiqī, † 1164 A.D.—*ed. cit.*, II, p. 366; and Stapleton and Azo, *Mem. A.S.B.*, I, p. 57, n. 5; and text—which refers to *Rūsukhtaj* of Baṣrah).

¹ Gums were supposed to have magical properties, as they were regarded as the blood of the tree—hence the use of incense (Robertson Smith, *Religion of the Semites*, pp. 133, 426, and 427). Another gum used in alchemy was the *Būraq al-Qharb*—from the willow or acacia tree (*vide supra*, p. 348). Marsh has suggested that rosin was used in chemical operations among the Assyrians from the practical point of view, to prevent undue oxidation of metals (Thompson, *op. cit.*, p. 69).

² Cf. *infra*, *K. al-Asrār*, note 1, p. 371. Ibn Sinā in the *Qānūn* (*ed. cit.*, p. 167) says "The best kind is the yellow which comes from Armenia and occurs in thin golden plates like yellow mica... Its smell resembles that of sulphur." The red and yellow varieties (our realgar and orpiment) correspond to the *Zavdarāqḥ*, and *Αρσενικον*, respectively of Dioscorides and Galen. Yellow *Shakk* and yellow *Zarnikh* seems now to be confused, as the Aṭṭār gave samples of Orpiment for both. This passage from the *Madkhal* is quoted by Ibn al-Baiṭār, without stating which of ar-Rāzi's works it was taken from (*trans. cit.*, II, p. 205).

³ As *Murdāsanj* is the same as *Martak* (or *Murtak*) either *aw* has been omitted, or the second word is a gloss (cf. Leclerc, III, p. 311). *Murdāsanj* is the Arabicised form of the Persian *Murdāsang*, which means 'dead stone.' The 'Aṭṭār's sample was a metallic looking substance with yellow lustre which proved to be Lead Oxide.

⁴ The method of preparation for the first six of these artificial substances is given at the end of the second section of the ninth chapter of the *Mafātīh al-'Ulūm*, the author of which probably obtained his information from the *Kitāb 'Ilal al-Ma'ādīn*. It may, however, be more than a coincidence that the 'Stone-Book' also concludes with an account of five artificial compound substances, *Usrunj*; *Zunjufr*; *Isfidāj* (made from lead); *Zanjār* (made from brass—*ṣifr*—and copper); and *Khubth al-Ḥadīd* (dross of iron, or iron oxide): especially if Ruska be correct in believing that it was translated into Arabi: during ar-Rāzi's life-time. On the other hand, ar-Rāzi may have drawn on Jābir for the description of their preparation (*vide pp.* 365-6, notes, for *Murdāsanj* and *Usrunj*).

⁵ Cf. First section of the *Mafātīh al-'Ulūm* (*infra*, p. 362).

After these there is an instrument employed by those who are experts in this Art, and labour long at it. It may be known from those who perform the great works, and therefore a description may be dispensed with.¹

In addition to these² is a thing which they call *Būt-bar-Būt*, which is suitable for the process of *Istinzāl*. The meaning of *Istinzāl* is this. Anything is melted, and drops from one crucible into another. The *Būt-bar-Būt* consists of two crucibles, one placed on the other, the upper having one or two holes in its bottom. The joint between the two is luted with clay. The substance that has to undergo the process of *Istinzāl* is placed in it (i.e. the upper crucible), and melted. When liquid, it descends into the lower crucible, the dross and impurity remaining above.

The hardest of the 'Bodies' to melt is Iron. It does not become as fluid as water, except after treatment and (the use of) Medicines. The process of melting it is this. Take filings of iron, as much as you want, and having thrown on them one-quarter their weight of powdered red *Zarnīkh*, stir (the mixture) up. Then put it in a bag (*ṣurrah*), and after luting it with good clay, place it in a hot *tannūr* (oven). Afterwards take it out, and weigh it. Then throw upon it one-sixth of its weight of *natrūn*, and add olive oil to the mixture.³ Next it is placed in a perforated crucible, fitted on to another. What comes down is received, and (again) melted. Then Sal-ammoniac and Syrian vitriol⁴—both powdered, and mixed with olive oil—are taken and made into small balls, and it (the fused product) is fed with these. It may be melted as many times as you choose, for that adds to its fusibility and whiteness. If this (process) is repeated, the mass becomes so soft that it may be beaten out, and it will be as easily melted as silver.⁵

¹ No passage has been found in ar-Rāzī's works which throws any light on what instrument is here referred to.

² Lit. 'And among them.' Ar-Rāzī in this paragraph may be drawing on some book of Jābir as in the 36th of the 'Seventy Treatises' (Latin translation) Jābir describes the use of the *Būt-bar-Būt*—under the name *botum barbatum*—in purifying some product of copper by fusing it with borax (Berthelot, *Archéologie*, p. 350). Jābir in turn probably drew on some previous Greek, or Egyptian, treatise on Instruments, e.g., that of Zosimus (cf. Berthelot and Ruelle, *Collection*, II, pp. 216-231). Zosimus again, at the beginning of these extracts, mentions that a large number of pieces of apparatus had been previously described by Mary, the Alchemist, whom al-Majrīṭī in the *Rulbat al-Hakim* declares to have been one of the 3 pupils of Asilāūs (=Asclepius), the other two being Democritus and Agathodemon.

³ This mention of *natrūn* and oil is an indication that the process in its origin is probably derived from Greek sources (cf. Olympiodorus of Alexandria's Commentary on the "Book of Action" of Zosimus, etc.—Berthelot, *Collection*, I, trans., p. 99).

⁴ Possibly *Zujāj* (glass) should be read for the *Zāj* of the Ms. (cf. the corresponding passage in the *Kitāb al-Asvār* trans., *infra*, p. 380).

⁵ This process is almost the same, both in the ancillary substances used and their proportions, as the process for the *tajsid* (purification) of Iron, given on f. 64 r of the Escorial Ms. of ar-Rāzī's *Kitāb al-Asvār*. The immediate source of ar-Rāzī's information regarding the conversion of Iron into a fusible Arseno-Sulphide by heating with Arsenic sulphide is almost certainly some work of Jābir, as will be evident from the following two quotations from the Latin translation of the 34th and 62nd Treatises respectively of Jābir's 'Book of the Seventy' (*Biblio. Nat. Ms. Lat. No. 7156*).

"*Modus mollificandi Martem*—Modus mollificandi ipsum est ut asses ipsum cum auripigmento, et fundas et distillas. Descendet enim corpus album. Deinde assa ipsum triduo igne continuo, vehementi igne quaque die. Pondera ipsum cum auripigmento, semel apponendo de auripigmento quantum ipsum est. Postea distilla ipsum et invenies ipsum album frangibile. Deinde tere ipsum cum triplo sui de nitro. Et sperge cum oleo et distilla *Argentum* liquefaciendo. Scilicet et invenies album sicut argentum, fundetur. Sicut *Argentum* utere eo in omnibus que volueris." (Berthelot, *Archéologie*, p. 347).

"*Ablutio Martis*. Et hoc est ut assetur cum medietate sui de auripigmento. Deinde abluatur donec fiat. Et fac ipsum desiccare. Et tere ipsum. Et fac ipsum descendere, donec descendat ita album ut argentum et molle. Utere eo. Et si non facis, ita utere ipsum et lava et fac ipsum descendere, donec perveniat sic" (*idem*, p. 359).

Next (comes) Copper. The method of melting copper is this. Cut it into small pieces and place them in a crucible in a *Kūr* (furnace). The furnace is filled with charcoal, and air is blown in until the copper melts. Then you sprinkle over it a little Goldsmiths' Borax. This is called, in their phraseology, *Tat'im* or *It'am*—'feeding'). They say "He fed it with *būraq*, so that its eye might be opened" which means "you see that it is altered (in appearance)."

This (process) will also melt Gold, and Silver. The two *Raṣāṣ* (i.e. Tin and Lead) melt more easily, being fused (even) in an iron ladle (*mighraḥah*).

As for the instruments of operation and treatment,¹ by means of which substances are so manipulated as to become Elixir²—Elixir meaning that Medicine which, when fed on to a molten 'Body', converts it into silver or gold, or changes it (in colour) to whiteness or yellowness—they are:

<i>Qar'</i> ³ and <i>Ambīq</i> ⁴	and <i>Qābilah</i>	Blind <i>Ambīq</i> :
(Cucurbit and Alembic),	(Receiver) :	<i>Uthāl</i> (Aludel) :

An even closer parallel to ar-Rāzī's text is a prescription found in the mediæval Latin translation from the Arabic entitled *Liber Sacerdotum*. The latter, on the one hand, seems connected, in some way, with Jābir's 'Book of the Seventy', while on the other, it may, in all probability, be regarded as a summary of the ancient Temple knowledge of the Near East.

"*De preparando ferro quoddam secretum. Rubrica*—Ferrum limatum cum quarta parte rubei auripigmenti permiscibus; idem in panno constrictum et luto circum linitum in fornace calida per noctem integram locabis. Quod cum diluculo [dawn] extractum fuerit in feream speciem redactum invenies. Illud item spissatum oleo et nitro liniendum erit; est idemque in vase fusorio, misso equali pondere eraminis, adhibendum est. Totum ergo per ignis potenciam admixtum, post in frigidacionem terendum." (Berthelot, *La Chimie*, I. p. 198, quoting from *Biblio. Nat. Ms. lat. No. 6514*.)

If the word 'aeraminis' (copper or brass) is a misreading for 'aluminis' (a possible translation of *Zāj*) the essential portions of our text and of the version of the 'Book of the Priests' become almost identical; and we are inevitably led to the conclusion that in this case at all events ar-Rāzī was only drawing on long-stored up scientific knowledge which Jābir was the first to publish to the world. If ar-Rāzī had been followed by men as keen as himself on experimental work, Chemistry might have come into being several hundreds of years before it actually was born. As it was, subsequent writers on alchemy were content either to copy or, in many cases, to pervert, with results that are only too evident when we follow up any particular experiment given by Jābir or ar-Rāzī. In the present instance, the following is what is found in the curiously misnamed *De Inventione Veritatis*, which some mediæval Latin writer published under the name of Geber (*Artis Chemicæ Principes, Avicenna atque Geber*, Basle, Peter Perna, 1572, p. 725):—

De praeparatione Martis. Caput XIII.

"Martem sic praepara: Tere libram j. limaturae ejus, cum libra semis arsenici sublimati. Imbibe illud cum aqua salis petrae et alcali, ter reiterando, funde violeuter, et habebis ferrum album: itera quousque sufficienter liquescat cum dealbatione peculiosa."

The 'sal-petrae' of this Latin text seems to be a mistranslation of *natrūn*, while 'alcali' may correspond to the 'sal-ammoniac' of ar-Rāzī's accounts in the *Madkhal* and *K. al-Asrār*. From a reference to the translation of the latter (*infra*, p. 379) it will be seen that ar-Rāzī subsequently modified his earlier description to the extent of mixing the iron filings with *hal* their weight of yellow arsenic, viz., the proportion of 'sublimed arsenic' mentioned in the *De Inventione*.

It may be noted in conclusion that Jābir in the Latin version of the 34th book of the 'Seventy' ascribes the discovery of the importance, in alchemy, of reducing substances to a fused state, to *Harius*. If, as is possible, this is a corruption of *Horus*, the affiliation of the chemical knowledge of Arabic writers to that of the ancient Egyptian priests is still further confirmed.

¹ Treatment in the medical sense ('*ilāj*'). This is an obvious echo of Jābir's ideas on the 'cure' of base metals.

² *Al-Iksir*—from Greek *ἕρπύς*, dry medicine.

³ A gourd-shaped vessel. The Latin *cucurbita* is thus a literal translation.

⁴ From Greek *ἀμβίξ* cup: but used by Dioscorides in the sense of 'still-head' (Leclerc, Ibn al-Baitār, II, p. 230). From Dioscorides, the word passed into constant use by Arabic alchemists. Mention is often made in Jābir's 'Book of the Seventy' of the Cucurbit and Alembic (as well as of the next but one instrument in ar-Rāzī's list, the Aludel), e.g., p. 317 of the Latin translation published in Berthelot's *Archéologie*: and, as we have already noted, it is very probable that ar-Rāzī's information was largely based on Jābir's works. If, however, the second treatise of *Khalid bin Yazid*

<i>Aqdāh</i> (Cups) :	<i>Mustauqad</i> (Cylindrical Stove): and <i>Kurah</i> (round mould).
<i>Qannānī</i> (Flasks) :	<i>Atūn</i> (Oven) :
<i>Qawārīr</i> (Phials) ¹ :	<i>Tābashedān</i> ² (Oven heated from above) :
<i>Ṣalāyah</i> (In India <i>Sil</i> , a flat stone mortar) :	<i>Nāfikhū naṣīh</i> , ³ (a brazier with perforated sides) :
<i>Fīhr</i> (Stone roller for grinding substances on the <i>Ṣalāyah</i>) :	<i>Durj</i> (Clay box in which substances are calcined) :

Explanation of the Fore-going.

Qar' and *Ambīq* is that (apparatus) in which rose-water is made. The [Blind] Alembic is that which is (fitted) on the top of the Cucurbit. As it has no spout through which the (distilled) water can flow into the receiver, the water then flows down, that is, collects in the upper portion only. The 'Blind' (Cucurbit) is a cup (*qadah*), which is placed on the Cucurbit, in which collects whatever rises up from the latter.⁴

The *Uthāl*⁵ is made of Glass or Earthenware (*ḡakhhkhār*). The way of making it is this. Take a layer of *Tīn al-Ḥikmah* (Clay of Wisdom)—the meaning of *Tīn al-Ḥikmah* is this. Pure (potters') clay is moistened with water for a day until it becomes plastic.⁶ Then you mix with it an equal quantity of powdered dung (*sarqīn*) that has been passed through a sieve, a little chopped-up animals' hair, and salt, for each *raṭl* (pound) of clay one handful. If you desire it to be harder, (use instead) potsherds (*khadhf*) pounded as fine as a collyrium (*kuhl*) but the first alone (i.e., clay) will do well enough. Knead it well until it becomes like wax. A layer of this clay (I say) is spread over a flat surface, some ashes being placed underneath so that it may be lifted when it has to be taken up. Then an Aludel of earthenware or glass is taken and inverted on it, so that an impression is made which must be (exactly) central. After this, the Aludel is removed and its place is hollowed out. The size of the layer should be the size of the cover (*mikabbah*) that is placed over it (to complete the apparatus). The meaning of *mikabbah* is that it is a cover of earthenware or glass within which the aludel is (placed), and which resembles (in shape) a dish-cover. (Be careful

found in the Rāmpūr Ms. (*vide Mem. A.S.B.*, III, p. 61) is authentic, Jābir, in turn, drew on Khālid (or Khālid's original authorities), as references to *Qar'* and *Ambīq* appear in this treatise.

¹ Cf. Muḥammad bin 'Abd al-Malik's treatise (*loc. cit.*, p. 62) '*Qawārīr* for the process of *Takhniq*, similar to those used for holding rose-water.' *Qārūrah* was apparently, however, sometimes used as synonymous with *qinninah*.

² Arabised Persian word, meaning 'holder of heat.'

³ Lit. 'That which blows itself.'

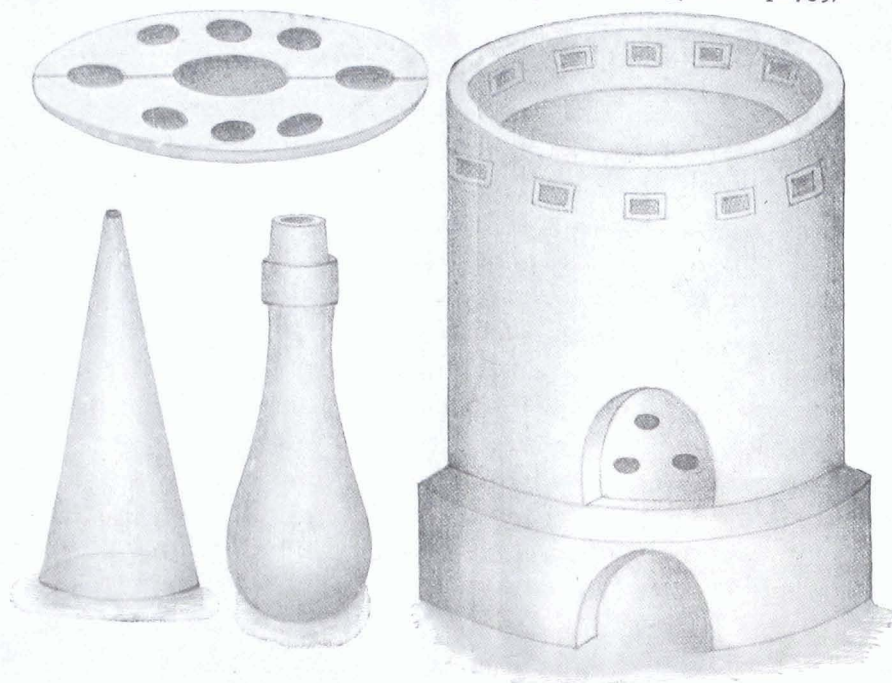
⁴ The 'Blind' (*Al-A'mā*), i.e., Cucurbit closed by a cup, is not to be confused with the 'Cucurbit and Blind Alembic.' In the latter the Alembic, or Cucurbit, had an internal channel in which the substance to be dissolved was placed, while some 'strong water' was poured into the bottom of the vessel. On boiling the 'strong water' the distillate was condensed in the alembic, and on running down into the channel gradually dissolved the substance contained in it (*vide K. al-Asrār*, trans., *infra*, p. 381).

⁵ From the Greek *αἰθάλη*, originally the sublimed vapour: but later the apparatus for subliming volatile substances (*cf. Berthelot, La Chimie*, II, pp. 93 and 133).

⁶ Or 'rises like dough.'

Furnace for Sublimation.

Liber Fornacum Gebri (Artis Chemicæ Principes—Basle 1572 ed.—p. 739).



NOTE.—From the figure on p. 743 of the *A.C.P.* the furnace used by European alchemists of the early 13th century seems to have been 4' or 5' high, i.e., very much larger than the Arabic *mustaugad* of the 10th century, which was only 2 spans high and 3 spans broad, or 1½' by 2¼'.

FIG. 1.

'Athamor' (Arabic *Tannūr*).

Furnace for Calcination of Metals: and Fixation.

(*Liber Fornacum Gebri: ed. cit.*, pp. 738 and 745.)

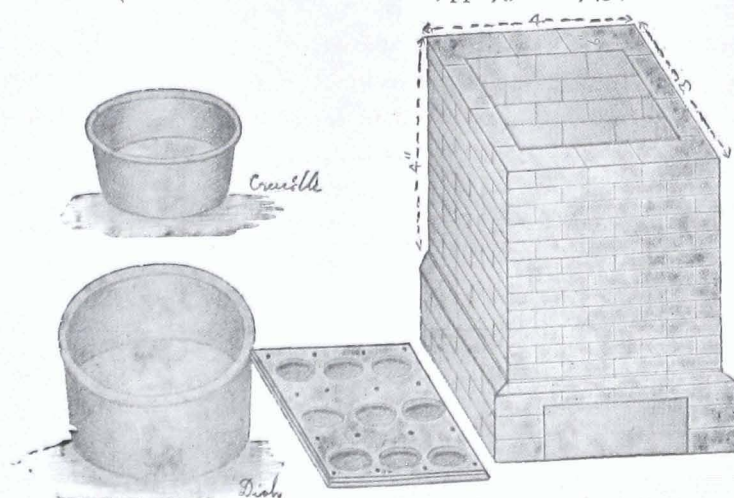


FIG. 2.

to) make the layer a little larger (than the diameter of the cover) as it will shrink when dried or baked.¹

Then you return the aludel to the place that you have made for it, and having thrown much dust (over it), cover it with clay until it reaches the edge and the joint all round is closed with *ghumrah*, which is (red) clay. Smear the whole of the aludel with the clay time after time if you wish it to remain intact, but, if it is an aludel that has (previously) stood fire, only (smear it) once to the thickness of a finger. You must also see that the clay is spread evenly, not thin in one place and thick in another. When it is completely dry, invert it, and in this way the clay will project over the aludel like a shelf. Fit the cover on it, and adjust it properly. Next, under the shelf at a distance of four fingers, make projections² such as pots usually have, so that it may rest on the stove (*mustauqad*). When you have fixed it on the stove, you close the junction (between aludel and stove) with clay so that the flame of the fire may not rise up and damage the shelf and (thus) spoil what is on it.

As regards the making of the *Mustauqad*, you built up a *tannūr*³ with a pit underneath for the live cinders to fall into, and construct a single door in it (the furnace), by which you introduce fuel. It has one hole under the wing for the smoke to go out of.⁴

The Cucurbit and Alembic is for anything you wish to distil. The meaning of Distillation (*taqīr*) is this. You put the substance (you wish to distil) into it (the Cucurbit) and fit the alembic over it, and the joint having been luted by rags, smeared with *khitmi*⁵ and glue (*ashrās*),⁶ the apparatus is left to dry. Then you place it on a stove (*mustauqad*), and adjust a receiver (*qābilah*) to it. The meaning of the latter (phrase) is this. The spout of the alembic is placed in a cup (*ritl*)⁷ in such a way that what passes down, drop by drop, collects inside. After that, you kindle fire of the proper intensity under the pot (*qidr*).⁸ If it be a humid substance, a gentle fire by means of charcoal, or some other (fuel, should be used). If otherwise, then to a greater or less degree; which must be learnt by experience, as our discourse would become too long (if we gave an account of it). If (properly) heated for a long time, the substance passes over in the form of water into the receiver. This is called the Distillate (*muqattar*), no matter what the substance is (that is distilled).

Sometimes the Cucurbit, if you desire it to be gently heated, is placed in a vessel

¹ Lit, 'It is also permissible to bake it'

² Lit. 'wings.' If we had access to the original Arabic of the 34th treatise of the book of the Seventy, it would probably be found that it contains a very similar description to what is here given of the making of the Aludel (vide Lat. trans., *op. cit.*, p. 347).

³ Stove or furnace: hence the 'Atanor' or 'Athanor' of mediæval alchemical treatises in Europe (vide Plate II).

⁴ For a fuller description of the *Uthāl* and its *Mustauqad*, as well as how to make the 'Clay of Wisdom', vide the Instrument section of the *K. al-Asrār*, *infra*, pp. 382-3. Also Muḥammad bin 'Abd al-Malik's '*Ain aṣ-Ṣan'ah*—Stapleton and Azo, *Memoirs A.S.B.*, I, pp. 62-64. The *Uthāl* was used as the principle instrument for carrying out the process of Sublimation, and two methods, given in the *K. al-Asrār*, for using it will be found later on pp. 385-7.

⁵ Marsh mallow—a gum-producing plant.

⁶ Or 'shoemakers paste.' Vide also *infra*, p. 384, note 2.

⁷ Persian word meaning a 'wine cup', or 'bowl'.

⁸ The Cucurbit seem to have been placed in an air or water-bath (vide next two paragraphs).

(*qidr*) of water. On the vessel being heated, the substance distills from the warmth of the water. Alternately a vessel containing ashes (may be used).

Sometimes the Cucurbit is (simply) suspended in a suitable vessel, without either ashes or water, but (even then) distillation takes place.

These, and similar, processes are easier to understand by actually seeing (them). Enquire therefore of these (things) from adepts, that you may view them (for yourself).

Should anyone say "If, according to your word, we are compelled to see the instruments ourselves, and seek information about them from experts, then of what use is your book to us"? We say to such a man "Its value is that it collects together all that a man can desire to ask about and displays it fully to view. In that is great advantage, for, if you wish to learn from experts the instruments and substances in any different way (than the one I am giving), you can only do so after a long time, just as they happen to be mentioned, or are needed in the processes. Nor are you secure from deception, for a thing may be called by other than its proper name. If, on the other hand, you learn these things from a book the time will be shortened and you will be saved by means of it from the quibbles of charlatans."

As for the 'Blind Alembic', it is needed in lengthy operations, which you will become acquainted with if you ever progress so far. The 'Blind' (Cucurbit) is needed for the Coagulation (*Aqd*) of things that have undergone the process of Solution (*Hall*). The meaning of this is that alchemists treat some of their substances until they change into water, and when they desire to coagulate this (liquid), they place it in a Cucurbit. Over this they put a cup, luting the joint as I have explained (above). Underneath a gentle charcoal fire is maintained, so that the water may coagulate and turn into a stone. It is also used for the coagulation of oils. Similarly (it is needed) for everything that has to undergo (the process of) cooking (*ṭabkh*).

Cups and Phials (*Qawārīr*) are needed for submitting Medicines to (the process of) *Tashwiyah* (Assation). Alchemists make their substances imbibe water on a *ṣalāyah* and (then) put them in a luted phial, or cup. The latter is placed over another (vessel).¹ They close it, that is, the mouth of the phial, with what I have mentioned (above), or by some other kind of stopper, and place it on a fire of suitable temperature. This (process) they call *Tashwiyah*.²

Flasks (*qannānī*), smeared with clay, are needed in the Sublimation (*Taṣ'īd*) of everything that they wish to be deposited in the upper part (of the flask), since alchemists often desire to submit to (a process called) *Takhnīq* (Constriction) some of the substances, such as Mercury and yellow Arsenic sulphide, that can be sublimed.³

¹ I.e., the phial or cup is hung inside another which serves as an air-bath (*vide* description in *Mafātīh al-'Ulūm*, *infra*, pp. 366-7.

² For further details, *vide* *K. al-Asrār*, *infra*, p. 384. According to the author of the '*Ain aṣ-Ṣan'ah*', the cups and flasks used in alchemical processes were made of glass (*Mem. A.S.B.*, I, pp. 60 and 61).

³ Or 'that have already undergone the process of sublimation'. The details of the process are probably quoted from some book of Jābir (*cf.* the 26th and 27th treatises of the Latin translation of the '*Book of the Seventy*'—*ed. cit.*, pp. 335 and 336—where two descriptions of 'Constrictio' are given, using sulphur instead of arsenic sulphide).

The meaning of *Takhniq* is that the sublimate should collect in the neck of the flask. Sometimes, when the amount is small, they put it in a luted rose-water bottle (*māwardiyah*). This (process) is also called *Tarkhīm* (Incubation). If they want the substance in its own (natural) colour, they make it undergo the process of *Takhniq* without (the addition of) oil, but if they want it as an essence (*jawhar*) they mix it with oil and then make it undergo this process.

The process (of carrying out *Takhniq*) is to place in the flasks whatever has to be treated, filling one-fourth of the flask. It (i.e., the flask) has wings, as I have mentioned (in the case of the aludel), and it is placed on a stove (*mustauqad*). If there are no watery or unctuous humidities present, close the mouth of the flask; but if there are, cover the mouth with wool, until the humidity is got rid of, and the wool is found to be dry. Then the flask is closed, and a fire maintained (underneath) until the sublimate¹ collects in the neck.

By Sublimates of liquids are meant Distillates; and by sublimates of 'Spirits' what you volatilise by means of the Aludel.

There are several ways of performing *Taş'īd* in the Aludel; and the substances which alchemists sublime in it are Mercury, Arsenic Sulphide, Sulphur and Sal-Ammoniac. They are placed, after treatment, in the aludel, and the cover being fitted in position over it, a fire is lit. Then the substance rises up, and settles on the shelf. The treatment of these (substances) should be studied in the *Kitāb at-Tadābīr* (Book of Processes).

The (alchemical) Oven (*atūn*) is exactly like a Potters' *atūn* except that it is smaller. You place in it whatever you desire to calcine, and keep the fire burning until the substance is calcined. The meaning of *Taklīs* (Calcination) is this. Alchemists place inert substances or any other thing they wish to calcine to (the fineness of) dust,—some with treatment² and some without—in luted cups (*kizān*), which are put in the fire until the substance is calcined. The meaning of this is that it becomes like flour. This is called *Taklīs*, and (an account of) this treatment is (to be found) in the *Kitāb at-Tadābīr*.

As regards the *Tābashedān*, it is an inverted *atūn*—the fire being kindled at the top—similar to that used by food hawkers. They place in it whatever they wish to heat superficially so that its unctuous humidity may be burnt away as quickly as possible.

The *Nāfikhū-naṣīh* is a *tannūr* with a base supported on three legs, the walls and bottom being perforated with holes. Charcoal is poured into it, and whatever they wish is placed inside. It has a projection of clay on which the grate (*kūwah*)³ rests. This is piled up with charcoal. It (the apparatus) has a cover, fitted over it. When the fire has been kindled in it, it is placed where the breeze can play round it. This produces a very hot fire for calcining substances, and for bringing them together and combining them⁴ by fusion.

¹ Lit. 'that which is produced in the process of *Takhniq*.' For further details as regards luting the flasks and sealing their mouths, *vide* the *K. al-Asrār*, trans, *infra*, p. 383.

² In the medical sense—'*ilāj*.'

³ Another possible reading is 'on which the cup (*hūz*, containing the substance to be treated) rests.'

⁴ *Mudākhhalat*, lit. 'mutual entering of one another'.

The *Durj* resembles a box made of clay. In it the 'Body,' which it is desired to calcine, or whatever they wish to subject to treatment with medicines,¹ is placed in layers, one course after the other. A cover is placed over it, and after the joint is closed, fire is kindled on top.

The *Kurah* (Spherical Mould) is that by means of which filings or pounded substances are treated. The Medicine is thrown on to them and stirred up with vinegar, after which it (the mixture) is collected in a rag or piece of paper, made into (the shape of) a bag (*ṣurrah*). Then clay is smeared round it, and it is made into a ball. When dry, the ball is roasted in the fire. After that it is treated as you think fit.

[Concluding Remarks.]

Such an account as we have given of these instruments and substances will enable the learner to make experiments (*tajārib*) with them, and (thus) add daily to his knowledge; and in proportion to the knowledge derived from his experiments, he will discover things that we have not alluded to.

In the study (of this Art) he will also sometimes need, in addition to all this, a knowledge of the reactions (*af'āl*) of 'Bodies,' 'Spirits' and 'Stones.' The meaning of 'Stones' is that they are substances which are not malleable like the 'Bodies,' nor are they injuriously affected by one another, like the 'Spirits,' in their natural state, i.e., in the state they were before being employed and subjected to treatment (*tadbīr*). By knowing their (different) reactions the beginner in the Art will be prevented from falling into grievous error. We have given an account of (all) this in the *Kitāb 'Ilal al-Ma'ādīn* (Treatise on the Causes—or Diseases—of the Minerals), which is next (in order) to this book. It has the title *Al-Madkhal al-Burhānī* (Demonstrative Introduction).

He will also need to melt the difficultly-fusible Iron; to harden the easily-fusible Lead; to whiten red Copper; to sublime Mercury and solidify it; to make Silver, and similar substances, yellow, so as to resemble gold. (These things he must know) by way of introduction to other things that are dealt with in the *Kitāb at-Tadābir* (Book of the Operations). We have given an account of the former (processes) in the *Kitāb al-Ithbāt* (Book of Confirmation).

If he becomes perfect in all this and comprehends everything that we have mentioned in those of our books that follow this one (taking them) in their proper order, book after book, (that is to say) reading first *Al-Madkhal al-Burhānī*, which we have also termed *Kitāb 'Ilal al-Ma'ādīn* so that he may have an exact knowledge of the constitution² of the 'Spirits,' 'Bodies,' 'Stones' and Minerals; next, the *Kitāb Ithbāt aṣ-Ṣan'ah wa'r Radd 'alā munkirih* (Book of Confirmation of the Art and Refutation of those who deny it); next, the *Kitāb al-Ḥajar* (Book of the Stone), which explains of what it (the Stone) is made; next, the *Kitāb at-Tadbīr* (Book of the Operation), which shows by what operations it (the Stone) is made; next, the *Kitāb al-Iksīr* (Book of the Elixir), which explains by what power it imparts colour to the Medicine,

¹ *Adwiyah*, pl. of *Dawā*—vide later under *Kitāb al-Iksīr*.

² *taḥwīn*, lit., 'creation'.

and why, and how; next (he should read) the *Kitāb Sharaf aṣ-Ṣan'ah* (Book of the Nobility of the Art), so that he may know the Nobility of the Art and of its Followers; its Excellence; and the Superiority of the Man who strives over him who (only) relies upon Providence; next, the *Kitāb at-Tartīb* (Book of the Method),¹ so that he may know the claims of the Masters of this Art, and the method of experimenting; next, *Kitāb at-Tadābir* (Book of the Operations), so that he may know why the Sages have adopted these operations and what compelled them to do so, and how to carry on any operation that is required; next, the *Kitāb al-Miḥan* (Book of Testing), so that he may have a correct knowledge of the (differentiation by) tests of Gold and Silver from all other bodies; next, *Kitāb ash-Shawāhid* (Book of Evidences)² so that he may know that all the ancient Sages were in agreement with our opinion; next, *Kitāb Sirr al-Ḥukamā' wa Ḥiyalihim* (Book of the Secret of the Sages and their Devices), so that he know how to ward off the common herd, and especially his own family, and dependents; and how to save himself if he is vexed either by the ruler or the common people—(I say) if he becomes well versed in all this, then his initiation into the Art will be complete.³

He who studies these our books must also have some skill in Dialectic (*al-kalām al-jadalī*), for without this, he can scarcely attain its highest limit, nor will his profit be complete.⁴

Here ends *Al-Madkhal at-Ta'limī* (Instructive Introduction) which deals with Instruments and Substances. There follows it, forming the second part (of the whole 12 Treatises), *Al-Madkhal al-Burhānī*, which is (also) known as '*Ilal al-Ma'ādin*.

To Allāh alone be praise, and may blessings rest upon his messenger, Muḥammad, and upon his descendants! Allāh is our Support, and best Protector! He is the best Master, and best Aid!

¹ An alternative title for this—given in the Rāmpūr Ms. of the *Shawāhid* (*vide Mem. A.S.B.*, III, p. 69)—was *K. ar-Rāḥah* (Book of Rest). It was an explanation of Jābir's *K. ar-Rahmah* (Book of Mercy).

² Lit. 'texts quoted as proofs.' An alternative name, given in an-Nadīm's *Fihrist* (Flügel's 1871 Leipzig ed.), is *Kitāb Nukat ar-Rumūz* (Book of the Epitome of Mystical Sayings), which is also given in the *Shawāhid* itself (*loc. cit.*) as an explanation of the ordinary title. It was also called, simply, *Kitāb ar-Rumūz*.

³ The list of ar-Rāzī's Twelve Treatises given in this paragraph is identical with the one found in the *Fihrist* except in the following four instances: (a) it enables us to correct Flügel's tentative readings of the 3rd Treatise (*K. al-Abyāl* and 11th Treatise (*K. al-Muḥabbah*); (b) both the *Madkhal* and Rāmpūr Ms. of the *Shawāhid* (*loc. cit.*) agree in placing the *K. al-Ḥajar* before the *K. at-Tadbir*, instead of after the latter: (c) probably, as in the *Fihrist*, the *K. al-Miḥan* should follow the *K. ash-Shawāhid*, as it is not mentioned in the Rāmpūr Ms. of the latter work: and (d) in the *Fihrist*, the 12th Book is called, simply, *Kitāb al-Ḥiyal*.

⁴ From this passage one might almost conclude that ar-Rāzī had read Plato's 'Republic' (which had been translated by Hunain bin Ishāq, d. 260/873): *cf.* the following passages from Jowett's translation.

"And so, Glaucon, I said, we have at last arrived at the hymn of Dialectic. . . . When a person starts on the discovery of the absolute by the light of reason only and without any assistance of sense, and perseveres until, by pure intelligence, he arrives at the perception of the absolute good, he at last finds himself at the end of the intellectual world, as in the case of sight at the end of the visible." (Vol. III, p. 235.)

"Dialectic, then, as you will agree, is the coping stone of the Sciences and is set over them: no other science can be placed higher—the nature of knowledge can no further go?"

I agree, he said". (Do., p. 238.)

In Dr. Ruska's article on al-Bīrūnī (*loc. cit.*) besides other books on Logic and Scholastic Philosophy, a work by ar-Rāzī on Dialectic is mentioned (No. 95, p. 42) which Dr. Ruska thinks is based on Aristotle's *Σοφιστικοὶ ἔλεγχοι*.

An echo in mediæval Latin of this passage of ar-Rāzī is probably the following sentence, found in the early 13th Century *De Anima*, falsely ascribed to Ibn Sīnā by the real author (who—early in his work—expresses the greatest respect for ar-Rāzī's knowledge of alchemy): "Ad quid est necessaria Dialectica in hoc magisterio? Ut sciamus, si est aut non" (*ed. cit.*, p. 288).

III. THE *MAFĀTIḤ AL-'ULŪM*,

OR 'KEYS OF THE SCIENCES.'

By Abū 'Abdallāh Muḥammad bin Aḥmad bin Yūsuf al-Kātib al-Khwārazmī
(G. Van Vloten's Text: Leyden, 1895).

The Ninth Chapter of the Second Part, on Alchemy; in Three Sections.

The First Section deals with the Instruments of this Art; the Second Section, with the Substances (*'aqāqīr*) of the Alchemists, and their Medicines (which are produced) from metals and Stones;¹ the Third Section, with the Operations and methods of treatment² of the aforesaid substances.

THE FIRST SECTION:

ON THE INSTRUMENTS OF THIS ART.

The name of this Art is *Al-Kīmiyā*,³ and the word is Arabic, being derived from '*Kamā Yakmī*', which means 'to hide' or 'to conceal': as in the phrase *Kamā'sh shahādata yakmihā*, meaning 'he concealed his evidence.'³ Experts generally give the name of *Al-Ḥikmah* ('The Wisdom') to this Art, and some of them call it *Aṣ-Ṣan'ah* ('The Art').

Among their instruments are some well-known to goldsmiths and other artificers, such as *Kūr* (furnace); *Būṭaq* (crucible); *Māshū*⁴ ladle; *Rāt* (mould); and the *Ziqq* (bellows), which are blown. All these instruments are for melting or casting.

The *Rāt* is that vessel into which any molten 'Body,' such as gold, silver, etc., is poured, and it is also called *Misbakah*. It is made of iron, and shaped like a half-reed.

Another of their instruments is *Būt-bar-būt*. It is a crucible (*būṭaqah*), with a perforated bottom which is placed on another, the joint between the two being well luted with clay. Then the body is melted in the upper crucible, and drops through into the lower one, the dross and impurity remaining in the upper one. This operation is called *Istinzāl* ('making descend').

Among their experimental apparatus⁵ is the *Qar'* (cucurbit) and *Ambiq*, (alembic), the two instruments used by makers of rose water. The lower is the Cucurbit, and the upper, which is shaped like a cupping-glass (*mihjamah*)⁶, is the

¹ *Wa adwiyatihim min al-jawāhir wa'l ahjār.*

² In the medical sense (*wa mu'ālatihā*).

³ The more commonly accepted derivation of the term is that it is connected with the Egyptian name for Egypt, *Chemī*. Alternately it is associated with one or other of two Greek words, *χυμός* (juice), or *χέω* (to melt or cast): the idea in the latter case being that alchemy was the art of working with metals (Berthelot, *Collection*, I, p. 251).

⁴ Van Vloten (following Berthelot) read *Māshaq*. Corrected from the Lucknow Ms. of the *Kitāb al-Asrār*.

⁵ Lit. 'Instruments for the operation' (*tadbīr*).

⁶ Lit. 'the instrument used by the *Ḥajjām*', or barber-doctor. In India a cow's horn is used: but the Arabic alembic is obviously derived from the Greek form of the cupping glass—nipple-shaped, with lower half of narrower diameter, and hole at the top (*vide* Plates opposite pp. 114 and 120 of Singer's *Greek Biology and Greek Medicine*). The

Alembic. The Blind Alembic is that which has no delivery tube (*mizāb*). The *Uthāl* (Aludel) is one of their instruments, made of glass or earthenware, shaped like a covered dish (*ṭabq*), with a rim.¹ This is used for the volatilisation (*taṣ'īd*) of Mercury, Sulphur, Arsenic Sulphide and similar substances. The Receiver (*qābilah*) is a vessel which will hold a *raṭl* of liquid, or something like this, into which the spout of the alembic is fitted. The *Mauqūd* is a sort of stove (*tannūr*) which they use. The *Ṭābistān* is a brazier (*kānūn*) like that used by food-hawkers. The *Nāfikhū nafsih* is a stove (*tannūr*) with a base supported on three legs, the walls and bottom being perforated with holes. It has a projection of clay. Fire is kindled, and the medicine having been placed in a luted cup (*kūz*), the apparatus is placed where the breeze can play round it. The *Durj* resembles a box made of clay. Fire is kindled on top, and by means of it the 'Bodies' are subjected to treatment.²

THE SECOND SECTION :

ON THE NAMES OF THE METALS, SUBSTANCES, AND 'MEDICINES' THAT ARE EMPLOYED IN THIS ART.

The 'Bodies' (*Ajsād*) are Gold, Silver, Iron, Copper, Lead (*Usrub*), Tin (*ar-Raṣāṣ al-Qal'ī*), and *Khārṣīnī*. The last is a rare metal which is almost incurable.

Alchemists term, in cabalistic fashion,³ Gold, *Shams* (the Sun); Silver, *Qamar* (the Moon); Copper, *Zuhrah* (Venus);⁴ Lead, *Zuhal* (Saturn); Iron, *Mirrikh* (Mars); Tin, *Muṣhtarī* (Jupiter); and *Khārṣīnī*, 'Utārid (Mercury). Discrepancies are sometimes found in their interpretation of many of these names, but they seldom differ about Sun and Moon.

The 'Spirits' (*Arwāḥ*) are Sulphur, Arsenic Sulphide, Mercury and Sal-ammoniac.

introduction of a model of the cupping glass into alchemy was almost certainly due to magical association between living bodies and those of inorganic (as well as organic) origin. The cupping glass removed the blood in which the soul of the person was supposed to reside: while on the other hand the spirits of both inorganic and organic substances when heated were collected in the alembic.

¹ Reading Cod E الشرف (rim) for the الرق (bellows) of Van Vloten's text.

² Apart from the general very close resemblance of the *Maḥāṭih al-'Ulūm* to the *Madkhal*, the identity of several phrases in this paragraph shows that the author had the *Madkhal* in front of him when writing this account of the *Nāfikhū nafsih* and *Durj*.

³ *Fi rumūz*. Ar-Rāzī's *Kitāb aṣṣ-Ṣhawāhid* was written to explain the mystical phraseology of the earlier (mostly pre-Islamic) alchemists in terms of his own matter-of-fact knowledge.

⁴ The equivalence of Copper with *Zuhrah* (Venus), and of Tin with *Muṣhtarī* (Jupiter) is somewhat doubtful, as all Van Vloten's 5 Mss. assign Copper to Jupiter and Tin to Venus, though in Ms. B this assignment is corrected in a different hand. The original order would bring the *Maḥāṭih al-'Ulūm* list into agreement with that given in the *Madkhal*, unless indeed our Ms. of the latter is wrong: but on the other hand they will agree even less than before with the order of the metals—Gold, Silver, Copper, Iron, Tin, Lead and *Khārṣīnī*—found in all the three chief Mss. of the *Kitāb al-Asrār*. In the Second Century list of Celsus (which was apparently drawn from Persian sources—*vide* Berthelot and Rouelle, *Coll. des anciens alchimistes grecs*, I, pp. 78-9), Tin is assigned to Venus, Brass to Jupiter, and another Copper alloy to Mars; while in Muḥammad Ḥusain's list, in which the order of the planets was that used by the Ṣābiāns—*vide* table on p. 414—we find Brass assigned (as an alternative to Tin) to Jupiter, and Copper (as an alternative to Iron) to Mars. All this will serve to illustrate al-Khwarazmī's subsequent remark on the discrepancies found in the case of all the metals, except those of Gold=Sun and Silver=Moon.

'Bodies' are so-called because they remain inert and fixed when heated, while 'Spirits' owe their name to the fact that they fly away when fire touches them.

Among their (other) substances is Salt. One (variety) is sweet. One is bitter. One is (called) *Andarānī*. One is red, and from this crucibles and trays are made. One is (called) *Nafī* as it has the smell of naphtha. One (kind) is (called) *Baiḍī* as it has the smell of boiled eggs (*baiḍ*). One, which is black, is (called) *Hindī*. One is (called) *Tabarzad*. One is (called) Salt of Urine, as it is made from Urine. One, (called) Salt of *Al-Qilī*, is made from *Al-Qilī*.¹

Another of their substances is *Nūshādḥur* (Sal-ammoniac), and it is of two kinds, (i) Mineral; and (ii) Artificial, made from Hair.

Another (substance) is *Būraq*, and it is of several kinds. One is *Būraq al-Khubz* (Bread Borax). One is called *Natrūn*. One is (called) *Būraq aṣ-Ṣāghah* (Goldsmiths' Borax). One is (called) *Zarāwandī* and it is the best of all. And one is *Tinkār*, which is artificial.²

Another (class of substances) are the *Zājāt* (Vitriols). One kind is white, which is called *Minjānī*:³ it has green veins. One kind is called *Shabb* (alum): this is pure white. One kind is (called) *Zāj al-Asākiyah* (Cobblers' *Zāj*). One is *Sūri*, which is red: it is rare. One (variety) which is called *Qalqandūn*, is green; on moistening it, and rubbing it on Iron, it will turn the latter red.⁴

Another of their substances is *Mārqashithā* (Marcasite, or Pyrites). Among (the varieties of) it, some are square, some round, while some are (found as) large pieces, without definite shape. There are several kinds of them. (One is) yellow, which is called *Dhahabī* ('golden'). (Another which is) white, is called *Fiddī* ('silver'). And (one is) red, which is called *Nuḥāsī* ('copper-coloured').

Another of their substances is *Maghnisiyā*, and it is of several kinds. One is (called) *Turbah* (dust). It is black, with white eyes of great brilliancy. One kind is (found in) large hard pieces, with similar eyes. One kind is like iron. One is red. And other kinds closely resemble these.⁵

Another of their substances is *Tūtiyā*. One kind is (called) *Akhḍar* (Green): and another, which resembles egg-shells is (called) *Aṣfar* (yellow). There are also several varieties of it. One (called), *Hindī* is white; it is rare. Another is yellow, and this is (called) *Khazarī*.⁶ Another is green and this is (called) *Kirmānī*. And another kind (of *tūtiyā*) is called *Mahmūdī*;⁶ and there are, besides, other kinds. The *Hindī* is artificial.

Another of their substances is *Dahnaj* (Malachite). It is a green stone, which

¹ The author has omitted the Salts of *al-Uqāb* (Sal-ammoniac), Lime, and Ashes which are found in the *Madkhal* list of Salts. Possibly, however, he included Salt of Ashes (potassium carbonate) under *Al-Qilī*.

² The author omits the *Būraq al-gharb*, which is found in the *Madkhal* list of Boraces.

³ Corrected from the *Madkhal*. Ms. B had *Minhānī*, but Van Vloten read *Minhātī* (following Leyden Ms.).

⁴ Al-Khwārazmī omits *Zāj al-Hibr*, *Qalqaṭūr* and *Qalqadis*.

⁵ This paragraph is copied almost word for word from the *Madkhal*.

⁶ A corrected reading of Cod. D. has been accepted from the note on p. 261 of Van Vloten's edition, following both of ar-Rāzī's works in preference to the text reading of *Khūzī*, i.e., *Khūzistān*: var. lect., *Jazīri*, of *Jazīrah* (Mesopotamia). Similarly *al-Mukhawṣ* (thin plates like palm leaves) has been replaced by *al-Mahmūdī*.

is used for signet rings, and beads. A similar substance is *Fairūzaj* (Turquoise), but it is less green than *Dahnaj*.¹

Another of their substances is *Lāzaward* (Lapis Lazuli). It is a stone² with brilliant eyes, and beads are made out of it.

Another (substance) is *Talq* (Mica). There are several kinds of it, such as, *Bahrī* (sea), *Yamānī*, and *Jabalī* (mountain). When hammered, it separates into thin plates of brilliant appearance.

Another (substance) is *Jibsīn* (Gypsum).³ It is a white stone, obtained in mountains.

Another (substance) is *Shādhanaḥ*. One kind is the '*Adasī* and another kind is the *Khalūqī*.

Another (substance) is *Kuḥl* (Galena). It is the essence of Lead.

Another (substance) is *Mashaqūniyā* (the dross of glass). It is a thing which comes out from glass. It is a white, hard, fusible, and potent salt.

Another (substance) is *Shakk* (Arsenic Oxide) which is of two kinds, Yellow and White. It is a mineral, and is (also) made artificially from the smoke of silver. It is called *Samm al-fār* (Rat Poison).⁴

Another (substance) is *Dawṣ*. It is the 'Water of Iron.'

Another (substance) is *Saktah* (? Copper Oxide). It is a stone used by copper-smiths.

Another (substance) is *Rātīnaj*. It is the gum of the pine tree.

Another (substance) is *Zarnīkh* (Arsenic Sulphide). It is of several kinds: Red Yellow and Green. The green is the worst kind, and the best is that which can be laminated.

Another (substance) is *Maghnātīs*. This is a stone which attracts iron.⁵

Among their Derivative Substances which are not original are:—

(a) *Zanjār*. It is made from Copper. Plates of copper are put into the dregs of Vinegar, and so are turned green. Then they are scraped, and the process repeated until all (the copper) is converted into *Zanjār*.⁶

(b) *Zunjufr* (Mercuric Sulphide). It is made from Mercury and Sulphur. When they are mixed in phials (*qawārīr*) and heated, they form *Zunjufr*. What degree of heat to be employed must be learnt by a series of experiments. As regards quantities (*wazn*) weight), one (part) of Mercury and one of Sulphur should be taken.

(c) *Ustrunj* (Red Lead). Lead (*usrubb*) is burnt, and the fire increased until it becomes red.⁷

¹ This is copied word for word from the *Madkhal*.

² From the *Madkhal* it seems likely that the adjective *lāzawardī* (blue) has been omitted in the Mss. of the *Mafātīḥ al-Ulūm*.

³ Van Vloten's text has the impossible reading الجومست. The true reading can be seen from Cod. C الجينيس, and also from the *Madkhal*.

⁴ Vide Note 3, p. 352 *supra*.

⁵ No mention of *Maghnātīs* occurs in the Ms. of the *Madkhal*, or (apparently) in the *Kitāb al-Asrār*.

⁶ I.e., Copper acetate. Another way of making it is that given in the *K. al-Asrār*, viz. by acting on *Rūsukhtaj* (copper oxide), with a little sal-ammoniac, and twice its weight of hot vinegar (*vide supra*, p. 331).

⁷ Ar-Rāzi (in some unnamed book—possibly the *Ḥal al-Ma'ādīn* and following Galen) notes that *Ustrunj* can also be

- (d) *Murdāsanj* (Litharge). Lead is melted¹ in a pit, and fed with powdered brick and ashes. It is (then) blown upon strongly, until it becomes solid. This is *Murdāsanj*.
- (e) *Qalimiya*.² This is the dross (which separates) from all 'Bodies' during their purification.
- (f) *Isfidāj*.³ It is made from plates of Tin (*raṣāṣ*) with vinegar, in the same way as *Zanjār* is made. Similarly,
- (g) *Za'frān al-Ḥadīd* ('Saffron of Iron,' i.e., Ferric Oxide)⁴ is from Iron.
- (h) *Tūtiyā*⁵ is the smoke of Copper, and of *Kuhl*.⁶

THE THIRD SECTION:

ON THE OPERATIONS AND TREATMENT OF THE FORE-GOING SUBSTANCES.

Taqṭīr (Distillation) is (a process) similar to that of making rose-water. The substance is put in a Cucurbit, and a fire is made underneath. The water of the substance ascends into the alembic, and passing down to the receiver, collects there.

Taṣ'īd (Sublimation) is like *Taqṭīr*, but the term is more generally used for (the process of volatilising) dry substances. *Tarkhīm*⁷ (Incubation) is a sort of *Taṣ'īd*.

Tahlīl (Solution) is the conversion of solids into fluids.

'*Aqd*⁸ (Coagulation) is the placing of any thing in a Cucurbit and putting fire under it until it become solidified and turns into a stone.

Tashwiyah (Assation) is the (process of) making some of the (foregoing) substances imbibe water, and then placing them in a phial (*qārūrah*), or a luted cup

obtained by igniting *isfidāj*, i.e., that obtained from Lead (Ibn al-Baiṣūr, *trans. cit.*, I, pp. 75 and 76). *Ustrunj* was the *Sandyx* of the Greeks.

¹ Reading with Codex D *yudhābu*, instead of Van Vloten's *yulqā* is thrown. The following extract from Treatise 33 of Jābir's 'Book of the Seventy' indicates the original source of these methods of making *Ustrunj* and *Murdāsanj*. "Significatio vero quod preparatio eorum cum igne solum sine medicina est bona. Est ut facias de Plumbo cerusam et litargirum" (Latin Ms. quoted on p. 345 of Berthelot's *Archéologie*).

² Otherwise *Iqlimiya*, both words being possibly a corruption of the Greek *καμέλα* by which apparently Dioscorides referred to one of the volatile products formed in the manufacture of copper and silver. (Vide also Pliny, *Nat. Hist.*, XXXIV, 10). It is not clear how it was differentiated from the artificial *tūtiyā* mentioned just afterwards.

³ There was apparently some confusion about this substance or rather the substances that passed under the name of *Isfidāj*. Ibn Sinā in the *Qānūn* (*ed. cit.*, p. 134) says '*Isfidāj* is the ashes of *raṣāṣ* or *ānah*. That made from *ānah*, if well heated, becomes *ustrunj*. Elsewhere (pp. 131 and 253) Ibn Sinā states that *Ānah* is Black lead (*raṣāṣ al-aswad*) and *raṣāṣ* (simply), Tin, so that his *isfidāj* was either Tin Oxide, or Lead Oxide (i.e., *Murdāsanj*). This is confirmed by the remarks of the author of the *Maḥḥẓan* (p. 125) who says '*Isfidāj* is the Arabised form of the Persian *Isfidāb* (i.e. 'white water'). Also called in Arabic (?) *Baruq*. In Greek it is *Sāmūniyūn* (i.e., Psimythion), etc., and in Hindi *Safidāh*. It is made from Tin (*qal'i*), Lead (*Ustrubb*) and *rū-y-tūtiyā* by burning. The best sort, which is made from Tin, is called *Isfidāb Rūmi* and *Kāshghari*'.

⁴ For some methods of making it, vide *supra*, pp. 323 and 331.

⁵ I.e., possibly, the solid bye-products from the metallurgy of copper and lead. If, however, the definition is to be taken literally, one form of *tūtiyā* must have been Litharge (*murdāsanj* or *martah*).

⁶ From the statement regarding Derivative Substances in the *Madḥḥal*, (*supra*, p. 353) it is probable that the author of the *Majātib* at *Ulūm* obtained the details of the above mentioned preparations from ar-Rāzi's *Kilāb 'Ilal al-Ma'ādīn*.

⁷ Following Cod. C. and *Madḥḥal*. For process see *Madḥḥal* *trans., supra*, p. 359.

⁸ Following Codd. C. and D instead of Van Vloten's *Muḥqad*. For details of the process, using the 'Blind Cucurbit', see *Madḥḥal*, *trans., supra*, p. 358.

(*qadah*). This is made to hang inside another (vessel). The mouth of the phial having been closed, it is placed on the fire till it (the substance) is roasted.

Taṣhmī' (Ceriation) is to soften anything, so that it becomes like wax.

Taṣḍī'ah (Rusting) is derived from *ṣadā* (rust). It is (an operation just) like that for making *Zanjār*.

Taklis' (Calcination) is the placing of any 'Body' in luted cups (*ḥizān*) and putting them on the fire until it (the 'Body') becomes like flour.

Taṣwīl (Lixiviation)² is to cause anything which sinks in liquids to float by converting it into fine particles, in order that the substance may float on water. The substance is first calcined, and (thus) made to float.

*Ilghām*³ (Amalgamation) is the crushing of any 'Body' and then mixing it with Mercury. One says "*alghamtuhu bi'zzaibāq wa'ltagḥama*" (I mixed it with mercury, and it became intermingled).

Iqāmah (Fixation) is to cause anything to withstand fire, and not to be burnt. Mention has been made of this word previously.⁴

Istinzāl has been mentioned in the First Section.

Tin al-Ḥikmah (Clay of Wisdom). Pure clay is made into a paste, and mixed with powdered dung, a little chopped animals' hair, and salt.

Al-Iksīr is that 'Medicine' which, when cooked with a molten 'Body,' converts it into Gold or Silver, or changes it (in colour), to whiteness or yellowness.⁵

Al-Ḥajar ('The Stone'). Among them (i.e., the Alchemists), this is anything by which the Art can be performed, that is, anything out of which Elixir can be made. It is of two kinds, Animal and Mineral. The best of these are the Animal. The latter are: Hair, Blood, Urine, Eggs, Bile, Brains, Skull, Mother of Pearl, and Horn. The best of these is Man's Hair, and next the Egg. The varieties of Mineral ('Stones') are, among the 'Bodies,' Gold, Silver, Lead and Tin; and among the 'Spirits,' Mercury, *Zarnīkh* (Arsenic Sulphide), Sulphur, and Sal-ammoniac.

The separable portion of *Zarnīkh*⁶ is the 'Soul of Whiteness,' and Sulphur is the 'Soul of Redness,' and (in the performance of Alchemy) Mercury is the 'Spirit' of them both. *Al-Iksīr* is a combination of 'Body' and 'Spirit.'⁷

¹ For a description of various methods of carrying out this process *vide* Introduction, pp. 330-1 *supra*.

² The root meaning of the word is to wash out impurities. The process appears to have been only another form of calcination, but no other reference has been found from which details could have been obtained.

³ For a fuller account of this process, *vide* Introduction, p. 329 *supra*.

⁴ In the Astronomy section of the *Mafātīḥ al-'Ulūm* (*ed. cit.*, p. 222).

⁵ Comparison with the portion of the *Madḥḥal* text from which this definition is copied (*vide* p. 355, *supra*) shows that the order in Cod. D. is correct, viz., 'silver or gold'; while the *ta'm* (fed) of the *Madḥḥal* is probably a copyist's error for *ṣabh* (cooked).

⁶ *Qāli az-zarnīkh*.

⁷ The first portion of this paragraph is quoted either directly or, more probably, through some work of ar-Rāzī, from Jābir's *Kitāb al-Waṣīyah* (Book of the Testament). In a Ms. in possession of H.E.S. the following sentences occur. "Sulphur is the 'Soul of Redness' and *Zarnīkh* is the 'Soul of Whiteness' and Mercury is the Spirit of them both. Sal-ammoniac (in behaviour) is just like Water, cleansing from impurities . . . and bringing about union between the principle elements (*jawāhir al-arkān*), and causing one to combine with another."

As regards the definition of Elixir it was at first believed that the words *wa nafs* ('and Soul') had been omitted by oversight of the copyists as the trinity of Body, Soul and Spirit is constantly mentioned in the writings of Arabia

alchemists—*cf.*, e.g., the following sentences from the *‘Ain aṣ-Ṣan‘ah* of Muḥammad bin Abd al-Malik (*Mem. A.S.B.* p. 54). “Any Elixir which does not contain a ‘Spirit,’ viz., Mercury, and a ‘Soul,’ which is either Sulphur, *Zarnīkh*, and a ‘Body,’ either dissolved, or coagulated, is valueless.”

It has, however, already been noted (*vide* Introduction, p. 339) that Jābir seems to have attached very little importance to the differentiation of ‘Soul’ and ‘Spirit,’ and the sentence in question is apparently a summary of the concluding passages of the last treatise of his ‘Book of the Seventy.’

“Preparatio vero lapidis est magna Et in ipso sunt multi modi que in duas distribuitur partes, quarum una est spirituum, altera corporum, Et hoc est secundum iiiij. modos Unus istorum est verus Et hoc est ut firmet spiritus in corporibus, et ita solves corpora. Spiritus autem firmabis cum aquis corporum” (*Lat. trans., loc. cit., p. 363*).

This lack of emphasis by Jābir on ‘Soul’ probably accounts for the fact that all volatile substances are found grouped together as ‘Spirits’ in ar-Rāzi’s treatises.

It may be noted in conclusion that Jābir, in turn, must have drawn on Greek—and ultimately Egyptian—alchemists for his ideas. *Cf.* the following extracts from the Second Section of the Rāmpūr Ms. of ar-Rāzi’s *Ṣhawāhid* (on the Preparation of the ‘Stone’):—

- (1) Hermes also said in the ‘Book of Thoth’: “Dissolve the ‘Bodies’ by means of the Strong Waters, and (or, i.e.) Acid Vinegars. Secure by these means the ‘Spirits.’ When you return them (the ‘Spirits’) to their dissolved ‘Bodies’ they will dwell therein, owing to the humidities that strive with fire, and the dissolved ‘Bodies’ will retain the ‘Bodies.’ By this means you will accomplish the Great Work, and the Art will be perfected.”
- (2) He (Hermes) also said: “Know that if you do not slay by fire and revive by fire, and if you do not slay the ‘*Aqāqir*’ and then, after their death, return to them their ‘Spirits,’ you will not obtain what you are seeking.”
- (3) Mary said: “Subject the ‘Spirits’ to treatment and dissolve the ‘Bodies’ to dissolution (*tahlil*), and cause the treated ‘Spirits’—that is, those that have been purified—to drink of the solution of the ‘Bodies,’ for they will thus remain fixed and sink into the ‘Bodies.’”
- (4) Aṣṭūs also said: “If you know how to remove the ‘Spirits’ and mortify the ‘Bodies,’ and, by bringing back the ‘Spirits,’ revivifying the ‘Bodies’ gently, slowly and without haste, then the Work will be achieved.” He means that if you know thoroughly the processes of Separation, Purification, Solution, and Combination, your work will be achieved.
- (5) Rūsam (? Zosimus) said: “It is desirable for you to treat ‘Bodies’ with ‘Spirits.’ When the ‘Body’ is held, and becomes a White Cloud, which imparts tincture to all substances, then it will tincture the ‘Bodies,’ and convert them into ‘Spirits.’ And know that had there been no connection between these ‘Bodies’ and ‘Spirits,’ then one would not have united with the other and would not have become one ‘Nature,’ imparting colour and having spiritual attributes. Nor would that ‘Soul’ have become fixed and capable of imparting colour. The Ancients said: ‘The Mercuries impart colour and flee away (on fire), but they can be restrained by similar Mercuries.’ Understand this well.”
- (6) Rūsam said: “Take the Water which is compounded with the Sulphur, for it is that which, mixed with *Maghnisiyā*, does all that I have mentioned to you; for it is the Sulphur that you mixed with the Water when you first combined them, meaning the Tincture.” What he means is this: ‘It is that which tinctures and imparts colour.’
- (7) Quotation from a treatise by Sālim al-Harrānī, who, in turn, probably refers to Zosimus (*cf.* Berthelot, *Collection*, I, trans., p. 80).
“As for their saying: ‘The solidification of the Mercury converts *Maghnisiyā* into the ‘Body,’ it means that Mercury is the ‘Spirit’ which they desire to introduce into the ‘Body’; and the ‘Body’ of the *Maghnisiyā* is that which they dissolve until they have combined with it the ‘Spirit.’ *Maghnisiyā* is the name of that compound which possesses both ‘Body’ and ‘Spirit’: and it is a compound.”
- (8) Mary said: “If they wish to whiten *Maghnisiyā*, they whiten it by means of White Sulphur. They make it red by the Soul of Redness.” By this the Dregs of *Maghnisiyā* are indicated.

IV. THE TWO INTRODUCTORY SECTIONS OF AR-RĀZĪ'S KITĀB AL-ASRĀR,

ON SUBSTANCES AND INSTRUMENTS.

(beginning at practically the same place as the Latin translation called *Liber Secretorum Bubacarīs*—Bibliothèque Nationale, Lat. Ms., No. 6514: written about 1300 A.D.).¹

This our book contains Three Discourses. The First deals with Substances ('*aqāqīr*'), and it has two Parts. The first part deals with good and bad substances, and the second part with the preparation of what is made from them.

The Second Discourse deals with Instruments, and it has two Parts. The first describes their forms: and the second how they are used.

The Third Discourse deals with Operations, and it has seven Parts. The first describes the Cleansing and Purification of Spirits: the second, the Calcination of 'Bodies,' Salts, and Stones: the third, the Ceration (*Tashmī*³) of 'Bodies,' 'Spirits' and other things: the fourth, the Solution (*Tahlīl*) of 'Spirits' and their (subsequent) Admixture²: the fifth, (various) Coagulations ('*Aqd*): the sixth, the Reddening Waters and the Operation with Vegetables; and the seventh, Animal (processes).³ And with this our book will come to an end, if it please Almighty Allāh! ⁴

¹ The translation chiefly follows

(1) ff. 3 v—end of 10 v of Ms. No. 700 of the Escorial Library (referred to as M); but this has been collated with:

(2) the Leipzig Ms. No. CCLXVI (Lg.):

(3) & (4) Two indifferent recent Mss. from Lucknow (Lw. and X).

(5) Duval's translation of the Syrio-Arabic Ms. No. 1593 of the Library of the British Museum, of which at least Sections II and III are drawn from the *Kitāb al-Asrār* (referred to as S.A.): and, finally,

(6) the Paris mediæval Latin translation (P).

[berg.

An edition of the complete Arabic text of the *Kitāb al-Asrār* will shortly be published by Dr. J. Ruska of Heidel.

² The latter phrase is omitted in Ms. M. The addition is made by inference from the obviously incorrect *wa la'qīdihā* (for *wa tamzījihā*) of Ms. Lw.

³ This list of Processes may be usefully compared with a subsequent list (f. 11 r of Ms. M).

⁴ The Third Discourse is concerned with the knowledge of the different kinds of Operations. These number Seven. The first is the Purification of 'Spirits,': and the Calcination of 'Bodies' and Stones, and Salts, and Egg Shells, and Mother of Pearl, and Dregs: The second is the Ceration of 'Spirits,' Calcined substances, Salts, etc. The third is the Solution of 'Spirits,' and of Cerated Calcined substances, and of Boraces and Salts. The fourth is the Mixing (*lamzīj*) of dissolved substances. The fifth is Coagulation, by which the Work is brought to completion. The sixth is Sublimation (*tas'īd*) of 'Bodies' and Stones in order to fix (*taqwīm*) Tin (*raṣāṣ*), etc. And the seventh is Reddening Waters."

In this list the first and second processes of the earlier list are grouped together: while the process of Mixing is separated from that of Solution. Sublimation is mentioned after Coagulation as, in addition to the earlier section on *Tas'īd* at the beginning of the treatise (ff. 11 v—20 v) under the heading 'Purification of Spirits,' the Sublimation (as well as *Tajīd*) of 'Bodies' and 'Stones' is also dealt with on ff. 62 v—63 v. On the other hand, no reference is made to the processes with plants and animals, as well as of the other miscellaneous processes, with which the treatise concludes.

The corresponding list in the *Liber Bubacarīs* is an index of the contents of that version, which is only partially a translation of the *Kitāb al-Asrār*. Folios 16 v—46 v of the Escorial Ms. (i.e., part of the section on Purification of 'Spirits'—including most of the instructions regarding their Sublimation, as well as all the passages on their Assation, Lavation and Coction; the whole of the section dealing with Calcination; and part of that on Ceration) have been replaced by some other more chemically advanced treatise, dealing with 'Sharp Waters' (including Sulphuric Acid, Ammonia, etc.), Solution, Combustion, Sublimation, Ceration and Combination. This occupies nearly half the Latin manuscript. Folios 46 v—77 v of the Arabic have been roughly translated, but with large omissions; while there is no rendering at all of the remaining folios of Ms. M. From the chemical character of the interpolated material we are inclined to think that the Latin translator tried to bring the statements of the *Kitāb al-Asrār* up to date from the point of view of European readers of possibly the 12th Century A.D.

⁴ Following Ms. Lw. instead of M, which reads *wa Allāh a'lam bi's ṣawāb* ('And Allāh knows the truth'!).

The first Discourse deals with Substances. Substances are of Three kinds, Earthy, Vegetable, and Animal.

The Earthy are of Six kinds: 'Spirits,' 'Bodies,' Stones, Vitriols, Boraces and Salts ¹.

The 'Spirits' are Four :—Mercury, Sal-Ammoniac, Arsenic Sulphide, and Sulphur.

The 'Bodies' are Seven :—Gold, Silver, Copper, Iron, Tin (*Raṣāṣ*), Lead (*Usrub*), and *Khārṣīnī* ²

The Stones are Thirteen :—*Mārqashīthā* (Pyrites) *Maghnīsiyā*, *Dauṣ*, *Tūtiyā Lāzaward* (Lapis Lazuli), *Dahnaj*, (Malachite), *Fairūzaj* (Turquoise), *Shādanj* (Hæmatite), *Shakk* (Arsenic Oxide), *Kuhl* (Lead Sulphide), *Ṭalq* (Mica), *Jibṣīn* (Gypsum), and Glass.

The Vitriols are Six :—Black vitriol: Alum: *Qalqand*, *Qalqadīs*, *Qalqatār* and *Sūrī*.

The Boraces are Six :—Bread Borax: [Red Borax which is ³] *Naṭrūn*: Goldsmiths' Borax; *Tinkār*: *Būraq az-Zarāwandī*; and *Būraq al-Gharb*.

The Salts are Eleven :—Common ⁴ Salt; Bitter Salt; *Tabarzad*; *Andarānī*; *Naṭṭī*; *Hindī*: *Baidī*; ⁵ Salt of *al-Qilī*; Salt of Urine; Salt of Lime; and Salt of Ashes ⁶.

Section on the Knowledge of the Varieties of the Substances, i.e., which of them are Good and Bad.

As for the 'Spirits,' the best Mercury is that which is liquid and white: and when it is squeezed through a cloth, nothing like *Kuhl* remains behind.

Sal-ammoniac (*Nūshādūr*) is of two kinds: one is mineral, (found) in white pieces like sugar-candy, (and it is) sharp-tasting, salty, and acid. [It comes from *Khurāsān* and *Samarqand* ⁷]: and one (variety) of this is yellow, which is not used in the Art. The other kind is the Sal-ammoniac of Hair, and we shall mention its different varieties in the (description of) Operations with Animal 'Stones.'⁸

Arsenic Sulphide (*Zarnīkh*) is of several kinds. One of them is Green, mixed with stones and earthy matter, and this the worst (variety) of *Zarnīkh*. Another is Yellow, not clear in colour, and mixed with earthy matter, and it is

¹ The order of the last two is corrected from Ms. Lg., and Latin. Mss. M and Lw read *amlāh wa buwāriq* (Salts and Boraces).

² Ms. Lg. has, instead of *Khārṣīnī*, *Ḥadīd aṣ-ṣīnī* (Chinese Iron).

³ Added from Ms. Lw, as 'rubea borax' is mentioned in the Latin. The order of the boraces is differently given in the various Mss.

⁴ Lit 'good'.

⁵ Corrected from *Madkhal* and Ms. Lg.: Mss. M., Lw., and S.A. read *aṣ-ṣīnī* (the Chinese)—probably from association with the previous word *Hindī*.

⁶ Ms. Lw. adds, 'The artificial are (the last) four.' It is to be noted that *al-Uqāb* (Sal-ammoniac), though given in the *Madkhal*, has disappeared from the *K. al-Asrār* list of Salts.

⁷ Added from Ms. X. in partial agreement with the Latin, 'Venit de terra que vocatur Corssa' The phrase may, however, be only a gloss from the *Madkhal*.

⁸ Ms. M., f. 79 (*vide* later, p. 390). The 'Stone-Book' of the pseudo-Aristotle says that the nature of Sal-ammoniac is that it attracts substances and unites them to each another. It also fixes the colours (of coloured substances) if added to them (*op. cit.*, p. 118).

used in baths¹. Another is very yellow, which is found in layers and resembles fish-scales. It is called 'Golden,' and it is good for our work.

Another is Yellow, mixed with red. It is found in layers, and it is good for our work.

Another kind is Red in which are turbid eyes, and it is of no use in our work: [and there is (another) clear red (variety) found in layers, which is good for us²].

Sulphur also is of several kinds: Red, which is (almost) unprocurable³: bright Yellow, like *Sandarūs*,⁴ or pure *khazarī (tūtiyā)*⁵; clear Yellow, which is granular, and of perfect yellowness; White, like ivory; White, mixed with earth, which is no use to us: and Black, (of which one sort is) mixed with earth and is no good to us, and (another) black (variety is) mixed with earth and pebbles. These (last) two are used by fullers (*qaṣṣāf*)⁶.

As for the Seven fusible 'Bodies,' they do not require to be explained, except *Khārṣīnī*. This resembles a mirror, but is softer than it,⁷ and is (almost) unprocurable.

Turning to Stones:

MĀRQASHITHĀ is of various kinds.⁸ One of them is white, like silver: and another red, like copper: and another black, like iron: and another yellow, like gold.

MAGHNISIYĀ is of various kinds. One of them is black, like earth, and has brilliant eyes. Another occurs in pieces as hard as iron, and this is the 'Male.' Another, which is 'Female', is red: and it is soft (?) like copper⁹ and has brilliant eyes: and this is the best (of all).

¹ As a depilatory, when mixed with quicklime (the Latin translator rather quaintly explains: 'non valet huic arti nisi mulieribus'). This depilatory action, as well as its poisonous effect, probably accounts for its employment in alchemy, as the destruction of the Hair of a living being was considered equivalent to the destruction of its Soul (*cf. Stapleton, Mem., A.S.B., I, pp. 30-38*). Another reason is supplied by the 'Stone-Book': 'when calcined and added, with borax, to fused copper, the latter is whitened, beautified, and its bad smell removed' (*ed. cit., p. 113*). [which is no good']

² Omitted in Ms. M. Added from Ms. Lw., following Latin. Ms. Lg. also adds another variety, viz., 'Dusky,

³ *Cf. Niẓāmī's* couplet in the *Sikandar Nāmah*:

"You are not the Red Sulphur or the White Ruby,

That a seeker shall be disappointed in (his quest for) you."

⁴ From the *Qānūn (ed. cit., p. 218)* and *Makhzan (ed. cit., p. 500)* it appears to have been the gum of some Arabian or Indian tree, resembled amber in colour. The 'Stone Book' (*Ruska, op. cit., pp. 112 and 113*) notes that Sulphur is used in the preparation of Gold: it reddens the 'White' and colours it. When gold leaf is rubbed with sulphur and heated, it becomes powder, in the same way as glass does, but it returns to its former state if pounded [and heated] with borax. The water of sulphur-wells is useful against skin diseases and wounds. If sulphur is mixed with any stone and the mixture is heated, the stone will be burnt (by the sulphur).

⁵ *Vide* next page.

⁶ Pliny (*Hist. Nat., XXXV, cap. 15*) also noted two kinds of sulphur as being used by fullers to bleach cloth by fumigation. The red variety was possibly sulphur containing traces of Tellurium and Selenium: the white like ivory, a sulphur formed by the decomposition of gypsum and thus intimately mixed up with Calcium carbonate: while the black was sulphur contaminated with bitumen.

⁷ The meaning evidently is that *Khārṣīnī* was like some metal employed in Arabic times for making mirrors, but softer. Ms. X replaces *Mīr'at* (mirror) by *Ānah* (Lead): and Ms. Lg., instead of *Khārṣīnī*, again has *Ḥadīd aṣ-Ṣīnī*. The Latin translation reads 'Katesin istud assimilatur speculo et est molle et non de facili invenitur.'

⁸ *Alwān*: hence the literal translation of the Latin, 'diversi coloris.'

⁹ Ms. M. *hashsh nuḥāsi*, which is omitted by both Lw. and Lg. Mss. Latin: 'que assimilatur eri.' The

DAUṢ is of two kinds: *Iṣṭakhrī*¹ and '*Irāqī*'. The best of them is the *Iṣṭakhrī*: and it is the 'Water of Iron'.

TŪTIYĀ is of various kinds. One of the varieties occurs is green pieces: another is yellow, like egg-shells, and is called *Al-Muqaṣṣab*²: another is yellow and comes from the Caspian (*Khazari*): another is the *Mahmūdī*: another is white and thin like egg-shells and soft, and comes from India. The green is called *Kirmānī*.

LĀZAWARD occurs in (only) one form. It is a stone of the colour of *Kuhl*³ in which is a little of redness; and it has brilliant eyes.

DAHNAJ is a green stone in which are veins. It is used for signet-rings. It is of two kinds: modern and ancient. A further classification is into *Miṣrī*, *Kirmānī*, and *Khurāsānī*. The old *Kirmānī* is the best sort.

FAIRŪZAJ occurs in (only) one form and it is a green stone. It is improved if kept in grease.⁴

SHĀDANJ is of two kinds. It is a red stone. One kind is called '*Adasī* and the other *Khalūqī*. The '*Adasī* is the best of them.

Dahnaj, *Lāzaward*, *Shādanj*, and *Fairūzaj* are stones for making gold⁵; and all of them colour Gold red,⁶ because in them is the essence (*jawhar*) of Copper.

SHAKK is of two kinds. One of them is yellow, and the other white. It comes from Silver-mines: and it is the Smoke of Silver.⁷

KUHL is of two kinds: one is *Muṣammad Zujājī al-Mukassar Rāzī*,⁸ and the other, *Muhabbab Isfahānī* (granules of Isfahān). It is not a stone like (ordinary) stone, but it is the Essence of Lead.

TALQ is of several kinds. One is *Yamānī*, another is *Bahrī*, and another is *Jabalī*. When hammered, it splits into layers, which are transparent and glittering. The best variety of it is the *Yamānī*,⁹

whole paragraph is quoted in the Syrio-Arabic MS. (Duval's translation; *La Chimie*, II, p. 200) and this sentence may be a later gloss, as it is not found in that collection.

¹ From *Iṣṭakhr*, or Persepolis, the capital of the Sāsānian Kings of Persia. It was situated on the River Polvar, to the N. E. of the modern Shirāz. This paragraph about *Dauṣ* is also quoted on the same page of the Syrio-Arabic MS. translation.

² 'Like reeds' (in colour).

³ Or 'of the sky'.

⁴ Ms. P.: 'et pingosus.'

⁵ Lit. 'golden stones'. Lat. 'Lapides auri.'

⁶ Lit. 'reddens the gold and colours it.' The meaning probably is that they were supposed to increase the red colour of ordinary gold which, in ancient times, was generally alloyed with a greater or less amount of silver.

⁷ This passage appears to be quoted at the end of the Syrio-Arabic MS. (*La Chimie*, II, p. 200): but Duval has read *Shabb*, for *shakk*; and instead of the concluding phrase, he translates 'it has a dull colour.'

⁸ The meaning of the phrase is rather obscure and, probably owing to this, Ms. Lw. splits up the first form into two, viz., (a) *Zujājī* and (b) *Mukassar Rāzī*. It possibly means that variety of *Kuhl*, coming from the neighbourhood of the author's native town of Ray, which was found in large glassy pieces. Ibn Sinā in Book II of the *Qānūn*, (p. 129, Rome 1592 ed.) says under *Iḥmid*. 'It is the essence of dead Lead and its strength resembles that of burnt Lead. The best kind of it is the *Isfahānī*.' The *Makhzan* (ed. cit., p. 954) states that the *Isfahānī*, *Sulaimānī*, and *Jilā* (bright) varieties of *Kuhl* are the same as *Iḥmid*: and also mentions the *Fārsī* and *Kirmānī* varieties. Baden Powell ('Punjab Products,' I, p. 11) notes that a sample of *Surma Isfahānī* proved on analysis to be 'micaceous glistening iron ore'; while *Surma Safaid* was found to be simply Iceland Spar. The Indian varieties do not therefore offer much assistance in settling the chemical constitution of the varieties of *Kuhl* mentioned by ar-Rāzī and Ibn Sinā.

⁹ The 'Stone Book' says *Talq* produces wonderful effects in alchemy (ed. cit., p. 119).

JIBSIN is a white brilliant hard stone, found in mountains.

GLASS is of various kinds. It is made from sand and *qili*. The best is the white transparent glass of Syria, which resembles Crystal in transparency.¹

The VITRIOLS are of various kinds. One is completely yellow, and hard. One of the yellow varieties, which has golden eyes, is used by goldsmiths. Another (variety), which is green mixed with earth, is used by cobblers and dyers.

ALUM (*Shabb*) is of various kinds. One, which is white, comes from Yaman, and looks like sugar-candy (*ṭabarzad*).² Another, which is the white Syrian, is mixed with clay and pebbles. Another, the *Minjānī*, is somewhat green. Another is the yellow Egyptian, which is greasy (in appearance); and another is permanently white.

Al-Qalqadīs is white vitriol; *Al-Qalqand* is green vitriol: *Al-Qalqaṭār* is yellow vitriol; and the *Sūrī* is red vitriol.³ These four are valuable; but the most valuable is the *Sūrī*. It is used in the process of Reddening (i.e., making Gold), and is brought from the mines of Cyprus. These all originate from vitriols and alums. Floods wash against the latter and carry them into the crevices of mines; and the sun (then) shines upon them and they become coagulated. Sometimes experts (*ḥukamā'*) use them when other things cannot be obtained; and they serve as satisfactory substitutes.⁴

Section on the Preparation of *Qalqadīs*.

Take white Alum of Yaman, and dissolve it, and purify it by filtration.⁵ Then distil Vitriol and *Zanjār* (copper acetate) and mix it (the distillate of acetic acid) with the filtered solution of alum. Then concentrate⁶ it in glass beakers,⁷ and *qalqadīs* will result.⁸

The best method of preparing *Qalqand*.

Take Vitriol, and dissolve it in water, and purify it by filtration. Then pour into it filings of copper, and let it undergo coction until it becomes green. Filter, and leave it until it is coagulated.

Another very good method.

Dissolve Vitriol and filter it, and put it into a copper pot and, after having added half of *dirham* of Sal-ammoniac for every 10 (*dirhams*) of the solution, subject it to coction until it is coagulated.

¹ The 'Stone-book' says: "Glass is of two sorts, stony and sandy. If fire is kindled over it and the stone *Maghnisiyā* is added, the latter unites its substance to the mass by means of the 'lead' contained in it, which makes the stone of the glass solid. . . Its nature is hot and dry, and if powdered, it heals the wounds of animals' (*ed. cit.*, p. 117).

² Lat. 'sciscille' (easily split).

³ This sentence is quoted in the Syrio-Arabic Ms. (*trans. cit.*, p. 200).

⁴ This paragraph was too much for the Latin translator who simply states 'ista quatuor attramenta sunt optima quod tinctura rubea quorum multa sunt que manualiter componuntur.'

⁵ *Wa tasfihī*.

⁶ *Wa ya'quduhu*: lit., 'and coagulate it.'

⁷ *Jāmāt*, a Persian word meaning 'goblets' or 'wine cups.'

⁸ The net result is that the original alum will crystallise out unaltered.

Another very good method.

[Dissolve Vitriol and filter it.¹] Take yellow Vitriol, and boil it with water and filter it. Mix with the water of Vitriol an equal quantity of *Zanjār* (copper acetate) and leave it for several days so that it may be dissolved in the solution, and become green. Then filter and concentrate it.²

Another very good method.

Take Vitriol, and dissolve and filter it. Then mix with it an equal quantity of *Za'frān al-Ḥadīd* and cook it well, and filter it, and it will come out red. This will sometimes serve as a substitute for *Sūrī*.³

The preparation of *Qalqatār*.

Take Vitriol, and dissolve it in water and filter it. Then add to it one-fourth its weight of the distilled water of yolk of egg, and concentrate it.

The preparation of *Sūrī*.

Zanjār is moistened with the filtered water of Vitriol, and heated until it becomes red.

These are the Vitriols which the Philosophers have employed for the process of Reddening: and they are better than those which come from the mines. Remember carefully the knowledge of how to make them, and how to use them in the time of need. This will be sufficient (for your purpose), if it please Almighty Allāh!

The Boraces.

One variety of them is 'Bread Borax.' It occurs in big pieces that are white and hard. Another is *Natrūn*: and it is redder than 'Bread Borax.'⁴

Another is Goldsmith's Borax: and it is white.⁵ It resembles the efflorescence which appears at the bottom of walls.

Another is the Borax (called) *az-Zarāwandī*. Its colour is dusky, inclining to redness, and it is the best of the boraces.

Another is *Tinkār*, which is both a borax and a salt.⁶ It is prepared with the fatty secretion⁷ of animals and this is the process of making it. Take 1 part of fresh white 'Salt of *Al-Qilī*' and 3 parts of pure white Borax. Pour over them

¹ Following the Latin, as well as Duval's translation of the Syrio-Arabic Ms., this passage between square brackets should probably be omitted, though it is found in Mss. M., Lw. and Lg.

² I.e., crystallise out the solution: not, as Duval said, 'agglomère (la parte insoluble).'

³ These references to Iron Oxide and *Sūrī* are omitted by the Latin translator.

⁴ The 'Stone Book' says: 'It cleanses bodies from dross, and if the skin is washed with it, it cleanses and beautifies it. It is also used in alchemy' (*op. cit.*, p. 118).

⁵ Both Escorial and Lw. Mss. read *aṣṣar* (yellow). Corrected from the *Madkhal*, Latin Ms. P., and Duval's translation of the extracts from the *Kitāb al-Asrār*, found in the Syrio-Arabic Ms. (*loc. cit.*, p. 45).

⁶ The 'Stone Book' says: "It is a kind of salt which possesses the taste of borax, but is more bitter. It is found on banks as an efflorescence (*wa yakūnu 'alā sawāhil as-sabkḥah*). It helps in melting gold" (*op. cit.*, p. 123). The similarity of this passage to what is here found in the *Kitāb al-Asrār* (under *Tinkār* and Goldsmiths' Borax) suggests that ar-Rāzī drew upon the 'Stone Book' for his information.

⁷ *Dasm*.

buffaloe's milk until they are well covered, and cook them until it (the mixture) is coagulated. Make it into pellets and spread them on a large plate, and dry them. Keep them protected from dust, and employ them (whenever required).

A still better Process.

Take 1 part of white 'Salt of *Al-Qilī*' and 3 parts of *Naṭrūn* and cook thrice after covering it with cow's or buffaloe's milk. Make into pellets, and dry by hanging (in a bag) in the sun until the moisture has all dripped out. Pound it; and use it when required, if it please Almighty Allāh!¹

A still better Process.

Take 1 part each of good white 'Salt of *Al-Qilī*,' *Naṭrūn*, purified Borax, *Andarānī* Salt, Salt of Urine, and Sal-ammoniac. These will be ground together into powder and then triturated with buffaloe's milk until thorough admixture has occurred and it has become dry. Do this thrice: and then make the mixture into pellets and hang in (in a bag) in the sun for 40 days until its fatty constituent has dripped out, and its interior will have become pure, if it please Almighty Allāh!

Another variety (of Borax) is *Būraq al-Gharb*. It is found on the *Gharb* tree: and it is white.

The Salts.

The Salts are Ten²: (1) Good Salt, viz: the salt used for food: (2) Bitter Salt, which is used by Goldsmiths: (3) *Ṭabarzad*, which is pure white salt, (found) in hard pieces which have not much transparency: (4) *Andarānī* which is of two kinds, one white, hard, pure, and transparent: the other red which is transparent, and from which trays³ are turned: (5) *Naftī* (found) in hard black large pieces which have no transparency: it smells of naphtha; (6) *Hindī* (Indian), which is black (occurring in large crystals like) *Ṭabarzad*, and has little transparency; and (7) *Baiḍī*⁴ (pertaining to eggs), which is not procurable, but is white and hard and its smell is the smell of a boiled egg.⁵

¹ The fact that a very similar method for preparing *Tinkār* to those just given is quoted in the so called Xth Book of the Syriac Ms., translated by Duval, confirms the editor's suggestion that this book is not really a translation of any work of Democritus, as the previous books may be, but is only a collection of receipts by later writers added either by the original translator, or by some other person.

The product, both in these two cases as well as in the next process, will be chiefly a readily-fusible sodium salt of butyric or some other fatty acid, mixed with the casein of the milk.

Only the first process is given by the Latin translator. The second is also omitted from Ms. Lg.

² Sic for Eleven: but perhaps ar-Rāzi did not include the *Baiḍī* (or *Ṣini*) as it was not procurable.

³ Or 'vases' (*Sawānī*). The author of the *Makḥḥẓau* says that 'in India it is called *Namak Lāhūrī* (Lahore Salt) as it comes from that town. Salt cellars and cups are made in India from it' (*ed. cit.* p. 198). Specimens of this phase of Indian artistry (e.g. cup and saucer, water pot, and flower vase) from the *Kālabāgh* mines (near Bannu in the Punjab) are on exhibit in the Economic Section of the Indian Museum, Calcutta.

⁴ Mss. M. Lw. and S.A. all read *Ṣini* (Chinese). The *Madḥḥal* and Ms. Lg. reading has been followed: but as the same adjective *ma'dūm* is used to describe it here as is used previously to characterise *Kḥārṣīnī*, there is just a chance that *Ṣini* may be correct. The Latin translator omits this salt: and the author of the *Makḥḥẓau* does not refer to it.

⁵ Only two of the above 7 kinds of Salt can be certainly traced to the 'Stone-book,' viz. the white stone hard as crystal (*Ṭabarzad* or *Andarānī*) and that found in naphtha wells (*Naftī*). The other two varieties mentioned

(8) Salt of *Al-Qilī*; (9) Salt of Urine; (10) Salt of Ashes; and (11) Salt of *Nūrah* are artificial.

The following is the method of making Salt of *Al-Qilī* (Sodium Carbonate).

Take 1 *mann*¹ (2 lbs) of white pieces of *Al-Qilī* and powder it, and pour on to it 7 times its amount of water. Leave it for 7 days, and then put it into a pot² and subject it to coction until it is reduced to half (its volume). After letting it rest, filter³ it ten times and put it into thin glass cups (*kizān*) and hang them in beakers (*jamāt*). Scrape down whatever first crystallises out⁴ in the cups, and return it to the solution. Protect anything that drops down into the glass beakers from dust. Scrape off whatever crystallises out the second or third time, and take it out, until all will have turned into salt, if it please Allāh!

A Better Process.

Completely purify it and put it into phials (*qawārīr*) smeared with 'Clay of the Philosophers.' The mouths (of the phials) will be firmly closed. Then put them on hot ashes until the solution coagulates like *Tabarzad* (salt), if it please Almighty Allāh!⁶

Salt of Ashes. (Crude Potassium Carbonate)

Take the ashes of white oak⁶, in which no charcoal is left, and sieve it through a silk cloth. Then treat it by the same process as that for Salt of *Al-Qilī* and it will come out a white salt, if it please Almighty Allāh!

Description of Salt of *Nūrah*.⁷

Take unquenched Lime and adopt the same process with it as with salt, I mean, Salt of *Al-Qilī*, and it will come out white salt, if it please Almighty Allāh!

in the 'Stone Book' are (a) one like snow: and (b) 'that produced in salt marshes: it is turbid, soft and deliquescent'. The author adds: 'Salt brightens the colour of gold and whitens silver, and cleanses bodies from dirt. It is the fourth of four, liberated from three, and rules two, and is completed in one.' The last phrase rather reminds one of that of Mary the Jewess, quoted by the alchemist Christian: "One becomes two, and two becomes three, and by means of the third, the fourth brings about unity. Thus two are made only one," (Berthelot, *Collection*, III, p. 389). An attempted explanation of this by Zosimus will be found on p. 192, Vol. II, (*idem*).

The ancient Hindu pharmaceutical work *Caraka* gives 5 kinds of salt: *Sauwarcala* (which Rāy—*Hindu Chemistry*, p. 99—is inclined to identify with saltpetre, though the present day *Sochal* is ordinary rock salt); *Saindhava* (reddish rock salt from the Salt range, said to be the best of the salts); *Vit* (which is the same as ar-Rāzi's *Hīndī*); *Audbhida* (*reh*, a mixture of Sodium Carbonate and Sodium Sulphate); and *Sāmudra*, or Sea Salt, now called *Karkach*. It is obvious, therefore, that ar-Rāzi did not draw on *Caraka* for much, if any, of his information about Salts, or for their classification. His readiness, as he became older, to modify statements made in the *Madkhal* is shown by the exclusion of Sal-ammoniac from the list of salts given in the *Kitāb al-Asrār*.

¹ This weight is probably the Assyrian *mana* (Thomson, *op. cit.*, p. 129)

² *Ṭabkhīrah*, a Persian word, meaning 'a cooking pot.' Latin 'Caldaria'.

³ *Rawwighu*, lit. 'strain it through a cloth'. Lat. 'coletur'.

⁴ Lit. 'grows like a plant'.

⁵ This process is omitted by the Latin translator, but is given in the Syrio-Arabic translation (*La Chimie*, II, p. 148).

⁶ As Democritus gives oak ashes (along those of cabbage, the camphor tree (?), and vine twigs) as one of the sources of mild alkali (*La Chimie*, II, p. 90), the mention of Oak ashes in the *Kitāb al-Asrār* indicates that ar-Rāzi drew, directly or indirectly, on some Greek source for his information. Ar-Rāzi also mentions oak-ashes as being used in the sublimation of Mercury for making Elixir (*infra*, trans., p. 385). Pliny (*Nat. Hist.*, XXXI, Caps. 10 and 7) states that a sort of natron is made from oak ashes and that in France and Germany in the 1st Cent. A.D. the simple ashes of oak were used as a substitute for salt.

⁷ Following Ms. Lw. The Escorial Ms. reads *ajalla minhu*.

Salt of Urine. (Microcosmic Salt)

Take 10 *ratls* (lbs) of Urine, and let it stand in the blazing sun in a *Qarābah*¹ for 40 days. If it coagulates and becomes salt, then it will be satisfactory: otherwise smear the *Qarābah* with 'Clay of the Philosophers' and place it on hot ashes. When the ashes become cold, renew them until the solution is coagulated like *ṭabarzad* (salt), if it please Almighty Allāh! If, however, you place it (the liquid) in thin cups and hang them in beakers, and scrape down what crystallises out, time after time, and protect what drops down into the beakers and collect it, it will produce a salt to your liking, if it please Almighty Allāh!

A Better Process.

Take whatever (amount) you like, and leave it for a full month. Then distil it.² Next, add to each *ratl* of what you have distilled 4 ounces of Salt of *Al-Qilī*: and coagulate the mixture in the *A'mā* (Blind Cucurbit). It will solidify (into something) like crystal in three days if it please Almighty Allāh!³

A Better Process.

Take as much Urine as you like, and leave it for one month. Then distil it. Next calcine its residue, so that it may become white. Then mix with each *ratl* of the distillate 6 ounces of the residue and 2 ounces of Salt of *Al-Qilī* and 1 ounce of Calx of Egg. Coagulate the mixture on hot ashes and it will become solid like crystal.

Section on Artificial⁴ Substances.

There are two varieties of these: 'Bodies', and 'Non-Bodies'⁵

The 'Bodies' are: (1) *Shabah*: (2) *Isfīd-rūyah*: (3) *Tālīqūn*: (4) *Tabrūyah*: and (5) *Mufragh*.⁶

The 'Non-Bodies' are: (1) *Zanjār*; (2) *Za'fran al-Hadīd*; (3) *Qalmiyā* (or *Iqlimiyā*—

¹ According to Johnstone's Dictionary, this Persian word means a large flagon or vessel having two handles and a spout. It was made of glass, and in it wine was clarified by allowing it to stand for 40 days. Lat. 'ampulla vitrea'.

The absence in this and the succeeding processes of any magical allusion (e.g. the stress laid both in writings from Egyptian sources—the treatise of Isis to Horus, Berthelot, *Collection*, I, Trans., p. 34—as well as in those of subsequent writers, on the urine being that of a boy who had not reached the age of puberty) is noteworthy as indicating how completely ar-Rāzi had freed himself from such ideas.

² *Tuqaṭṭirhu*.

³ ar-Rāzi evidently did not realise that all he got by this process was pure *Al-Qilī*. This process, as well as the next, is omitted by the Latin translator.

⁴ *Al-Muwalladāt*, which, in the Latin Ms. at Paris, is literally translated by 'que nascuntur'.

⁵ This is an obvious echo of the well-known saying of Hermes (*Collection*, II, p. 124), which was afterwards ascribed to Mary, the alchemist, by Olympiodorus (*idem*, I, p. 101), and quoted by ar-Rāzi in the *Shawāhid*: "Mary also said: 'Unless you make the 'Bodies' bodiless, and change those that have no bodies into 'Bodies,' you can accomplish nothing,' (Rāmpūr Ms.—Second Section—On the preparation of the 'Stone')."

⁶ For the constitution of the first three of these alloys, see note on *Khārṣini*, *infra*, pp. 408-9. *Shabah* consisted of 4 parts of Copper and 1½ parts of Lead: and *Isfīd-rūyah* of 4 parts of Copper and 1 part of Tin. *Tālīqūn* (which Dozy and Engelmann, *Glossaire*, p. 252, state is a corruption of *Katholikōn*) was probably, as the etymology of its name suggests, an alloy of all the metals. The names of *Tabrūyah* and *Mufragh* have not been traced elsewhere: but possibly *tabrūyah* is connected with *tibr*, 'native gold' (or silver). The reading of the last two names cannot be checked from the Leipzig Ms., as it omits the whole paragraph, while the Latin translator quietly replaced the five alloys by 'aurum et argentum.'

Ms. Lw.); (4) *Khubth al-Fiddah* (Dross of Silver); (5) *Martaḥ*; (6) *Ustrunj*; (7) *Isfidāj*; (8) *Rūsukhtaj*; and (9) *Mashaqūniyā*.¹ We will soon mention the way in which these things are used in our work, when we happen to require them.

The description of the Earthy Substances is now complete and we will next mention the Vegetable Substances. The Sages paid little attention to them and very seldom used them. What they mostly employed was the long fresh red *Ushnān*.²

Section on Animal Substances.

The Sages made their Elixirs from them, and hinted about them in enigmatical sayings.³ They are ten 'Stones': (1) Hair; (2) Skull; (3) Brain; (4) Bile; (5) Blood; (6) Milk; (7) Urine; (8) Egg; (9) Mother of Pearl; and (10) Horn. The best of them is Hair; then Brain; then Bile; then Egg; then Skull; and then Blood.⁴ And we shall describe the Elixirs made from them when we reach the place in which it is necessary for us to describe them; and these (instructions) the reader of our book should note carefully. But success is from Allāh!

On the Knowledge of the Instruments.⁵

In other places in our books we have stated that Instruments are of two kinds, one for melting 'Bodies' and the other for the treatment (*tadbīr*) of substances. The instruments for melting are well-known: they are:—

Kūr (Furnace).

Minfakh (Bellows).

¹ Although, following the *Madkhal*, we should expect *Zunjufr* (Mercuric sulphide) to be included in this list, it is not found in any of the three Mss. (M, Lw., and X) in which this section is given.

² Ms. Lg adds a note from later in the *K. al-Asrār* (f. 78r, Ms. M) that this was known as the 'Five Fingers'.

This passage of ar-Rāzī clearly proves that he did not accept as authorities in alchemy the ancient Indian treatises of *Caraka* and *Suśruta*, though these had been translated before his time (*vide Fihrist, ed. cit.*, p. 303) and he was certainly acquainted with them. In the quest of the Elixir of Life (*rasāyana*), which was the ultimate aim of the older Indian alchemists, the latter almost entirely relied on vegetable substances.

³ Reading with Ms. Lw., *wa ilaiḥā ashārū wa 'alaiḥā ramazū* instead of the unintelligible *wa ilaiḥā yazdādū mahmū katharū* of the Escorial Ms. This section is quoted, practically *verbatim*, on p. 183 of Duval's translation of Ms. S.A. (*La Chimie*, II). It may be here noted that Sections V, VI, and VII of this Syrio-Arabic work are drawn from the so-called '*Risālah* of Mahrāris', a Ms. of which is found in the Royal Library of Cairo. This treatise begins with a long passage regarding Mahrāris and a pupil; but in reality (as the contents prove) it is a detailed work on alchemy by some unknown author, similar to the *K. al-Asrār*, and dating probably from about 940 A.D. It will be discussed in a later paper. Probably, therefore, the whole of Ms. S.A. dates from the first half of the 10th Century.

⁴ In the Rāmpūr Ms. of the *Shawāhid*, brain, bile, etc., are scarcely mentioned at all, and it is obvious that ar-Rāzī almost entirely relied in the case of animal substances on Hair and Eggs as sources for what he evidently regarded as the only 'Stone', viz: Sal-ammoniac. The statement at the end of the *Mafātiḥ al-'Ulūm* is, therefore, more trustworthy than the one found here regarding ar-Rāzī's own procedure. In the *K. al-Asrār* ar-Rāzī may, however, be referring to the practice of his master Jābir, as the latter certainly also used blood as a source of Sal-ammoniac (*cf.* the 12th treatise in the '*Book of the Seventy*'—Berthelot, *Archéologie*, p. 325), and possibly brain and bile as well.

All the animal substances mentioned in the *K. al-Asrār* (in addition to a good many others) are found in the writings of Zosimus (e.g. *La Chimie*, II, p. 305), but in *Caraka* only Nos. 1, 4—7, and 10 appear to be mentioned as being used in *Rasāyana*. The omission of all reference to Eggs is noteworthy—particularly in view of the prominent position assigned to the Egg in the writings of Greek alchemists. This fact is alone sufficient to indicate that in the case also of animal substances the authorities on which Arabic alchemists drew were Greek, and not Indian, writers.

⁵ Following Ms. Lw. The Escorial Ms. has 'Now, O Allāh, grant us guidance in speaking somewhat regarding the knowledge of the Instruments!' and Ms. Lg. has 'The fourth Chapter (*Faṣl*) on the knowledge,' etc.

Būtaqah (Crucible).

*Māshū*¹ (Ladle).

Ambur (or *Māsik*—Mss. L,w and Lg—Tongs).

Būt-bar-būt.

Maqattī' (Shears).

Mukassir (Hammer).²

It is possible to know all these from the goldsmiths, except that the '*Būt*' on the '*Būt*' is only found with the people of this Art (Alchemy).

The *Būt-bar-būt* is a Crucible on a Crucible. In the base of the upper one are one, or two, or three, holes. There is placed in it those substances—mixed with *natrūn* and olive oil—which are to be subjected to (the process of) *istinzāl*; and it (the *būt-bar-būt*) is placed in the *Kūr* and covered and packed round with charcoal. Blow on it as in the melting of copper. If the things to be treated are iron, or *dawş*, or steel, or *talq*, (you heat it up) three times.

The secret of melting is that the skin of the bellows (*minfakh*) should be large, sound and soft; that its *qafizah* should be proportionate to the neck of the outside of the bellows (*ziqq*); and that its pipe should be the same size as the hole of the *qafizah*³. The wood which is on the back of the bellows should be well planed and tied with a soft thong.

Description of the Furnace (*Kūr*).

It ought to have a cover fitted on it; and a receptacle (*māsik*) with holes, fitted in the interior of the furnace.

The Crucible will be covered on all sides with charcoal, and when you melt the hard 'Bodies' there should be below the Crucible specially hard charcoal. In the case particularly of iron, *dawş* and steel, they must be melted in large furnaces (*kirān*), either with blacksmith's charcoal or with charcoal made from bamboo (*qaşab*).⁴

Melting of Iron, and of those things that are melted with Iron during combustion.

The iron that is to be melted should be filings, burnt with one-fourth (their weight) of red arsenic sulphide, or one-half of yellow arsenic sulphide. (Heat the iron) several times in a luted bag, hung in the middle of a well-heated furnace (*lannūr*).

[Take it out when it becomes cold]⁵ and wash it with water and salt. When it is dried, mix with it one-sixth (its weight) of red *Natrūn*. Then it is melted and

¹ Corrected from the Lucknow Ms. Both the Escorial Ms. as well, apparently, as the Syrio-Arabic Ms. translated by Duval (*La Chimie*, II, p. 449) read *Māshiq* (which Duval rendered by 'pilon ou marteau' though *mukassir*, which means the same thing, occurs later in the list). *Māshū*, *Ambur*, which follows it, and *Kalbatān*—the word used in the '*Ain aş-Şan'ah*', are all Persian words.

² The Latin list runs: *fornax orificium*, *bodice*, *et materiam* [i.e. *mortarium*], *et tenalia* (et) *scarpella* (et) *mallea*.

³ According to Duval (*op. cit.*, II, p. 149), *qafizah* is the same as *κοφινος*, a Greek measure. The Latin translator evidently failed to make any sense out of this difficult passage, as he simply states 'et secretum in hac est ut manticus talis qui recipiat bovum flatum'.

⁴ This mention of bamboo charcoal probably solves the problem raised by Thompson (*op. cit.*, p. 72) as to what was the knotted wood (*qişra*) which was prescribed by the Assyrians as the essential fuel for their glass furnaces.

⁵ Added from Duval's translation of the Syrio-Arabic Ms. No corresponding sentence is found in Mss. M. or L,w, or the Latin.

subjected to (the process of) *istinzāl* in the *būt-bar-būt*. If you want to whiten it, then feed it with white Syrian glass and an equal quantity of white and good Sal-ammoniac, mixed into pellets with olive oil. When it is melted, pour it out on the ground or into a dry mould. This will be repeated until it becomes white and soft. Mix it with an equal quantity of Tin (*raṣāṣ*). Then it will behave on fire like silver; and we shall soon attain a complete understanding of this when we reach the big chapters.¹

The Instruments for the treatment of substances are :—

<i>Qar'</i> , and <i>Ambīq</i> , with a spout,	<i>Ṣalāyah</i> :
and <i>Qābilah</i> (receiver) :	<i>Fihṛ</i> :
<i>Qar'</i> , and Blind <i>Ambīq</i> :	<i>Atūn</i> :
<i>Uthāl</i> :	<i>Ṭabashdān</i> :
<i>Mustauqad</i> :	<i>Nāṣikhū naṣīh</i> :
<i>Aqdāh</i> :	<i>Durj</i> :
<i>Qannānī</i> :	and <i>Kurah</i> . ³
<i>Qawārīr</i> : ²	

Description of the *Qar'*, and *Ambīq* with a spout, and *Qābilah*,
for distilling liquids.

The secret is that the Cucurbit (*Qar'*) ought to be big and thick. There should be no hole in its bottom, and no pores anywhere.⁴ The Alembic should be placed upon it. The earthen pot (*qidr*), in which it is placed, should be of the shape of a *mirjal* (copper cauldron), and the cucurbit should be plunged into water to the height of the medicine. There should also be near the furnace⁵ a jug (*qumqumah*) of boiling water, from which to fill up the pot when the water diminishes. Be careful that no water reaches the cucurbit: and fix it in such a way that it may not shake. The bottom of it should not reach the bottom of the pot, lest it be broken.

Sometimes Distillation⁶ is carried out with luted cucurbits, hanging in a *mustauqad*,⁷ constructed of clay and in shape like a dish cover (*tabaq*).⁸ A gentle fire is lit underneath. When the *mustauqad* becomes warm, and drops begin to come over rapidly, stop the fire until it goes out, and drops only come over singly.

¹ The Latin translator, who writes 'et cum eo preparabis quoddam caput quod tibi dicemus cum venerimus ad preparationem eius,' has literally, but incorrectly, translated *ra'san* 'completely' by 'caput.'

² The Latin translator explains *qawārīr* as being long flasks (*ampullae*) with long narrow necks.

³ The Escorial Ms. adds *wa'l-kūr* 'and furnace' at the end of the list, though this has already been mentioned in the previous list. while Ms. Lw. reads *wa'l-kūwat wa'l-kūrat*. Ms. Lg. has '*Kūr*, and whatever else is required.' Possibly the list should include, at the end, *Kūwah*, in the sense of 'grate.'

⁴ The explanation of this is given in Chapter XLVIII of Geber's *Summa Perfectionis* (ed. cit., p. 569) with reference to the need for making the pot of the Aludel of glass. "Solum enim vitrum et ei simile cum poris careat, potens est spiritus tenere ne fugiant et exterminentur ab igne. Alia autem materia nulla, quia per poros eorum successive dimi-nuuntur, et evanescent spiritus. Nec metalla in hoc valent: quoniam spiritus propter amicitiam eorum, et conven-ientiam illa penetrant et cum illis uniuntur: quare per illa transeuntes evanescent: quod per ea, quae a nobis deter-minata sunt aperte probatur."

⁵ Reading with Ms. Lw '*inda'l mauqid*' instead of '*inda jam al-waqūd* ('near the mouth of the fire').

⁶ *Tas'id* usually means Sublimation, but the description shows that it is here taken as a synonym for *taqīr*.

⁷ An explanatory gloss has '*tannūr as-saghīr*' (small oven). Duval wrongly translates *mustauqad* as 'bain-marie' (*La Chimie*, II, p. 151).

⁸ Another explanatory gloss has *ya'ni 'alā mithāl al-mirjal*: 'he means, 'of the shape of a cauldron.'

Sometimes the cucurbits are placed in a pot containing ashes, and a fire is kindled underneath. This is the best method for students.

Sometimes the cucurbits are placed below the *mustauqad*, while the bottom of the pot rests on big bricks. Ashes are placed over it (? them), and the cucurbit is placed above, and all its sides are surrounded with sifted ashes. Then it is heated. It is necessary that the sides of the lip (of the cucurbit) and the head of the receiving flask should be well closed¹ so that the smoke may not enter into it, and the air may not spoil it (i.e., the substance undergoing distillation).

Alembics are of Four kinds:

1. One of very broad diameter, which is suitable for the (removal by) distillation (*taqtīr*) of the black constituents (*siwād*) of substances that have to be calcined, as well as the volatilisation (*is'ād*) of Sal-ammoniac.

2. The Alembic which is not of very broad diameter, and is suitable for the distillation of 'Spirits,' [and Tinctures.]²

3. The Alembic of still less diameter,³ suitable for the distillation of the 'Stone'⁴ at the beginning of the Work.

4. The Alembic of very small diameter, useful for the distillation (*radd*),⁵ of water, and for its purification (*taṣfiyah*).

The Cucurbit and Blind Alembic are suitable for the solution (*taḥlīl*) of 'Spirits, as well as of 'Bodies' which have undergone the process of Ceration. It is a cucurbit which has a (internal) channel (*ḥandaq*) without a spout (*mīzāb*). Those things which you want to be dissolved are placed in the groove, and in the cucurbit any strong water. The alembic is mounted on top and the joint is closed. The apparatus is then placed on a pot of water, or ashes.⁶ It is not suitable for anything but (the process of) Solution. This is '*Al-Ḥammām*' ('The Bath') which is spoken of (by the philosophers) enigmatically.⁷

The 'Blind (Cucurbit)' is a cup mounted on the Cucurbit.⁸ You place in it the dissolved substances, and it (the apparatus) is hung in a symmetrical

¹ Lit. 'strengthened'. The whole of this rather obscure passage is omitted by the Latin translator. Ms. Lg., in continuation of the previous paragraph, has simply 'or place the cucurbit on bricks on which are ashes, and the ashes will be covered with the sides of the cucurbit.' There is no difference in the reading of Mss. M. and Lw. that might help to elucidate the meaning.

² Added from Mss. Lw. and S.A.

³ Duval, in his translation of the Syrio-Arabic Ms. (*La Chimie*, II, p. 152), has 'L'alambic à large oreille,' from which it would appear that he read *udḥan* 'ear' for *adnā*, 'less.' Lack of familiarity with alchemical nomenclature has also rather handicapped this translator. E.g., in the sentences that immediately follow, 'des pierres' is found for 'The Stone': 'des corps oleagineaux' for 'cerated 'Bodies': 'de l'eau' for 'the things you want to be dissolved': and 'le bain-marie' for *al-Ḥammām*.

⁴ Ms. Lw. reads *ḥumrah*, 'redness,' instead of '*ḥajar*.'

⁵ Lit. 'turning back.' Possibly this is an early reference to fractional distillation.

⁶ 'Or ashes' is omitted in Mss. Lw. and S.A.

⁷ Later, in the *K. al-Asrār* (Ms. M, fol. 59v), it is stated that 'Solution in the Cauldron' (*vide supra*, p. 334) is referred to in the books of the Sages under the name of 'Moist *Ḥammām*.'

⁸ An explanatory gloss in Ms. M. adds: 'The Blind Alembic enters into the mouth of the cucurbit.'

mustauqad. Below is placed either a burning lamp, or lighted naphtha, or charcoal, or hot ashes. Take care that neither the fire becomes extinguished nor the ashes become cold, until the dissolved substances are solidified.

The *Uthāl* (Aludel).

This is made of glass, or pottery, or stone,¹ or iron, or of the clay out of which crucibles are made. But none of them can function without being luted with the 'Clay of the Philosophers' (*Tīn al-Ḥukamā*).

Clay of the Philosophers.²

Take of pure clay, either red or white, which is adhesive and free from pebbles, and spread it in a clean place and sprinkle water over it several times till it becomes moist.

Spread it out without touching it with your hand and leave it to dry. Then it is powdered in the way employed by potters, and passed through a fine sieve (*ghirbāl*). Next it is pounded in a mortar (*mihrās*) and sifted through silk, or a hair sieve (*minḵhal*), or a sieve used for sifting flour. After moistening it with water and mixing with it rice bran separated from flour, it is kneaded gently into dough for a day and a night, and left to rest for a day and a night.³

Take dry dung, and sift it gently through a hair sieve, until all the dust has passed through. Then sift it again through a flour sieve, and pound it gently in a mortar, and mix it with a equal quantity of clay that has been made into dough. For every *ratl* of it take 10 *dirhams* of ordinary table⁴ salt, and 3 *ratls* of well-powdered pottery (*khadhaf*), which has been sifted through silk, and a handful of animal hair, chopped as fine as possible. Leave it 3 days; and this will be the best 'Clay of the Philosophers.'

The Making of the Aludel.

Take a pot of the shape of a *burmah*, its length being 1 cubit and its breadth 2 hands, and invert it on a level surface. After sprinkling sifted ashes round it in a circle for the space of 1½ hands, you remove the pot and make a disc of 'Clay of Wisdom' (*Tīn al-Ḥikmah*) over the sifted ashes. After letting it dry, lift it, and polish its surface, and smear it with *isfidāj* and white of egg. Polish it a second time. Make at its edge a groove⁵ round it, and a place will be left there in which the sublimes may collect. Allow it to dry. Then invert the pot of the aludel on its own base, and after covering it with an even layer of clay of moderate thickness, leave it to dry. Then invert the disk, and the pot will be placed on it, and on both sides the joint will be luted with clay. Fit the pot with wings, one hand below the disc, in order that the flame of

¹ *Birām*, pl. of *burmah*—which was a large vessel used in *Khurāsān*, made out of stone.

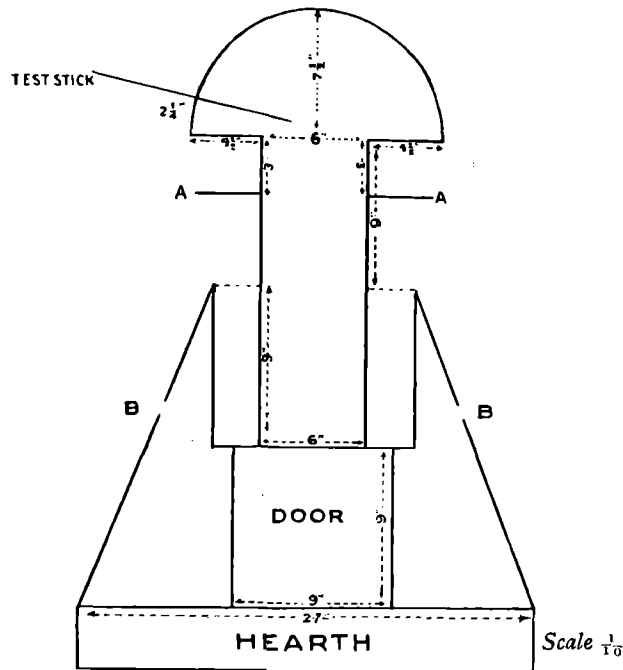
² Following Mss. M. and S.A. Mss. Lw. and Lg. have the more usual *Tīn al-Ḥikmah*—'Clay of Wisdom.'

³ This paragraph—as well as the references in the subsequent paragraph on the making of the Aludel to the size of the latter instrument, and to the need for smearing the disc of 'Clay of Wisdom' with *Isfidāj* and White of Egg—supplies details that are not to be found in the *Madḵhal*.

⁴ *Ta'ām*, lit. 'food.'

⁵ For the use of this groove, or channel, *vide* under 'Cucurbit and Blind Alembic' on previous page.

Hypothetical Sectional Drawing
of ar-Rāzī's *UTHĀL*, with its *MUSTAŪQAD*.



Notes. (1) The size of the *Uthāl* is that given in the *K. al-Asrār*, except that the position of the hole for the stick is shown as in the *'Ain as-San'ah*.

(2) The pot is shown half-inserted into the *Mustauqad*, as in the *'A. as-Ṣ*, the bottom being 1 span from the bottom of the oven. Nothing is said on these points in the *K. al-A*. In the earlier *Madkhal*, the pot was inserted into the oven up to the wings AA, recommended in the *K. al-A*. to prevent the flame damaging the sublimate on the shelf. Possibly ar-Rāzī found in the meantime that his earlier procedure interfered with the sublimation, owing to the shelf getting too hot.

(3) The section of the *Mustauqad* is largely conjectural. Its height and breadth are those given in the *'A. as-Ṣ*, which agree with ar-Rāzī's statement in the *K. al-A*. that it was about the same size as the *Uthāl*. As regards its shape, its section is shown as oblong in the illustrations given in the Arabic, as well as the Persian, version of the *'A. as-Ṣ*. Ar-Rāzī, however, clearly states (a) that only the base of the pot was heated; (b) that the lower part of the pot was symmetrical with the inner wall of the oven; and, finally, (c) that the top of the round oven was smaller than the bottom. This conical form of oven, which must have been difficult to make, may have been peculiar to ar-Rāzī; and the author of the *'A. as-Ṣ* certainly did not have any air space between the sides of the pot and an interior wall of the oven, for he states that the flames were allowed to play on the sides of the pot. In any case, the contrast in size and appearance between the 10th century Perso-Arabic *Uthāl* and *Mustauqad*, and the Aludel and Furnaces used in Europe in the early 13th century, is noteworthy (*vide* figures of the latter on Plate I).

(4) The dimensions of the large door (1 span square) are taken from the 10th century Syrio-Arabic Ms. (*La Chimie*, II, trans., p. 168) in which the length of the pot of the *Uthāl* was also 1 cubit. The *'A. as-Ṣ*, on the other hand, says the door should be small.

(5) The position of the two exits (BB) for smoke is uncertain. In the *Madkhal*, only one is mentioned 'under the wing,' i.e., presumably towards the top of the oven: but, in the so-called 'Treatise of Mahrāris' from which part of the Syrio-Arabic Ms. is derived, they are said to be towards the bottom of the pot 'to enable smoke to go out and air to enter.'

(6) The position of the hole for the test stick is also uncertain. In one place in the Persian version of the *'A. as-Ṣ*. a long stirrer is mentioned, so that in this case the hole must have been 3" from the top of the cover. It may even have been in the pot itself below the shelf (*vide* note 1, p. 383, *supra*).

(7) Ar-Rāzī mentions a hearth at the bottom of the *Mustauqad* to catch the cinders, in both the *Madkhal* and *K. al-Asrār*, but no dimensions are given.

(8) For the purpose of the drawing a cubit is taken as 18 inches, a span 9 inches, and a hand (of 4 fingers), as 3 inches.

the fire may not reach the disc and damage and destroy what settles on it. The cover will then be mounted on top. There is a mystery in this which we shall mention when giving an account of sublimate.¹

The *Mustauqad*.

It is a small oven (*tannūr*), as big as the aludel, and the lower part of the aludel is symmetrical with its inside wall so that the fire may not enter round the pot—in fact it only heats the base of the aludel. At the bottom is a pit, into which the live cinders can fall. Its top—I mean, of the *mustauqad*—is narrower than its lower part. At the side of the door of the *mustauqad* is a covered hole, below the wing, for the smoke to go out of.

The Aludel is used for the sublimation of dry substances, and the Cucurbit and Alembic with a spout is for the distillation of liquids.

Glass flasks (*qannāni*) was required for (subjecting) those things that can be sublimed, etc., to (the process of) *Takhniq* (constriction), because the alchemists² often require to subject to *takhniq* those things that can be sublimed. They place those things in flasks, and they cause the substance to ascend, and consequently it ascends in the flask and is constricted in the neck, e.g., Tin and things purer than tin. If they wish to carry out the process of *Takhniq*, they mix the thing which has been volatilised with oils; or it may not be mixed with any oils. If they want the essence (*jawhar*), they mix it with some oil. They fill one-fourth of the flasks in which the medicines are placed, and three-fourths is left empty. The flasks will have wings³ as I have mentioned. The flask will first be smeared with iron rust (*Khubth al-hadīd*), roasted

¹ The device here alluded to was the provision of a hole in which a stick, covered with cotton, was inserted. By this the progress of the sublimation could be followed. Compare, e.g., the following account of ascertaining when sublimation has ceased when using Mercury in the process of making Gold, by treating it in a pot covered with a plate. "The secret of this that one should ascertain when no more smoke (*dukhān*) comes from the exhalation (*bukhār*) of the sulphur, in order to stop the addition of fuel. The procedure is to make a hole, one finger broad, below the lip of the pot, in which the head of a large needle (*misallah*) is inserted. Take a piece of wood and wrap cotton round it, and insert it. Take it out constantly and inspect it and shake the deposit off as you take it out, and when nothing adheres to it, cease adding fuel" (*Ms. cit.*, f. 16v). From the description given under Sublimation (see *infra*, p. 385) it would appear that ar-Rāzī gave the credit of the introduction of this device for studying the progress of sublimation to Jābir bin Ḥayyān. That this was so, may be seen by referring to Jābir's account of the sublimation of Mercury, with sal-ammoniac, vitriol etc., found in the Latin translation of one of the later treatises of the 'Book of the Seventy'; but Jābir in turn gives the credit to some Greek author called Socrates in the Latin text (Berthelot, *Archéologie*, p. 360). In all probability, the idea was taken from the hole at the top of the cupping-glass on which the alembic was modelled (*cf. supra*, p. 362, note 6):

The account of the *Uthāl* that is here found in ar-Rāzī's *K. al-Asvār* is evidently the original of the extract on the same subject found in the Syro-Arabic text given in Berthelot's *La Chimie*, II (p. 69 text, and p. 153 trans.: *vide* also note 3 on p. 63 of Stapleton and Azo's paper on the '*Ain aṣ-Ṣan'ah: Memoirs, A.S.B.*, I). It may further be deduced from a comparison of the drawing of the *Uthāl* given in Pl. I with Muḥammad bin 'Abd al-Malik's description in the '*Ain aṣ-Ṣan'ah* that the probable source of the latter was also one or other of ar-Rāzī's works. The latter author undoubtedly in turn drew on Jābir, e.g., the mention of the large-headed aludel with narrow bottom for subliming a mixture of mercury, vitriol and salt, in the 60th treatise of the 'Book of the Seventy' (Berthelot, *op. cit.*, p. 358).

² *Ahl al-Hikmah*: lit., the followers of *al-Hikmah* (Wisdom), i.e., the Art of Alchemy.

³ Lat. adds, 'a quibus capiantur.'

and mixed with White of Egg, and then dried. Afterwards it is luted with 'Clay of Wisdom': and consequently the fire will not in the least affect it.

If oils are not used, the mouth (of the flask) is firmly closed with thread (*khitt*): but if oils are present, pure white wool is tied round the mouth, and when it becomes moistened it is removed and wrung out and another (pad) is substituted for it. When this in turn gets moist, the former is put in its place and the moistened one is taken away. In this way all the moistness is removed, until one of the pieces of wool catches fire. Then the mouth of the flask is closed with dried salt, mixed with clay—the salt and the clay being made into a paste with hot water—so that the flask may not be broken. And this is the strongest lute for the heads of flasks.¹

Cups (*Aqdāh*) are required for the assation (*tashwiyah*) of substances, for alchemists often cause their substances to imbibe liquids. They place them in two luted cups and close the joint with glue² smeared over a cloth, or with salt and barley flour and *khitmī*, smeared over a cloth, or with lime mixed with white of egg. Over this they place clay. Then they cause the substance to undergo assation on a fire made of dung, or in a *tannūr*, according to need.

The *Ṣalāyah* and *Fihṛ* are required for grinding substances. The best mortar³ is made of stone.

The *Atūn* is like the oven (*atūn*) of the potters; (but) it is small. Its use is to calcine the 'Bodies' so that they became lime, white, and so fine that its particles are incapable of further division.⁴

The *Tābashdān* is like the *atūn* of the mintmasters, when they heat the (blanks for making) *dirhams*, so that they may be softened⁵ by the fire. It is used for those things, the surface of which they wish to be affected by fire so that the unctuous humidity may be removed; or for things which they want to heat (simply) to redness.

The *Nāfikhū nafsīh* is a *tannūr*, the base of which is narrower than the top. It is fixed on three legs, the walls and base being perforated with holes. In the middle of it (i.e., the base) is a grate (*kūwah*) through which the ashes fall. Charcoal is poured into the lower part of it (the *nāfikhū nafsīh*), and those things that have to be calcined are put in the upper portion. A cover is fitted on it, and the apparatus is placed where the breeze can play round it.⁶ Its fire is sufficiently strong to calcine the 'Bodies,' and to bring them together and melt them.

The *Durj* is made of clay, (and it is used) for purification. Those 'Bodies' which it is desired to purify are put into it in layers, one layer of 'medicine,' and one layer of the thing you wish to purify, and a cover fitted on it. The joint is firmly closed: and fire is kindled on top.

¹ Ms. Lw. has 'And this is the secret of luting flasks.'

² *Asrāsh*, pl. of *Sirīsh*, a vegetable paste used by bookbinders and shoemakers. The alternative spelling *Ashrās* is found in the *Madkhal* (*supra*, p. 357).

³ *Hāwan*, a Persian word. Presumably ar-Rāzi is referring to the *ṣalāyah*.

⁴ *Lā juza' lahū*: lit. 'no parts for it.'

⁵ Lit. 'changed.'

⁶ The *Liber Bubacaris* gives the following rough version of this passage "Fornax que per se sufflat fit hoc modo quia debet esse de argilla et debet habere in medio craticulam ('grate') ferream perforatam ut cinis cadat inferius et carbones

The *Kurah* is that in which filings are treated. The powdered 'medicines' by which the treatment is to be carried out are mixed with them, and placed in a bag¹ made of a strong piece of rag. Then clay is smeared round it and it is made into a ball. After this it is roasted as you think fit.

This completes the description of the Instruments.

Various Alchemical Operations :
as well as certain Preparations of Chemical Substances.

SUBLIMATION (*Taş'īd*).

(*Kitāb al-Asrār*: Ms. M., f. 12 r.)

There are two methods of subliming Mercury, one for the 'Red' and one for the 'White'. In subliming it there are two secrets, one the removal of its moistness, and the other to make it dry, so that it may be absorbent. The removal of its moistness is by either of two processes. After trituring it with what you wish to sublime it, you heat it over a gentle fire in a phial (*qārūrah*) luted with clay, and then triturate and (again) heat it, doing this 7 times till it completely dies. Then sublime it with whatever you wish to sublime it, and heat it gently and place it in the aludel. Over the aludel there should be an alembic of green pottery, or glass, with a short wide spout, for the purpose of distilling all the moisture that is in the mercury. Under (the spout) is placed a dish (*sukurrujah*).

In place of this alembic, we may have a cover (*mikabbah*) properly adjusted on the head of the aludel. It should have a hole large enough for the head of a large needle (*misallah*) to enter. In this (hole) is placed a woollen lamp-wick, with one end of the wick hanging down into the dish, so that all the moisture that is in the mercury may be distilled.

Then you remove it (the alembic or cover), and replace it by the cover which covers its top completely, and lute the joint.

A better way (than using an alembic) is to have a hole in the cover of the aludel large enough for the little finger to enter. This hole is kept open until the substance appears in the form of dust, either white or black, by which you learn that the moisture has come to an end. Then the hole is closed with a properly-fashioned stick bound round with a rag, in accordance with the direction of our Master (Jābir) bin Hayyān.²

The substances with which Mercury is sublimed are Alum, Vitriol, Salt, Sulphur, Lime, (powdered) Brick, Glass, Ashes of Gallnuts, Oak Ashes, and *Mārqaṣhīthā*; and, of Waters, Vinegar, 'Water of Vitriol,' 'Water of Sal-ammoniac,' 'Water of

non, et hec ejus forma quia habet duas partes, superior et inferior que habet os per quam ventus intret." This is the only description of an alchemical furnace to be found in the Latin translation.

¹ *Yuṣarra* (cf. the reference on p. 360 of the *Madkhhal* translation to *ṣurrah*).

² This paragraph is taken from the Lucknow Ms. The Escorial Ms. has only a confused account in which there is no reference to Ibn Hayyān. This, and the previous two paragraphs, are omitted in the Latin translation of Paris Ms. No. 651.

Alum,' and the 'Water of Quicklime [and Sulphur,' which is called *Zād ar-Raghwah*].¹

Sublimation of Mercury for the 'White.'

Take of Mercury that has been coagulated ² 1 *ratl* (lb), and bruise it with an equal quantity of white Alum, the like quantity of Salt, and the like quantity of Ashes. Next sprinkle Vinegar over it, after placing it on a *ṣalāyah*, and triturate it thoroughly for three hours a day, one hour in the morning, one hour at noon, and one hour in the evening. Then place it in a phial covered with clay. Close the head of the phial, and place it on hot ashes in an oven (*tannūr*) which has just been used for bread making. Leave it there for one night, and in the morning transfer the substance to the pot of the aludel, after (again) triturating it. Place powdered salt at the bottom of the aludel. Adjust the alembic previously mentioned above the aludel, and (thus, by heating), remove the moisture from the substance. Then replace the alembic by a cover; and lute the joint; but first light a small fire beneath it, till its moisture has been removed by the gentle fire.³ Fit the cover to it and heat it (the aludel) for one hour with a gentle fire. Then increase the fire to a moderate degree. Keep the fire burning 12 hours for each *ratl* (of the substance); and, whenever the ring of the cover gets heated, stop the fire, lest the substance that is on the shelf⁴ be spoilt and burnt. (This is continued) until the whole has sublimed. Then bring back the sublimate to the residue, triturate, and again sublime it. This is done thrice.⁵

Then take burnt bones, which are procured from furnaces (*atānīn*), pound them thoroughly, and triturate the sublimate with an equal quantity of these burnt bones for an hour. Sublime it in this way thrice, adding fresh bones each time. It will come out the third time white, dead, and absorbent. At one end of the cover there should be a hole, large enough for a large needle to enter, in which you insert a stick, bound round with cotton. Take this out once an hour, and drop the sublimate that is on it (on to the shelf). When, on removing it, you see no more sublimate on it, stop the fire, and let it (the apparatus) cool. Then collect what is on the shelf after gently breaking the joint. Moisten and soften what has collected with Castor oil (*khirwa'*), and place it in a luted phial. Place this in a pot of ashes and close the mouth of the phial with (a piece of) wool. Burn a fire under the pot, in order to

¹ Added from Lucknow Ms. The list in the Latin translation (after Sal-ammoniac) is 'aqua alcali, aqua calcis, et aqua sulfuris.' For *Zād ar-Raghwah* see later, p. 391.

² The Lucknow Ms. at this point adds, as an explanatory gloss, 'by the 'odour' of Tin.'

³ This sentence is taken from the Lucknow Ms. in place of the confused passage in the Escorial Ms.

⁴ *Turs*, i.e., the disc connecting the cover and pot.

⁵ That ar-Rāzī drew on some treatise of Jābir for the process he is here describing is fairly certain from the close resemblance of detail with that of two other descriptions of the Sublimation of Mercury, found in the 61st treatise of the 'Book of the Seventy.'

" *Sublimatio argenti vivi secundum Platonem.* "

.... " Postea spergatur sal in fundo alutel, Et sublimabitur cum igne debili, donec removeatur ejus humiditas. Deinde vigora ignem per diem et noctes duas. Et permittite infrigidari. Et sume quod sublimatum est de eo. Et itera medicinas. Et opera operationem tribus vicibus." (Berthelot, *Archéologie*, p. 360.)

A few lines previously, in describing another method 'secundum Socratem,' the following additional details of the aludel and the method of sublimation are given :

remove the moisture. When this has occurred, seal up the mouth of the phial and heap ashes over it. Over the ashes small pieces of charcoal are placed, by which a fire is lit on the top. In this way the substance will coagulate in the phial like (the metal used to make) a Chinese mirror.¹ When this is attained, project (*tarḥ*) 1 *dirham* of it on to 20 *dirhams* of Copper. Then it will penetrate into it, and function most effectively.

"Deiude, postquam acceperis ejus humores, sublimabis ipsum iterum: aut cum spongia, que sit sursum in capite, aut cum inforaminibus in capite: quod est melius. Sunt autem foramina tante magnitudinis quorum capacitatem repleat digitus medicus (?medius). Cumque pulvis egredietur, fac ignem vehementem quis fit in medio. Sublimabitur enim. Cumque pulvis cessaverit, removes ignem. Et cum infrigidatum fuerit, aperi. Et quod in scuto adhumatum est sume."

It may be noted that the Greek authors of both these methods seem to have preferred to use the more reactive sal-ammoniac (instead of salt) in these and similar transformations of mercury, whereas earlier in the 'Book of the Seventy' (*trans. cit.*, p. 330), Jābir states that the best way of subliming Mercury was to use ordinary salt and 'Egyptian vitriol.'

¹ Or 'like a mirror, made of *Aṣ-Ṣinī*'. Dozy and Engelmann, (*Glossaire*, p. 252) identifies *Aṣ-Ṣinī* with the alloy *Ṭāliqūn* (*vide* later, pp. 408-410). The rendering found in the *Liber Bubacayis* is 'ut speculum.' In the 'Book of the Seventy' (*trans. cit.*, p. 360), the product is described as 'argentum fixum': 'quasi massa alba plumbi.'

SOLUTION (*Ḥall*).

(*Kitāb al-Asrār*, Ms. cit., f. 57v-58r).

Solution in Dung.

This solution is carried out as follows: Dig in a place in which the wind does not blow two trenches, the depth of each of them being two cubits (*dhirā'*), and their breadth one cubit, and lute them with the droppings of house pigeons, mixed with turnip juice.

Take one part of fresh horsedung, produced that very day, and an equal part of the droppings of house pigeons, and after making the mixture into a thick paste with turnip juice, fill up one of the trenches to the depth of one cubit.

Place the thing which you desire to dissolve in a square bottle (*qārūrah*) with a broad base.¹ There should also be with you a mould (*qālib*)² of the same size as the bottle in which the substance (*dawā'*) has been placed. Press the mould down into the paste and shake it (so that it fits loosely). Then take the mould away and put in its place the bottle after closing its mouth with plaster (*sārūj*). Put over the bottle a moistened basket (*sallah*),³ and cover it with dung up to its top. Place over (the whole) a (large) pitcher (*ijjānah*), and fill up the joint. Remove the pitcher every day, and sprinkle hot water over the dung, and renew the dung once a week.

Next, fill up to the middle with pigeon droppings the other luted trench, and add more of the prepared dung, and insert the

Latin Translation of the same passage found at the end of the 1572 Basle ed. of the *De Anima* of the pseudo-Avicenna (pp. 468 and 469), annotated from a second version found in the *Liber Bubacaris*.

Fimus ad soluendum calces & medicinas.

Solutio fimi: fode locum non ventosum. Fac duas foueas in profundum duorum cubitorum, & in latitudine vnus cubiti, & lutabis foueas intus palumbina, id est stercore columborum, pistata & pastata cum succo cucumerum agrestium: ¹ and accipe de fimo equino recenti partem vnam, & de sale communi quartam partem ² & de palumbina quantum est sal, & pastabis haec omnia simul grosso pastamento, & implebis foueam hanc vsque ad medium, ³ & quod vis soluere mitte in vrinale vitreo lato in fundo ⁴ & fac formulam ligni ad modum vrinalis, & mitte formulam illam in medio pastae, vt facias tibi locum, in quo possis mittere vrinale cum medicinis, capite vrinalis cooperto ⁵, mitte desuper filtrum ⁶, & de fimo vsque impleatur fouea postea cooperi os foueae cum cantara ⁷

¹ The different Lat. trans. in Paris Ms. No. 6514, has, more correctly, 'suo raporum.'

² *Idem* omits reference to salt, and adds 'amassa cum aqua raporum fortiter.'

³ *Idem*, 'quantum brachium unum est.'

⁴ *Idem* adds (following, and explaining the Arabic) 'et latitudo laterum quantum superius est inferius, et de superiori parte planum.'

⁵ *Idem* follows the Arabic more closely: 'Etiam post prius modullum in fimo ut faciat locum et cumulla et complana. Postea extrahere modullum et eius loco pone ampullam bene opturatam consurg.'

⁶ *Idem* 'cohoperimentum' (cover).

⁷ *Idem* 'genna (i.e., *ijjānah*) et obtura iuucturam.'

¹ Lit. 'in a bottle, with a broad base, the walls, top and bottom being equal' (*mustawi*)

² Persian word.

³ Persian—a snake charmer's basket.

mould, and place over it the pitcher for a night, and do not close the joint. When the morning dawns, uncover the buried bottle, remove the mould, take the bottle quickly and having buried it (in the depression on the second trench), place the basket over it and cover the basket with dung. Then cover everything with the pitcher, and close the joint. You will act in this fashion until the substance has (completely) dissolved; and this (process) will bring about the solution of most refractory substances, viz. Stones, 'Bodies,' etc.

vt non exeat inde odor: sed semel in die eleua cantaram, & super fimum infunde de aqua salsa¹ calida, & ita facias per septem dies. & in capite 7. dierum facias in alia fouea quod fecisti in ista, & mutabis in ea vrinale cum medicinis, & cooperias bene: quia non est opus quod se refrigeret. & omnia potes ibi soluere.²

¹ *Idem* omits 'salsa.'

² In the *Liber Bubacaris* the concluding paragraph follows much more closely the Arabic: 'sicut habeas aliam foveam paratum ut dictum est superius que hanc fimum palumborum usque ad media. mitte per noctem unam et non ponas confectionem et in mane extrahe ampullam et removeas modulum (-?-) et accipias (-?-) cum festinantiam ampullam et sepellias eam in fovea con festinatione et cooperias ut superius dictum est et obtura iuncturas et sic facias donec solvatur istud solutionem firnum et indissolubile.'

CHAPTER ON ANIMAL PREPARATIONS.

Preparation of Sal-ammoniac (*Nūshādūr*) from Hair.

(Ms. M., f. 79 r et v.)

Take washed black Hair, and put it in an iron pan (*miqlāt*) with a cover, and close the joint, and cover the pan with small pieces of charcoal, and ignite them, and let them burn until they are extinguished. Then pour upon it (i.e., the calcined residue of hair), after placing it in an iron *burmah* (pot), 20 times (its weight) of distilled water of Hair—and it is Spirit—and let it (the mixture) undergo coction for one hour. Then filter it, and coagulate with it the Spirits which whiten by means of coction, if you so desire. But if you need Sal-ammoniac, coagulate the solution, and it will turn into solid Sal-ammoniac.

Another (method).

If you distil Hair, and take its water and oil separately, and place over it (the residue) an alembic with a wide spout, and light a fire, and fit below the spout a receiver wrapped in moistened felt, then the best (sort of) Sal-ammoniac will be coagulated in the receiver, if it please Allāh!

Another (method).

Take washed Hair, and distil its water, placing under (the spout of) the alembic a receiver, whose bottom has holes fitted with tubes,¹ and, below (each of) these, another receiver. The oil will then drop into the lower receiver, and the Sal-ammoniac will remain in a crystalline form² in the upper one.

Another (method).

If you dissolve Hair and distil off its white, yellow and red water, and, if then, you place over it an alembic with a broad spout, and distil off its tar (*naṣṭah*) and blackness, and finally transfer it (the dregs) to the Blind Alembic, and kindle a fire, then Sal-ammoniac will rise up, according to your desire, if it please Allāh!³

[Sodium Carbonate, or Mild Alkali.]

Calcination of *Al-Qilī* (f. 76v).

Take pieces of *Al-Qilī* and put them in a luted pot in an oven (*atūn*). Take it out when it becomes cold. Do this without trituration, until it (the salt) is whitened.

¹ *Khurṭūm*, lit. 'trunks of an elephant.' Evidently the Greek *Tribikos* (cf. Berthelot's reproduction of the sketch from the 11th century Ms. of St. Mark's, Venice—*Collection* I, p. 139). A sketch of an apparatus with apparently the same basic idea, but applied to the separation of calcined bodies by relative ease of fusion, is copied by Berthelot (*La Chimie*, I, p. 162) from the version of Geber's *Summa*, found in *Biblio. Nat. Lat.* Ms. No. 6514. The round objects at different levels appear to be flasks—not, as Berthelot says, bellows.

² *Ṭabarzād*, i.e., like sugar-candy.

³ All the above processes are almost certainly based on the directions given by Jābir in the 'Book of the Seventy' (*trans. cit.*, pp. 317-320 and 325-329). Even the double receiver, the top one covered with moistened felt, is referred

[Solution of the Same.]

Water of Strong *Al-Qilī* (f. 76 r).

Take 1 *ratl* of white *Al-Qilī*, and after pouring over it 12 *ratls* of pure water, leave it for a day and a night. Then boil and filter it, and add another *ratl* of *Al-Qilī*, and leave it (again) for a day and night. Boil it (again) and filter it. Do this 7 times. Then decant and keep it, because it will dissolve *Ṭalq* and Gypsum as we have said previously in our book.

[Preparation of Caustic Soda.]

Section on Salt of *Al-Qilī* and Lime (f. 75 v et 76 r).

Take 1 *mann* of white *Al-Qilī* and an equal quantity of Lime¹ and pour over it (the mixture) 7 times its amount of water, and boil it until it is reduced to one half. Purify it (by filtration or decantation) 10 times. Then place it in thin evaporating² cups (*kizān*), and hang then in (heated) beakers (*jāmāt*). Return what separates out (to the cup), and raise it (the cup) gradually, and protect from dust whatever drops from the cups into the beakers, and coagulate it into salt.

[Solution of Calcium Polysulphide.]

Zād ar-Raghwah (f. 34 r).

Take 2 parts of Lime that has not been slaked, and 1 part of Yellow Sulphur, and digest them with 4 times (their weight) of pure water until it becomes red. Filter it, and repeat the process until it becomes red. Then collect all the water, and cook it until it is decreased to half, and use it. And Allāh knows (what is best!)³.

[Solution of Sodium and Ammonium Sulphide and Arsenide.]

Section on a Sharp Water (f. 55 v).

Take 20 *ratls* [Ms. Lw : Ms. M. 1 *ratl*] of pure water, and after adding to it 2½ *ratls* of white *Al-Qilī* and unslaked Lime, leave for 3 days. Filter it, and repeat the process 7 times, each time adding one-eighth of pure water. Then add to it about one-tenth of *Zanjār* (copper acetate) and yellow Arsenic Sulphide, and leave for 3 days. Filter it, and add half its amount of dissolved Sal-ammoniac. Leave it several days. Dissolve with it anything you like. It will dissolve *Ṭalq* immediately⁴

to on p. 327: and Jābir clearly states on p. 325 that 'when the distillate is coagulated, it turns into Sal-ammoniac'. This 'lapis famosus' was of special use in making the 'White Elixir.'

¹ Presumably unslaked: cf. the next preparation.

² *Rashāhiyah* (corrected from Ms. Lw.)

³ A comparison of this method of preparing a solution of Calcium polysulphide with the following prescription from the 3rd century Leyden papyrus will clearly indicate the marked advance ar-Rāzī has made beyond the magic pervaded processes of his original predecessors. The meaning of *Zād ar-Raghwah* is possibly 'Food (made out) of froth of milk.'

"Invention of Water of Sulphur (or, Divine Water). A handful of lime, and an equal quantity of Sulphur in fine powder. Place them in a vessel containing strong vinegar, or the urine of a boy who has not reached the age of puberty: warm the mixture from beneath, until the supernatant liquid appears like blood: decant it properly in order to separate it from the dregs, and use it." (Berthelot, *Archéologie*, pp. 299-301.)

The liquid was used in Egypt to change the colour of base metal coins (e.g., copper) to that of gold.

⁴ The method of making a solution of pure Sodium Sulphide had long been known: cf. the following receipt from

[Solution of Caustic Soda and Ammonia.]

Water of *Al-Qilī* and Quick Lime (f. 55 v).

Take equal parts of calcined *Al-Qilī* and unslaked lime, and pour over them 4 times their amount of water and leave it for 3 days. Filter the mixture, and again add *Al-Qilī* and lime to the extent of one-fourth of the filtered solution. Do this 7 times. Pour into it half (the volume) of dissolved Sal-ammoniac. Then keep it; for, verily, it is the strongest Sharp Water. It will dissolve *Talq* immediately.

[Impure Solution of Ammonia.]

A poisonous Water (f. 56 r et v).

Take equal parts of pounded Sal-ammoniac and Copper oxide (*rūsukhtaj*), and distil it. Then pour upon that which has been distilled, a similar quantity of Sal-ammoniac and Copper Oxide, and distil them. Do this 7 times. While distillation is going on, put a plug of cotton moistened with the oil of violets, or the oil of roses, in your nose, and put aside what has been distilled. Mix the dregs with a similar quantity of Sal-ammoniac and one-fourth of Colocynth¹ pulp, and sublime it. Take what sublimes, and cerate it, and dissolve it, and mix with it that which has been put aside and bury it several days. It will be turned into a Sharp Water.

[Use of Mercury Ammonium Chloride Solution as a Dissolving Reagent.]

(f. 57 r.)

Take volatilised Mercury and drench it with dissolved Sal-ammoniac.² Cause it (the mixture) to perspire 10 times in a luted cup and dissolve it. If anything of it (the Mercury) remains, drench it (again) with Sal-ammoniac, and cause it to perspire several times. Then dissolve it till everything is dissolved. Do not be annoyed with the (length of time necessary for the) dissolving, for it is one of the most important of the substances, because it is a very strong water, dissolving all calcined substances and filings.

the 'Book of the Priests' (Berthelot, *La Chimie*, I, p. 222). "For making a Red Water. Take equal quantities of sulphur and water of *Al-Qilī* and heat until the sulphur has dissolved, closing (the vessel) so that no smoke can escape. Then place it in a glass vessel in a damp place. A Red Water will result." In the Persian translation of the '*Ain as-San'ah*' of Muḥammad bin 'Abd al-Malik that has recently been discovered in the Hyderabad Library, the same compound is stated to have been prepared by triturating together sulphur and *qilī* and, after mixing with water, boiling the mixture until the solution was reduced to one-third its original volume. The salt that separated out was heated with more sulphur and *qilī*, and on extracting the mixture with water, a red Solution was obtained.

¹ Colocynth was also a favourite reagent with Jābir (*cf.* 'Book of the Seventy', *trans. cit.*, p. 362).

² Sal-ammoniac, when heated with metals or their oxides turns them into the corresponding chlorides. Similarly Mercuric chloride is acted on by most metals, Hg_2Cl_2 and Mercury being precipitated, and the metallic chloride passing into solution, (*cf.* Mellor, II, p. 573; and IV, p. 831). In the case of Copper Oxide and Sal-ammoniac, it was found that Ammonia and some Chlorine was liberated; while Ammonia and Mercury were produced when Fusible White Precipitate was heated with iron or copper filings.

[Use of Sal-ammoniac as a Dissolving Reagent.]

Another (Process) (f. 48 v).

Take the Calx of whichever you like (of Lead or Tin), and drench it with the water of Sal-ammoniac and the water of distilled Alum¹ on the *ṣalāyah*, and rub it for 8 hours. Then cause it to perspire in a rose-water bottle, until its smoke comes out. Do this 7 times. Then cause it to perspire 3 times with the water of Sal-ammoniac, until it becomes a salt which will melt.

[Saponification of Olive Oil to Soap.]

Ceration of Salts with Oils (f. 55 r).

Take food Salt, and make it into a paste with Olive Oil and heat it for one night with a Dung fire in a luted pot which has its head closed. Do this 7 times. It will melt and flow.²

[Preparation of Glycerine from Olive Oil.]

Distillation of Olive Oil (f. 76 r).

Take as much as you like of fresh Olive Oil, and heat it with a similar quantity of water containing a little pure white clay, until two-thirds of the water has disappeared. Then filter it. Repeat the process with water and clay thrice. Then place it in a cucurbit, and after scattering over it Lime until it becomes like a thin paste, distil it. Do this several times. When you will test it (*jarrabtahu*), fire will not be ignited in it.

¹ *Mā'-ash-shabb al-muqattar*. It is extremely curious to see how close ar-Rāzī came to the discovery of Sulphuric acid, without actually recognising the powerful solvent properties of the distillate of vitriols and alum. This is all the more surprising, as he fully realised the reactive powers of both Arsenic sulphide and Sal-ammoniac, the 'Spirits' with which he must have associated the distillate from alum.

² This preparation of ar-Rāzī was copied by the compiler of the Syrio-Arabic Ms. (*vide trans. cit.*, *La Chimie*, II, p. 191, para 151).

V. SELECTIONS FROM JĀBIR'S *USTUQUS AL-USS*.

A. JĀBIR'S CLASSIFICATION OF THE SUBSTANCES USED IN ALCHEMY (*Ustuqus Al-Uss al-awwal*—Bombay Lithographed edition— First Section, pp. 29 and 30).

'The advocates of (the use of) Stone say that the knowledge (of Alchemy) lies only in Stone, and that certainly no knowledge or work (i.e., result) lies in Animal or Vegetable. They say that the alchemists, in giving the description of *Al-Ḥajar*, hinted at¹ Mineral bodies and not at anything else, and these are the Sulphurs, the Arsenic Sulphides, Mercury, and the 'Bodies'². They are classified as 'Spirits' (*Arwāḥ*), *Ajsām*, 'Souls' (*Nufūs*) and 'Bodies' (*Ajsād*)³. The alchemists have made distinctions between them, and say that 'Spirits' are those that volatilise over fire. These are of two varieties, and their total is six—viz., the Sulphurs, the Arsenic Sulphides, Sal-ammoniac, Camphor (*kāfūr*), the Oils, and Mercury. Three of them are consumed by fire and burn substances which come in contact with them; and these are Sulphur, Arsenic Sulphide and Oil. The other three volatilise over fire, and neither are themselves consumed nor do they consume anything; and these are Sal-ammoniac, Mercury and Camphor.⁴

The meaning of the word 'Spirit' (*Rūḥ*), as used by the alchemists, is 'active tincture,'⁵ because it imparts to 'Bodies' a large amount of 'Spirit.' It is said in this connection: 'Verily in our substances the amounts of *Jism* (inert matter) are small, but the amounts of 'Spirit' are very large.' Thus a small quantity of it (the *Ḥajar*, or Elixir) tinctures⁶ a great quantity of the amounts of inorganic substance. Galen, the Physician, has given a very good example of this when stating that alchemists have given a correct account of their Elixir. A little of it imparts much colour to a large quantity, just in the same way as we find that when one or two *dirhams*⁷ of Yellow Bile are mixed with the 10 *ratls* of Phlegm found in the stomach of human beings, it makes the whole of the phlegm yellow; and the latter

¹ The word used is *روحى* which, in Qur'anic literature, is only used with reference to the revelations of God to the Prophet. No one but a free-thinker would probably have ventured to use this word in referring to alchemists.

² *Ajsām*—possibly a copyist's error for *ajsād*: *vide* next note.

³ On p. 207 (and note), Vol. III of De Slane's translation of the *Prolegomena* of Ibn *Khaldūn*, *Jism* is defined as an inorganic mass possessing length, breadth and thickness, and *Jasad* as a body which is capable of being, or is already, animated with a soul (or spirit).

⁴ This failure of Jābir, when he first began to write, to recognise the reactive power of mineral Sal-ammoniac probably explains why he did not include it in the *Ustuqus* among the 'Stones,' i.e., sources of the Elixir (*vide* next section, p. 396). By the time, however, that he began to write the 'Book of the Seventy,' he had evidently discovered that the distillate of Hair and other organic bodies was Sal-ammoniac, as he devotes several of the earlier treatises to its preparation from these substances. Similarly it is noticeable that Camphor and the Oils are carefully excluded from the list of 'Spirits' given in the 61st treatise of the 'Seventy.' These facts tend to confirm our belief that Jābir really was what he claims to have been—viz., a careful experimenter and recorder of facts that he himself had observed.

⁵ Omitting *البيضة* (before *الفاعل* *الصيغ*), as it is probably an interpolation.

⁶ Omitting a redundant *ما* before *يصيغ*.

⁷ A *ratl* was a pound of 12 oz.: and 10½ *dirhams* went to an ounce.

becomes as bitter as aloes. This is a very good example, and closely resembles (the action of) Elixir.

Between 'Soul' and 'Spirit' there is this difference, viz., that in the 'Spirit' there is no oily property, while the 'Soul' in its very nature is oily. Every oil catches hold of, and enters into, and unites with, the 'Bodies,'¹ so that the property of admixture is found in 'Souls' only, viz., the Oils. According, therefore, to this (classification) there are three 'Souls': Sulphur, Oil, and Arsenic Sulphide: and three 'Spirits'—Mercury, Sal-ammoniac and Camphor. There is an element of doubt regarding Mercury because, with 'Spirits,' it is a 'Spirit' and, with 'Souls,' a 'Soul.' Hence it has much resemblance to the planet '*Utārid* (Mercury) because when the latter is in conjunction with an auspicious star it becomes auspicious and when in conjunction with an inauspicious star it becomes inauspicious, and so on. Owing to this, the distinction between 'Soul' and 'Spirit' is in regard to Admixture, and Inability to mix. That which has the capacity of Admixture is in reality 'Soul': but it is also 'Spirit' on account of volatilization: and that which has no power to mix is 'Spirit' only, owing to its volatilization, and to there being no 'Soul' (i.e., Oil) in it. However, another class of alchemists hold that Camphor and Sal-ammoniac impart colour and exercise (some alchemical) effect;² but this is (only) the opinion of those who have not gone deeply into the matter.

'Bodies' (*Ajsād*) are those (metals) whose 'Souls' and 'Spirits' are complete and perfect, and neither increase nor decrease in proportion to the amounts of 'Body,' e.g., Gold, Silver and all the other fusible 'Bodies.'

Inorganic substances (*Ajsām*) have neither the least power of Admixing, nor have they any connection with this Art except in the opinion of those who have no knowledge and who have not made any experiment with them.³ They are Glass,⁴ Ruby (*Yāqūt*), and similar things to these, such as *Talq*, Diamond, and those substances which are formed from water only, with no oil in them—or which possess very little power of Admixture, as is found in the case of *Maghnīsiyā*, *Māraqashīshā*, and those similar things which are both *Jasad* and *Jism*. These stones are of that class regarding which it has been said that they possess neither 'Spirits' nor 'Souls.'

¹ *Ajsām*—again possibly a copyist's error for *ajsād*.

² I.e., some alchemists reckon Camphor and Sal-ammoniac as 'Souls,' in addition to the above-mentioned 'Souls.'

³ Reading حرت for جرب

⁴ It is very remarkable that, in this early treatise, Jābir regarded Glass as an entirely useless substance for alchemical operations, whereas in his later 'Book of the Seventy' he elevates it to the rank of a metal, i.e., a substance endowed with the attributes of 'Soul' or 'Spirit.' One suggestion that seems possible is that he did this owing to his having subsequently made experiments on the coloration of glass. The change in idea would then naturally follow from his belief that colour is a form of 'Spirit' (*vide* second paragraph of previous page: and end of the second quotation on next page. Another suggested explanation of why Jābir afterwards included Glass among the metals will be found in note 1 to p. 405, *infra*.

B. THE SOURCES OF *Al-Ḥajar*

(*Uṣṭūqus al-Uss al-awwal*—same edition).

(I) p. 28. Almighty Allāh made man perfect in this respect, viz., that he made *Al-Ḥajar*, (the 'Stone') by which the Art (of Alchemy) is performed, a part of man's body¹; and from this part originates the completion, as well as the existence of the art, viz., its method; and also from this part (i.e., the 'Stone') proceeds the adjustment and equilibrium of those (other) parts of the human body.

(II) p. 28 (later). People have differed on account of the ambiguous definition of *Al-Ḥajar*. One class (of alchemists) said that it is Yellow Bile; and another said that it is some part of the (actual) human body. Most of those who have knowledge of how to explain enigmas have agreed that it is the Yellow Bile which is specially found in the gall bladder, because, according to the alchemists,² it is of various colours, red, yellow, green, and blue.

(III) p. 31. People of the first view (i.e., who believe the 'Stone' is obtained from animal sources) are greatly divided in opinion. One class of them believe it to be Bile³ as I have (previously) mentioned, while another class suppose it to be Hair; and these two classes rank highest. Another class hold it to be Urine, Blood and Human Excrement, as I shall describe in the next book. Yet another class said it was only from the Egg and from nothing else; but these (last two) classes have very much less knowledge and are weaker in argument than the advocates of the former two views.

People (who advocate the use) of plants (in alchemy) say that the best are *Ushnān*, *Busr Aḥmar* (red, but only half-ripe, dates), *Shajarah al-Ḥibb*,⁴ *Samrā'* (wheat), and red and yellow flowers, and things like these.

(IV) p. 31 (earlier). [As for those who advocate the use of inorganic substances] they say that the best of them for 'Redness' (i.e., for making gold) are Gold, Iron, Copper and Lead, but for 'Whiteness' (i.e., for making silver) the best are Silver and Tin. They often include Lead in the latter class. Mercury is common to both. The 'Souls' previously mentioned (viz., Sulphur, Oil and Arsenic Sulphide) are common to both in the opinion of those who have knowledge of this Art and

¹ Lit., 'a part of his parts.' The whole paragraph is a curious anticipation of the 'hormone' theory.

² *al-qaum*, lit., 'the tribe.'

³ Lit., 'saw the bile.'

⁴ Lit., 'Plant of Love.' The name is not found in Ibn al-Baiṭār. In Johnstone's Dictionary *hibb* is defined as the seed of any pot-herb or fragrant plant: or a small plant growing among grass. Possibly, however, the *ḥabbat al-ḥaḍrā* or *ban* (Persian word) is meant, as the latter is mentioned in Jābir's *Liber Pinguetinis*, one of the 'Seventy,' as one of the plants yielding an unctuousness from which Sal-ammoniac can be obtained (Berthelot, *ed. cit.*, pp. 356-7).

have made researches in it. But men of insight and learning have often stated that Sulphur is essential for the Red Tincture and Arsenic Sulphide for the White Tincture.¹

¹ This paragraph may very well be compared with the following extracts from the 31st treatise of the 'Book of the Seventy' which give some indication of Jābir's later opinions as to which of the inorganic substances here mentioned (apart from the base metals: but including mercury, which Jābir then classified as a 'Spirit,' and alkali) were useful for preparing the Tincture.

"The wisest say that it is from everything....."

"And many say that it is only from yellow Arsenic Sulphide....."

"Many also say that it is only from Sal-ammoniac....."

"And others say that it is from all ('Spirits'), viz., from Sulphur and Arsenic Sulphide and Sal-ammoniac and Quicksilver, and assign all ambiguities found in ancient books to 'Spirits.'

"Many have said that the Tincture comes only from gold and silver—gold being for making the 'Red' and silver for making the 'White.' And this is the 'Body' which is called the 'Ferment.'

"Others have said that the Tincture is only from Quicksilver and Sulphur when they are mixed, by which they wish it to be understood (that this is due) to the force of the Tincture which is in them....."

"Others indeed say that they (the 'Stones') are the Vitriols, Salts (and) Boraces; and all these are well able to produce either Elixir or the means towards attaining the elixir [aut adunacia ad elyxir]."

"Many also have said that when these are well prepared in the sun, they will be the Elixir, and to this I have already pointed in my books.

"Others, indeed, have said that Alkali is good; but the salt is better. Neither were they able to say that from Alkali the Tincture could not be made. And they themselves use its salt which is very sharp, and make from it the Great Elixir."

VI. THE RELIGIOUS BELIEFS OF THE ŠABIANS (HARRĀNIANS OR CHALDAEANS): AND THE BEARING OF THESE BELIEFS ON THE IDEAS OF AR-RĀZĪ.

(Chwolsohn's 'Die Ssabier und der Ssabismus,' Vol. II, pp. 380-411: translated chiefly from the Arabic writer Ad-Dimishqī—b. 664 A.H./ 1265 A.D.: d. 727 A.H./ 1327 A.D.)

A.—HERMES AND AGATHODEMON:

THE ORIGINATORS OF THE ŠĀBIAN DOCTRINES (§. 9, P. 398).

It is said that the Šābians are divided into two sects: one of them believes in the Supernatural, and they are worshippers of the Stars; and the other in Persons, and they are worshippers of Idols. The former state they received their doctrine from 'Adimūn (Agathodemon) who was Shīth the Prophet, the son of Ādam: but verily in this they lie; and that 'Adimūn obtained this doctrine from *Akhnukh* (Enoch) who is Hurmus al-Hurāmīṣah (=Hermes Trismegistos), who is Idrīs. But in these statements also they lie.¹ The idolators think that their idols are representations of the spiritual attributes of the Stars.²

Some of the Šābians³ believe in the necessity of the (existence of the) stars on account of their revolution and rotation; and they believe that God is both One and Many. He is One in Essence and Eternity, and Many because the One apparently becomes the Many in the different phenomena (of Nature: e.g., the seven Planets).

B. THE TEMPLES OF THE ŠABIANS.

(§§. 1-8: pp. 380-98).

In addition to the following five Temples:—

- (1) A circular domed Temple of 'The First Cause' (i.e., the Creator). Apparently this was a Sun Temple, as the Sun's rays on rising came in at one of the 48 windows, shone in through another at midday, and finally in at another on the opposite side to the first, when it set;
- (2) Temple of 'The First Reason' (similar to the first in shape but without windows);

¹ Later, in §. 14, the graves of Hurmus and 'Adimūn are said to be in the Pyramids. Ad-Dimishqī is far too sweeping in his denunciation of these beliefs of the Šābians. In the Ms. of the *Risālah Aghātādīmūn* in the Royal Library at Cairo, the author states that the Science of Alchemy was bestowed by God upon Shīth bin Ādam, and quotes and explains a saying of Hermes in support of his (Agathodemon's) views. As the explanation is, in turn, quoted by Jāmās in his treatise to Ardāshir, (*vide Memoirs, A.S.B.*, III, p. 59) this 'Treatise of Agathodemon' must date back to at least 225 A.D. We propose to take up its study later when editing the Treatise of Jāmās.

² So both were really Star worshippers.

³ The Harrānians, according to two other Arabic writers—ash-Shahrastānī (1086-1153 A.D.), and al-Maqrīzī (1365-1442 A.D.)

- (3) Temple of 'The Administration of the World' ;
- (4) Temple of 'Form' ; and
- (5) Temple of the Soul (*Nafs*) :

the Šābians had seven others dedicated to the Seven Planets, which they considered as intermediaries employed in their relation to God. They said that the Planets lead to the Angels, who are the Directors of the Planets in the Spheres : and that the Angels will bring them into relation with God (§§. 12 and 13, II, pp. 406 and 408). To the Seven Metals were attached the properties of the Seven Planets, (§. 16), and hence the images of the Planets were made of these metals.¹

I. The Temple of SATURN (*Zuḥal*) was hexagonal, and was made of black stone, and hung with black curtains.. The pictures on the walls of the temple were as follows :—

- (1) that of a black Indian old man holding an axe in his hand ;
- (2) that of a similar old man drawing water in a pail ;
- (3) that of a man meditating on the ancient hidden wisdom ;
- (4) that of a worker in wood ;
- (5) that of a King, riding on an elephant, and accompanied by cattle and buffaloes.

The Šābians had some connection with India, as al-Mas'ūdī says they went on pilgrimage to a temple of Saturn in the land of Sindān, built by the Indian *Māshān*.²

1

§. 16 (p. 411).

"These Seven Metals, according to the Šābians, follow the attributes of the Seven Planets with regard to their colours, natures, attributes and properties. Gold belongs to the Sun in colour, dignity and nobility. The Šābians believe that Silver belongs to the Moon. *Usrub*... is Black Lead ; and regarding this metal the Šābians believe that it belongs to Saturn. Moreover, it darkens the 'Body' and illumines the 'Spirit.' It also spoils metals that are mixed with it. The body of a man who uses a signet ring made of it, gets thin. As for Tin, it belongs, in the opinion of the Šābians, to Jupiter. Copper belongs, in their opinion, to Venus. Iron belongs, according to the Šābians, to Mars."

§. 17 (p. 412).

"The Masters of the Science of the effect of the Heavenly Bodies say that the cause which brings about the formation of the metal substances is the revolution of the spheres and the movement of the stars, and that the object is the benefits which men and animals obtain from them."

Another passage quoted by Chwolson (II, p. 422) from *ash-Shahrestāni* is also of particular interest in its bearing on the origin of the ideas found in the writings of Arabic alchemists. "They call the (Spiritual Beings who preside over the) Houses (of the Seven Planets) 'Masters,' and sometimes 'Fathers' ; and the Elements they call 'Mothers.' The activity of these Spiritual Beings is due to their motion in accordance with a special law, so that, from their movements, effects occur among natural substances and elements, from which also arise compounds and mixtures, the bodily powers, and the spiritual souls similar to plants and animals" (the latter are referred to subsequently by *ash-Shahrestāni* as 'Children'). This supplies proof of the authenticity of the Šābian story, given in §. 9, of the ultimate derivation of their knowledge from Hermes and Agathodemon, for the same ideas are admirably summarised in the saying of the alchemical Hermes, mentioned by Berthelot (*Collection*, I, p. 260) as being quoted by Albertus Magnus ; 'The earth is the Mother of the metals : the sky is their Father'.

² *Yāqūt* (*Mu'jam al-Buldān*—Wüstenfeld's ed., III, p. 164—states that Sindān was 10 parasangs from Al-Manšūrah in India. Le Strange (*Lands of the Eastern Caliphate*, p. 331) notes that Al-Manšūrah was a great city, the capital of the Sind province, and was called Brāhmanābād by the Indians. It was situated in an old channel of the Indus (left bank) about 40 miles N. E. of the modern Hyderabad, and therefore only about 100 miles to the south of

The image was made of Lead, or Black Stone, and was mounted on a throne, placed on a pediment with 9 steps. The sacrifice to it was an old Bull, which was burnt.¹

II. The Temple of JUPITER (*Mushtarī*) was triangular at the base, but the roof and angles were pointed. It was built of green stone, and the walls were painted green. The image is made of Tin (*Qaşdır*), or of a stone connected with *Mushtarī*, and was placed on a throne mounted on a pediment of 8 steps. The sacrifice to it was a male child, aged 3 days, born of a maiden, purchased for the purpose, and a priest. The babe was pierced with a needle till it died. The Mosque at Damascus was formerly a temple of *Mushtarī*.

III. The Temple of MARS (*Mirrikh*) was oblong, and coloured red. Weapons were hung on the walls. The Idol is made of Iron, and was mounted on a pediment of 7 steps. In one hand it held a sword, and in the other a human head, held by the hair. The sacrifice was a red-haired man, who was bound to a wooden frame, and immersed in a vessel containing oil and medicines that dissolve skin and flesh. The corpse was left in the vessel for one year, and then the head was separated and presented to the idol. The head was supposed to prophesy for 7 days what was going to happen for the next year. A famous temple of Mars was that at Tyre; and some even say the temple at Jerusalem was formerly a temple of Mars.

IV. The Temple of the SUN was square, and was of a golden colour. The idol was of Gold, ornamented with pearls, with a King's crown on its head. Round it, on the 6 steps of the pediment, were smaller images of different materials, which represented dead Kings. The sacrifice in this case was the mother of the baby boy sacrificed to Jupiter.² The best-known Sun temple was erected by Hūshank in Egypt near 'Ain ash-Shams.³

V. The temple of VENUS (*Zuhrāh*) was triangular with a long base. It was coloured blue, and its hangings and walls were corn-flower blue (*lāzawardī*). In the temple were placed all kinds of musical instruments. Most of the temple servants were beautiful virgins, clothed in white robes, who continually sang and played on these instruments. The idol had a pediment of 5 steps, and was made of Red Copper. A famous Venus temple was at Mumbij, in Northern

Moheujo-dero, where many relics of prehistoric civilisation in the Indus Valley have recently been discovered by the Indian Archæological Department. An account of the excavation of the site of Brahmanābād—Maṅṣūrah by Cousins on behalf of the Archæological Survey of India will be found in the Survey Annual Reports for 1903-4 (pp. 132-144) and 1908-9 (pp. 79-87).

¹ As regards the details of the worship of the Šābian Planetary Deities, ad-Dimishqi may have become somewhat confused in his reports: e.g., in the case of the sacrifice of a bull here ascribed to Saturn, we find that at Babylon a white bull was offered as burnt sacrifice at the New Year's festival in honour of Marduk, the local Bāl, or Jupiter (Delaporte, *Mesopotamia*, p. 166).

² Possibly an echo of this phase of Sun worship may be found in the fact reported by Zosimus, that Agathodemon called some liquid used in alchemical operations 'Milk of the mother of a male infant' (Berthelot and Ruelle, *Collection*, II, p. 219).

³ Heliopolis, or On. Hūshang, in Firdawsi's *Shāhnāma*, is stated to have been the third King of the First Persian dynasty, and the first man to produce fire by flint and steel (Browne, *Lit. Hist. of Persia*, I, p. 112).

Syria.¹ The weekly service took place on Friday, and an old woman was sacrificed by being burnt to ashes, which were scattered over the idol. In the prayer to the Goddess, she was referred to as 'Wife of the Sun and Moon, residing in Taurus and the Balance'.²

VI. The Temple of MERCURY ('*Uṭārid*') was hexagonal, but with a square inside. Pictures of beautiful youths, holding green branches, and scrolls, in their hands, were shown on the walls. Temples of Mercury were found in Sidon and Farghānah. The image was placed on a pediment of 4 round steps. The service was held on Wednesday. A brown youth who was a good scribe, was intoxicated, and then sacrificed. The body was quartered, and the pieces burnt separately, after which the ashes were thrown in the face of the image. "This idol is made of an alloy of all the (ordinary) metals (*Ma'din*) as well as of *Khārṣinī*,³ and it is made hollow. In the hollow much quicksilver is poured".⁴

¹ This reference is important in confirming the identity of the Mesopotamian Venus (*Ishṭār*) with Atargatis or Astarte, the Mother-Earth Goddess of the Near East and consort of the Hittite Lord of Heaven and of Generation ('*Hadad*'),—the latter being symbolised in the same way as is the modern Indian Siva by the Trident, the Bull, and the Phallus. For a detailed account of the Hittite form of worship which still survived at Hierapolis (Mumbij) in the time of Lucian (c. 150 A.D.), cf. H. A. Strong's *Syrian Goddess* (London 1913). Lucian says that the images of the two principal deities were made of gold, but adds that, in addition to a great altar of brass, the temple also contained 'countless other brazen images of Kings and Priests.' The Hierapolis shrine seems therefore to have been dedicated to both Venus and the Sun.

² Chwolsohn (II, pp. 839 and 840) notes that both Cassianus Bassus in his *Geoponica*, and Paulus Alexandrinus in his *Eisagōgē eis Apotelesmatikēn* (Rudiments of the Science of casting Nativities) assign the following signs of the Zodiac to the Planets:

Mars	Aries and Scorpio
Venus (Aphrodite)	Taurus and Libra
Mercury	Gemini and Virgo
Moon	Cancer
Sun	Leo
Jupiter	Sagittarius and Pisces
Saturn	Capricornus and Aquarius

Cassianus Bassus was a writer of Constantinople who flourished c. 950 A.D. The *Geoponica* is a compilation on Agriculture in 20 volumes drawn from many previous authors, each of whom is carefully named. Astrology is dealt with in the first book. Paulus Alexandrinus was a Greek writer on Astrology who lived in the latter half of the 4th Century A.D.

Ibn Waḥshīya (the Arabic alchemist who flourished about 900 A.D.) gives the same list except that he omits Libra and Pisces.

Chwolsohn adds (*idem*, p. 683) that Taurus and Libra are found associated with Venus in the Chaldaean and Egyptian monuments.

³ Chwolsohn wrongly translates this as 'Chinese Clay': nor did he attempt to throw any light on the meaning of the word.

⁴ In the late *Dabistān* it is mentioned that the temple of the Planet Mercury was specially attended by philosophers, astrologers, physicians and writers (Chwolsohn, *idem*, p. 686). This is in agreement with the fact that the Chaldaean deity Nabū, or Mercury, was the God of the Scribes, and was represented by a stylus (Delaporte, *op. cit.*, p. 194).

The explanation of the use of metallic mercury may be found in the passage quoted by Berthelot (*Collection*, I, p. 257) from Aristotle's 'On the Soul.' "Some say that the Soul gives the Body its proper motion, e.g. Democritus. . . He says that Daedalus imparted movement to a Venus made of wood by placing in it some quicksilver." This association of Mercury with the life of the image makes it easy to understand how it soon took the place of the alloy of metals that at first symbolised in ancient Mesopotamia the Planet Mercury—especially if (as we know from ar-Rāzi) one of the constituent metals was 'almost impracticable.' It is curious, however, to note that even in the 18th Cent. *Makhzan al-Adwiyah* we find this planet still primarily associated with an alloy *Rūy* (in addition to the green semi-precious mineral Turquoise): and only secondarily with Mercury and Amber—*vide* Astrological Table given at the end of this section.

VII. The Temple of the Moon (*Qamar*) was five-sided. The walls were ornamented with inscriptions of silver and gold. The image was of pure Silver, and was placed on a throne mounted on 3 steps. The chief Moon temples were (1) (originally) the famous Fire Temple of Balkh, of which the Barmacides were the priests¹ : and (2) in Harrân where worship continued until the place was destroyed by the Tartars (i.e., 1254 A.D.). A moon-faced man was shot to death with arrows before the image, and his blood was sprinkled over the idol.²

The following is an analysis of the images mentioned above :—

This is in almost complete agreement with the planetary list of the metals and minerals quoted by Berthelot from various mediæval Greek Mss. (one of which is a translation from some astrological work by the 9th Century Arabic Astronomer Abū M'ashar): and, in view of the strength of tradition in the east, the list may, as Berthelot suggests (*Collection*, I, *Trans.*, p. 25), go back ultimately to the Chaldaeans.

It may also be suggested with considerable probability, particularly in view of (a) the fact that there was an outpost of Harrânian civilisation in the Sind Valley from early times: (b) the indications given in the *Mahābhārata* and *Rāmāyaṇa* of Balkh being the place from which the Indian Solar and Lunar races sprung (*vide* note 2—below): and (c) the use, even up to the present day (*vide infra*, p. 410—note on *Khārṣini*, etc.) of a multiple metallic alloy for making divine images in India, that the introduction of Mercury into mediæval Indian alchemy as the chief elixir (*rasa*), in place of the vegetable juices employed in earlier times, originated from Mesopotamia. From a magical point of view the transition is easy, the juices being regarded as the life of the plants just as quicksilver was the 'vehicle' of the life (or even the actual soul) of the image of the Planet Mercury. The theory gains further corroboration from (a) the name given in India to Mercury about 1200 A.D., viz., the Semen of Siva (the Destroyer), in allusion not only to its use as an aphrodisiac, and in magic, but also to its poisonous properties: and (b) that the Lingam, or emblem of Siva, was made of a gold amalgam in India at about the same period (*cf.* Rây. *op. cit.*, p. xlvi). Finally, it is admitted by every one who has studied the subject that the use of Mercury must have been introduced into India from elsewhere. This is proved by the fact that quicksilver is nowhere found native in India, and that it is explicitly stated to have been brought from the country of Darada, or Parada, somewhere outside of India. On the other hand, Mercury and its most important compound, Mercuric Sulphide, was known and used in Europe, the Near East, and China, for hundreds of years before the first mention of it appears in Indian medical works. In China, particularly *Tān Shā*, or mercuric sulphide, was regarded as the 'Elixir of Life' from at least 200 B.C. (*vide* Hanbury, 'Notes on Chinese Materia Medica,' *Pharm. Journ.*, II (1860-61), p. 114). It is all the more necessary to emphasize this, as very recently Sir P. C. Rây, in strange disregard of the mass of published work on the subject, including the striking evidence of the actual texts of his own 'History of Hindu Chemistry', has again stated that the knowledge of pharmacy which the Arabs brought to Europe—especially the use of Mercury and its chief compound, Mercuric Sulphide—was derived from the Hindus (*vide* 'Makers of Modern Chemistry', p. 90).

¹ *Khālīd* bin *Barīnak* bin *Jāmās*, his son *Yahyā* and the latter's two sons *Ja'far* and *al-Faḍl*, acted as Wazirs of the 'Abbāsid Caliphs from 752-803 A.D. Their ancestors had been hereditary High Priests of the ancient Fire-Temple at Balkh—the 'Nawbahar' (or 'Early Spring'—so called because the chief festival was held at that time of the year). *Ja'far* bin *Yahyā*—who was executed by *Harūn ar-Rashid* in 803 A.D.—was a special patron of *Jābir bin Ḥayyān*, and the latter dedicated one of the treatises of the 'Book of Hundred and Twelve' to *Ja'far*. Probably this early work of *Jābir* was written at the instance of the Barmacide family, for—as has already been pointed out—the first two treatises, called *Usūquṣ al-Uss*, are stated to have been written for them, while in addition to the 'Book on the Aims of the Art' for *Ja'far*, two other treatises in this volume are dedicated to other members of the same family.

² *Sin*, the Moon God, was the first of the Sepcon Triad of the Babylonians, the other two members being his children, *Shamas*, the Sun God, and *Ishṭār*, the Planet Venus. At *Ur* he was worshipped under the name of *Nannar*, and his temple there has recently been excavated by the British Museum—Pennsylvania Expedition under *C. Leonard Woolley* (*cf.* *Delaporte. op. cit.*, pp. 139 and 144).

MM. Haraprasāda Sāstri has very kindly pointed out to us the extreme importance of Balkh when considering the question of Indian origins. In the *Rāmāyaṇa* (VII, Chapters 87-90) it is stated that *Bālīka* (i.e., *Balkh*) had *Ila*, son of *Kardama*, a *prajāpati*, as King. This King was a man in one month and a woman in the next. In his feminine guise he was called *Ilā*, and with *Buddha*, the son of the Moon-God (whose hermitage was close by) as husband, she gave birth to *Pururavā*, the progenitor of the Lunar race of Kings, who moved into India and established his capital at *Pratiṣṭhāna*, or *Allāhabād*. *Sasāvinda*, the son of *Ila*, in his male form, retained his capital at *Bālīka*. The *Mahābhārata* (*Sāntiparva*, Chap. 336, verse 20; and *Karṇaparva*, Chaps. 37 and 38)

Image of Planet.	Associated Metal.	Associated Colour.	No. of steps in pediment.	Sacrifice.
I. SATURN ..	LEAD ..	Black ..	9	A Bull.
II. JUPITER ..	TIN ..	Green ..	8	A male infant.
III. MARS ..	IRON ..	Red ..	7	A red-haired man.
IV. SUN ..	GOLD ..	Yellow ..	6	Mother of child sacrificed to Jupiter.
V. VENUS ..	COPPER ..	Blue (but robes of attendants white).	5	An old woman (at the Friday service). ¹
VI. MERCURY ..	KHĀRSĪNĪ (and a mixture of all the other metals).	Brown ..	4	A brown youth who was a good scribe (at the Wednesday service). ¹
VII. MOON ..	SILVER ..	White ..	3	A moon-faced man.

denounces the Bāhikas as being born to no good purpose, owing to their not acknowledging the divinity of Hari and considering emancipation to be chiefly the attainment of a luxurious standard of life in their present existence. The caste system sat very lightly on them: they ate beef and drank wine; and they were shameless in their intercourse with woman, being in the latter respect like the people of the Five Rivers and the Sindhu Sauvīras.

As, in another account, Ila is said to have been the son of Manu, the son of the Sun God, Ila may be regarded as the progenitor of both the Solar and Lunar races of India.

The Rāmāyaṇa only states that Ila's monthly change of sex was due to his having been cursed for some transgression; but the true explanation almost certainly lies in the fact that in Chaldæan mythology Ištar, the planet Venus and child of the Moon-God, was male as the deity of the morning and female as goddess of the evening. Ištar in her feminine form was both goddess of war and goddess of pleasure—a combination of attributes that recalls one of the customs of the Japanese *Samurai*, when going into battle, of using as a talisman a small scroll, containing drawings of all the possible forms of coition.

¹ The two mentions of days in the above list agree with the statement of an-Nadīm who gives the following list of days connected by the Šābians with the Planets (Chwolsohn, II, p. 22). The Šābian names of the Planet deities have also been added to show the mixture of Greek and Near-Eastern mythology in their religion.

Sunday ..	Sun (Hēlios: Gr.),	Thursday ..	Jupiter (Bāl).
Monday ..	Moon (Sīn).	Friday ..	Venus (Balthī).
Tuesday ..	Mars (Arēs: Gr.).	Saturday ..	Saturn (Kronos: Gr.).
Wednesday ..	Mercury (Nabūq).		

The intimate connection between the Harrānian worship and that of the ancient Babylonians is shown by the fact that the arrangement of the list of the Harrānian planets is the same (but in the reverse order) as that of the stages—symbolising the spheres in which the seven planets moved—found by Sir Henry Rawlinson in the great temple of Birs Nimrud or Borsippa near Babylou (*cf.* Rawlinson, *Ancient Monarchies*—1865 ed.—Vol. III, pp. 382–384). The associated colours, however, were not in all cases the same, the second platform from the ground on the Babylonian *Ziggurat*—dedicated to Jupiter—being a rich red brown instead of green; the fifth platform, for Venus, being ornamented with pale yellow bricks instead of blue; while the sixth platform for Mercury was blue. The colours of the other four were the same as in the Harrānian list. Possibly the colours were not very rigidly assigned to the different planets.

Finally, it is particularly noteworthy that the Šābian order of the planets is found not only in the list of the Arabic Astronomer Abū Ma'shar (9th Cent.) surviving in various mediæval Greek Mss. in the Bibliothèque Nationale and translated by Berthelot on p. 25, Vol. I, of his *Collection des anciens alchimistes grecs*, but is also preserved in actual use to the present day in India in the Astrological Tables of the influence of the Planets given in the *Mahāzan al-Adwīyah* (*vide précis* on next page).

ASTROLOGICAL CLASSIFICATION,
 IN MUHAMMAD HUSAIN'S *Makhzan al-Adwiyah* (pp. 66-78),
 OF THE METALS AND VARIOUS OTHER SUBSTANCES UNDER THE DIFFERENT PLANETS.

Planet.	Male or Female.	Auspicious or inauspicious.	<i>Filizzāt</i> (equivalent to Arabic <i>Jawāhir</i> -Essences) i.e., Metals and Precious Stones.	Other Mineral and Animal substances—especially those mentioned by ar-Rāzī as being used in Alchemy.
1. <i>Zuḥal</i> (Saturn) ..	Generally Male: but some say both male and female.	Most Inauspicious	Lead (<i>Usrub</i>) ¹ ..	<i>Martak</i> (Lead oxide), ¹ <i>Khubth al-Hadīd</i> (refuse of iron): and hard black stones. Skin, Hair, Nails, Feathers, Wool, Bones, Horn and Urine.
2. <i>Muṣṭarī</i> (Jupiter)	Male	Most Auspicious ..	Tin ¹ (<i>Raṣāṣ al-Qal'ī</i>), <i>Safīdrūy</i> , good <i>Shabah</i> , and Diamond.	<i>Mārqaṣhīshā</i> , <i>Tūtiyā</i> , the Sulphurs, ¹ the <i>Zarnīkhs</i> , ¹ stone in general (<i>hajar</i>), White and Yellow stones.
3. <i>Mirrikh</i> (Mars) ..	Male	Somewhat Inauspicious.	Iron ¹ (and Copper- <i>sic</i> !) ..	<i>Maghnātīs</i> , ¹ <i>Shādany</i> ¹ (haematite), <i>Zunjufr</i> (Cinnabar). Flesh and gall.
4. <i>Shams</i> (Sun) ..	Male—the Pole and Master of Events.	Apparently Auspicious, but actually Inauspicious.	Rubies, <i>Baijādaq</i> (red stones), ¹ all precious stones and pure Gold. ¹	<i>Lāzaward</i> , ¹ <i>Sandarūs</i> , Marble, the Sulphurs, Pharaoh's Glass and <i>Zift</i> (pitch). Also Brain.
5. <i>Zuhrah</i> (Venus) ..	Female	Somewhat Auspicious.	Pearls, ¹ Emeralds, <i>Jada</i> (?) and Copper. ¹	<i>Maghnīsiyā</i> and <i>Kuhl</i> . Grease, Fat and Semen.
6. 'Utārid (Mercury)	Inclined to Masculinity.	Ditto ditto ..	<i>Fairūzah</i> (Turquoise) and Yellow Rūy.	<i>Nūrah</i> , <i>Zarnīkh</i> , Amber ¹ and Mercury. ¹
7. <i>Qamar</i> (Moon) ..	Female: and Mistress of Events.	Apparently Auspicious, but potentially Inauspicious.	Pearls, Crystal, ¹ Silver ¹ and all soft white stones.	'Nabatean Glass,' transparent stones and all stones, both white and oily, Also Skin, ¹ Hair and Nails.

NOTE.—¹ indicates identity (actual or probable) with entries in Abū Ma'shar's list. It seems likely that various other substances have been misplaced by copyists: e.g., *Zift* under Sun or *Asphalt* under Venus; *Kuhl* under Venus or *Stimmi* under Moon; Emerald under Venus or *Smaragd* under Mercury. Cinnabar seems to have dropped out of Abū Ma'shar's list. *Nūshādūr* is not assigned to any planet by Husain; while though *Ammoniakon* occurs in Abū Ma'shar's list, the word probably only refers to some gum (cf. Pliny's *Natural History*, Lib. XII, Cap. 23, and Lib. XXIV, Cap. 6.)

VII. NOTE ON THE CHEMISTRY, AND ASSOCIATION WITH RELIGION AND MAGIC, OF A. *KHĀRṢĪNĪ*: AND B. THREE OF THE ALLOYS MENTIONED IN AR-RĀZĪ'S *Kitāb al-Asrār*.

A—*KHĀRṢĪNĪ*.

The inclusion of this metal by ar-Rāzī among the Seven Metals is of considerable importance in clearing up the history of Chemistry, for, as we have shown in the preceding summary of Chwolson's *Die Ssabier und der Ssabismus*, it clearly indicates one other possible source from which ar-Rāzī may have derived his knowledge of Alchemy, viz., the ancient learning of the inhabitants of the Mesopotamian Valley, and of the last outpost of this civilisation—the town of Ḥarrān in the foothills to the North-West of Mesopotamia. As regards the identity of *Khārṣīnī*—a word of Persian origin, of which the literal meaning is 'Chinese Barb' (i.e., Arrow-head)—it may be noted, firstly, that, in ar-Rāzī's works, *Khārṣīnī* takes the place occupied by *Glass* in the list of metals found near the end of Jābir's 'Book of Seventy.'¹ Secondly, it is an *addition* to the list of the six metals recognised as separate entities both in ancient Egypt and pre-Islamic India.² And lastly, its meaning 'Chinese Arrow-heads' (the wound of which was mortal) points—if not to some very early invasion of Mesopotamia by Chinese hordes who conquered by virtue of the superiority of their metallic arrow-heads over the flint arrow-heads then used by the native soldiery—at least to a further possible source of Arabic Alchemy, viz., the Chinese School of Alchemy which was flourishing at least as early as 200 B.C., and of which the chief exponent, Ko-Hung, wrote his treatise on Taoist Philosophy and Alchemy, called the *Pao p'o tsz'*³ in 330 A.D. (Bretschneider's *Botanicon Sinicum*, pp. 42 and 178).

¹ Berthelot (*Archéologie*, p. 357, note) points out that Glass seems to have been regarded as a metal by the ancient Egyptians: but possibly Jābir, in including glass among the metals, was only using enigmatical language to indicate some other metal with which he, or the Egyptian priests, were acquainted. This is suggested by the following passage quoted by ar-Rāzī from the writings of Hermes in the second Section of the *Shawāhid* when dealing with the preparation of the 'Stone.' "He (Hermes) also said in a passage in which it was his intention to mystify: 'An earth which we call *Zuhrah* (Venus). It is Glass. It is a plot of ground belonging to the Sages in which they sow all their Tinctures.' He means by saying *Zuhrah* is Glass, the ground, which is the dregs. When it becomes white it changes into glass and *talq* (mica), as it is of the same nature as glass and *talq*. Moreover, it is as clear as they are. It is the ground of the Sages in which the Tinctures are sown by purification (*tašfiyah*), and the addition of Water. If you sow *Shams* (gold) then (you will obtain) *Shams*: if *Qamar* (silver), then *Qamar*; whatever you sow, that will you reap." As Jābir quotes the last mentioned phrase in the 'Book on Mercury': "And the tincture of each Elixir is according to its preparation. Just as certain have said 'As thou shalt sow, so also shalt thou reap'. Know this (well):" (*op. cit.* p. 352), it is quite possible that he was acquainted with this passage of Hermes. It may be added that the 'Book of Mercury' is included as one of the 'Seventy' in the Latin version, but seems from the *Fihrist* to have been actually one of the treatises Jābir wrote to explain the ideas of Balinās (Apollonius).

² For the former *vide* the extract from the 4th Century Greek writer Zosimus (quoting his predecessor Democritus) given on p. 167, Vol. II, of Berthelot's *Collection des anciens alchimistes grecs*: and for the latter Sir P. C. Rây's extracts from the *Caraka* and *Suśruta* ('History of Hindu Chemistry', Vol. I, pp. 13 and 26). It may be further noted that the Egyptians, although they regarded Copper, Iron and Tin as distinct metals, also believed that they were only modifications of Lead.

³ I.e. 'Old Sober-Sides'—the nickname given him in derision by men of the world and adopted by him as the title of his chief book on Alchemy. The following details may be quoted from a translation which Mr. T. Haneda of Kyoto

The literature of *Khārṣīnī* is somewhat meagre, and though the following account—quoted from pp. 203–208 of Wüstenfeld's edition of al-Qazwīnī's *Kitāb 'Ajā'ib al-Makhlūqāt*—is of rather a late date (c. 1275 A.D.) and deals with various other matters besides *Khārṣīnī*, we quote it as probably summarising the ideas that were current in Mesopotamia in the 10th and 11th Centuries.¹

Pp. 203 and 204 "Mineral bodies (*ma'danīyāt*) are bodies (*ajsām*) produced from moist and smoky exhalations in the earth when these are mixed in various ways in quantity and quality. They are either of strong or weak combination (*tarkīb*). That which is of strong combination is either malleable, or non-malleable. The malleable substances are the seven 'Bodies' (*ajsād*)—I mean Gold, Silver, Copper, Tin, Iron, Lead, and *Khārṣīnī*. And that which is non-malleable is sometimes extremely soft, such as Mercury, and sometimes extremely hard like Ruby. The thing that is extremely hard is sometimes liquefied by humidities, and these are the salty bodies (*ajsām*) like Vitriol and Sal-ammoniac. And sometimes they are not dissolved (by moistness), and these are the oily bodies (*ajsām*) like Arsenic Sulphide and Sulphur. The Seven 'Bodies' (*ajsād*) are produced by the various combinations of Mercury and Sulphur, both as regards quantity and quality."

Pp. 204 and 205. "The *Filizzāt* are the Seven Bodies. They (the alchemists) consider that they are produced by the various combinations of Mercury and Sulphur. If both the Mercury and Sulphur be pure and be perfectly mixed and the Sulphur absorbs the moisture of the mercury just as the earth absorbs the moistness of water, and the Sulphur be red, and if in it there be a tinctorial power, and the amount of the two be in (due) proportion, and the heat of the mine cooked them moderately, and nothing of either cold or heat hindered them before the process of coction occurred, they will be coagulated after a long time into pure Gold (*adh-Dhahab al-ibrīz*).

University, made in 1910, for one of us (H. E. S.), while visiting Japan, from an edition published in 1884 A.D. The account of making the 'Yellow' (Gold) and 'White' (Silver) Elixir is chiefly contained in the 4th, 11th and 16th of the 20 sections (out of the 116 of which the work is composed) called *Nuy pēn* or 'Inner Chapters.' The rest of the book seems to be devoted to an exposition of the Philosophy of Taoism. At the beginning of the 4th Chapter, it is stated that a man may prolong his life by taking medicines made from plants but can only become immortal—and incidentally lose his shadow—by the use of the Divine Elixir (*Tān*) made from minerals and metals. The work had, however, to be carried out on a mountain in order that the 'Spirits' of trees and stones might be present, and the whole procedure is inextricably mixed up with magical practices. It is very difficult to make out what substances exactly were used, but among them were undoubtedly the following: Red and Yellow Arsenic Sulphide (the latter apparently being divided into 'male' and 'female'); Sulphur; Mercuric Sulphide (*Tān ḡhā*); Alum; Salt; a blue salt or mineral (? Copper Sulphate or lapis lazuli); White Arsenic; Oyster shells; mica; chalk; and the resin of the pine tree. The resulting Elixir, when thrown on to Mercury, or a mixture of Lead and Tin contained in an iron pot, converted the metal into gold or silver: while if the Elixir was taken as a medicine for 100 days, it made a man immortal, free from disease and capable of going through water and fire (without being hurt). Incidentally 'Water of Sulphur' and 'Blood of Hair' are also mentioned.

The above account is sufficient to prove (a) that Chinese Alchemy was concerned almost entirely with Mineral Chemistry: and (b) that Ko-Hung's materials were so extraordinarily similar to those used by Arabic and Greek alchemists that it is certain that Chinese, Greek and Arabic alchemy must have had a common source of origin.

¹ Al-Qazwīnī constantly quotes Ibn Sinā's *Qānūn* and *Shifā'*: and the Physics section of the latter was certainly consulted in writing this account. The references to *Khārṣīnī* were apparently, however, quoted from some other writer.

If the Mercury and Sulphur be both pure, and the mercury be properly cooked with the sulphur, and the sulphur be White, then Silver will be produced from them. But if, before the operation of coction, some coagulating cold comes in contact with the mixture, then *Khārṣīnī* will be produced. If (on the other hand) the Mercury be pure, but the sulphur be not of good quality, and there is in it a consuming power, then Copper will be produced."

P. 208. "The formation of *Khārṣīnī* is like the formation of the other 'Bodies' mentioned above. Its mine is in the land of China. Its colour is black¹ (? White), inclining to redness. All spear (or arrow) heads (*naṣl*) made from it are very injurious: and fish-hooks are made from it by which large fishes are caught, because, when they are hooked, they cannot escape from the hook except with great difficulty. From it also is made a mirror from which a paralysed man derives benefit if he sits in a dark room and keeps gazing at it, for this is the best treatment for palsy. From it also is made pincers by which hairs are pulled out: and if the place where they were is then oiled several times, the hair will not grow (again)".

Beyond what is contained in these extracts from al-Qazwīnī we only possess the following information:—

- (1) *Khārṣīnī* was regarded by the Chaldæans as different from the other metals (*supra*, p. 401);
- (2) It resembled the metal of which mirrors were made, but was softer (ar-Rāzī's *Kitāb al-Asrār*, *supra*, p. 371);
- (3) Another name for it was 'Chinese Iron', so that we may assume that it was a white metal. Aṣ-Ṣafādī (writing, however, long after ar-Rāzī, as he died in 1363 A.D.) in his commentary on at-Tughrā'i's *Lāmīyat al-'Ajam* (which was the basis of Ḥājī Khalfā's long account of Alchemy) also states that the cauldrons that came from China were made of it (Wiedemann's *Zür Alchemie bei den Arabern*, p. 9);

Although the last piece of information suggests that, later on, it was considered (or confused with) an alloy, ar-Rāzī was too good a practical chemist to have classed it among the basic metals unless he had satisfied himself that it was actually one of them, and not one of the five artificial alloys he mentions. Laufer's attempted identification (*Sino-Iranica*, Chicago Field Museum Publication No. 201, 1919, p. 555) of *Khārṣīnī* with the Chinese alloy, *Pai t'un* 'White Copper'—other wise called *Pak'ong* or *tutenague*—which is an alloy of copper, zinc, nickel and a little iron) by equating *Khārṣīnī* with the alloy *Isfīd-rūy* which word also means 'white copper', is effectively disproved by the fact that ar-Rāzī in the *Kitāb al-Asrār* carefully distinguishes between the basic metal *Khārṣīnī* and the artificial alloy *Isfīd-rūy*. We may therefore—following the indication give by ar-Rāzī as to its comparative softness—conclude with some degree of probability that the lexicographers Humbert and Boethor were not far wrong in believing that the original *Khārṣīnī* of ar-Rāzī represented the metal now known to us as Zinc.

¹ That this is certainly a copyist's mistake for 'white' (*aswad* for *abyaḍ*) may be concluded from the account of its formation given in the previous paragraph, as well as the fact that another name for *Khārṣīnī* was 'Chinese Iron'.

It may also be noted that, in the *Makhzan al-Adwiyah*, its place—as the metal associated with the planet Mercury—is taken by the yellow copper alloy *Rūy*, the so-called 'Spirit of Tūtiyā.' This may possibly be an echo of the Šābian use of an alloy for making the image of the planet, but also suggests a reason why al-Qazwini assigns to the copper alloy, *Ṭālīqūn*, which we shall refer in the next section, the same magical properties as he had previously attributed to *Khārṣīnī*.

B. THE ALLOYS, *Isfīd-rūyah*, *Shabah* and *Ṭālīqūn*.

We have been unable to trace any other reference to the last two of ar-Rāzī's list of five alloys, viz. *Tabrūyah* and *Mufragh*. As regards the remaining three, the constitution of *Isfīd-rūyah* and *Shabah* will be clear from what follows. *Ṭālīqūn* seems sometimes to have been confused with *Shabah*: but was also a multiple alloy of various metals.

Isfīd-rūyah.

This is evidently the same as the *Safīdrūy*, mentioned by Abū'l Faḍl in his *Ā'in-i-Akbarī* (Blochmann's trans., pp. 40 and 41). He says: "The people of Hindustan call it *Kānsī* (Bell-metal). It is a mixture of 4 *sers* of copper and 1 *ser* of tin, melted together".¹ Al-Qazwīnī (*op. cit.*, p. 40) calls it 'Chinese Copper.'²

Shabah and *Ṭālīqūn*.

Shabah is mentioned in the 10th Century Syrio-Arabic Ms. in the following passage given on p. 155 of Duval's translation in the second volume of Berthelot's *La Chimie*. "As for yellow copper, its base is red copper. Project on the latter some *tūtiyā*³ burnt in olive oil, and it will acquire a lasting yellow colour both without and within, and will satisfy the touch-stone. This is *Shabah*."

The following references to *Shabah* and *Ṭālīqūn*, as well as to *Rūy Tūtiyā* and other varieties of *Rūy* are found in the *Makhzan al-Adwiyah*.

"*Rūy Tūtiyā* is *Shabah*. It is also known as *Rūḥ-i-Tūtiyā* ('Spirit of *Tūtiyā*') because it is made from *Tūtiyā* taken from mines and not from artificial *tūtiyās* like all other kinds of *Rūy*. In Persian it is called *Ṭālīqūn*. It is prepared from 4 parts of Copper and 1½ parts of Lead. The people of India call it *Bhangar*" (The last two sentences are also given by Abū'l Faḍl under *Rūy*: *op. cit.*, p. 41).

"*Shabah*. In Persian it is called *Rūḥ-i-Tūtiyā* and in Hindi *Jast*.⁴ It is a well-

¹ These are also the proportions of copper and tin in *Kāmsya* (Bell-metal) given in the *Rasaratnasamuchchaya* which Ray assigns to the 13th or 14th Cent. (*op. cit.*, p. 64).

English 'Speculum metal' contains 3 of Copper to 1 of Tin, while an ancient mirror has been found on analysis to contain Cu 62% : Sn 32% : and Pb 6%. The nearest approach to the proportion of Copper in *Isfīd-rūyah* or *Kāmsya* is found in the metal used by the Chinese for mirrors, which, however, also contains Antimony (Cu 80.9 : Sn 10.7 and Sb 8.5) : *vide* Hiorns' 'Mixed Metals', 1912 ed., p. 247.

² This may be an error on his part if Muḥammad Husain is correct in his statement (next page) that 'Chinese Copper' was made from Copper and a little Lead.

³ Not 'antimony', as Duval states. The *tūtiyā* will be reduced by combustion with the oil; and the method points to it being either Lead or Zinc Oxide.

⁴ *Jast* is probably *Jasada*, or Zinc, which was recognised as a separate metal in India as early as 1374 A.D. (*cf.* Ray *op. cit.*, p. 36). This knowledge may, however, have come from Persia, for Laufer (*Sino-Iranica*, pp. 511-515) states

known substance obtained from mines. If we mix $\frac{1}{3}$ rd *Shabah* and $\frac{2}{3}$ rds Copper, or $\frac{1}{4}$ th *Shabah* and $\frac{3}{4}$ ths Copper, a kind of yellow Body is produced like Gold which, in Persian, is called *Birinj*, and in Hindī *Pital* (brass).¹ In constitution (?) it is between Lead and Tin, but is melted with more difficulty than they are. It is inclined towards blue (*sic!*) in colour: but its colour is not very pronounced. Vessels made of it are very useful to hold cold water, and rose water and other extracts, as their properties are not effected by it".

"*Tālīqūn* is a Greek word.² In Arabic it is called *Şafar* (yellow) and in Persian *Mis* (usual meaning 'Copper'). *Rūy* is similar to it, as we get both of them naturally from the mines. It is of two kinds: one, artificial, and the other, natural. The latter is yellow *Mis*, similar to *Birinj*.

The artificial is made as follows:—

- (1) From Copper and *Rūh-i-Tūtīyā*. It does not become black by burning or hammering, as other forms of *Mis* do :
- (2) when *Mis* is repeatedly melted, and poured into cow's urine, boiled up previously with *Ushnān*, and then a little Lead is added. This is called 'Chinese Copper': and
- (3) From the Seven 'Bodies', Gold, Silver, *Mis*, Iron, Lead, Tin and *Rūh-i-Tūtīyā*. In Persian it is called *Haftjūsh* (seven times fused) and in Hindī *Kānsa*."

Tālīqūn was apparently first mentioned in the pseudonymous 'Stone Book of Aristotle' which Ruska believes to have been translated into Arabic from Greek or Syriac towards the end of the 9th Century A.D., or, in other words, in the early life-time of ar-Rāzī. Near the end of that book, under Copper, the following passage is found.

"When a hook (*sannārah*) is made containing (only) 1 *dānaq* (=2 carats) of *Tālīqūn*, it will catch a fish weighing 100 *raṭls*, and the fish will not be able to free itself from the hook. If anyone is suffering from facial paralysis and enters a dark room and directs his face towards (a piece of) *Tālīqūn*, he will be cured from the palsy. And when *Tālīqūn* is heated and quenched in water, flies will not approach the water. And when hair is pulled out thrice with (pincers made of) *Tālīqūn*, it will never grow (again). This is also done with hair which grows within the eyelid".

that the mining of *tūtīyā* ore in Kirmān was mentioned by Ibn al-Faqīh in 902 A.D. and that al-Jawbarī describes the smelting of the ore about 1225 A.D. *T'ou-shi*, the Chinese word for brass, from which the word *tūtīyā* may be derived is mentioned (a) in Chinese records as a metallic product of Sāsānian Persia: (b) by Huan Tsang as a material from which Buddhist statues were made (he adds in one place that it is found in Northern India): and (c) in 718 A.D. as an alloy (used in making official girdles) which came as tribute from near Samarqand. The oldest copper-alloy coins in Europe (down to Augustan times) were of bronze—often alloyed with lead: but brass coins began to appear in the 1st Century A.D. (Hiorns, *op. cit.*, pp. 214 and 138). Pliny (*Natural History*, XXXIV, Cap. X) gives a long account of *Cadmia*, the mineral from which brass was then made, but it is clear from his account in Cap. IX of the same book that the addition of Tin to the melt was still favoured when he wrote.

¹ Thompson (*op. cit.*, p. 69) mentions an Assyrian Copper-Lead alloy of the 7th Cent. B.C. (for overlaying bronze), which apparently consisted of 6 of Copper and 1 of Lead. This would approximate in constitution to the alloys here mentioned. He adds that a Copper-Lead Alloy was used in Babylonia as early as the time of Būr-Sin, a King of the Second Dynasty of Ur (i.e., prior to 2300 B.C.).

² Cf. note 6, p. 377, *supra*.

Here we find appearing some of the very same magical properties that al-Qazwīnī ascribed to *Khārṣīnī* and we therefore looked up with some interest the passage in which he deals with *Tālīqūn*. This is what is found on p. 230 of Wüstenfeld's edition :

"*Tālīqūn* is Copper to which medicines have been added so that it becomes very hard. In Persian it is called *Haftjūsh*. They (scientists) say that if arrow-heads are made, containing a little of it, and an animal is struck by the arrow, it will cause a great wound. Arastū (Aristotle, in the 'Stone Book') said it is of the species of Copper. But they have thrown on it absorbent medicines so that a poisonous character appears in it. If an animal is wounded by it, or if the arrow comes in contact with its blood, the animal will be (seriously) injured. From it, hooks for catching big fish are prepared. The fish cannot free itself when it is hooked, however large the fish may be and however small the hook may be, because *Tālīqūn* causes severe pain, which is due to the poison it contains. If a man suffering from palsy, enters a room in which there is no light, and continually gazes at a mirror made of *Tālīqūn*, he will be freed from his palsy. And whoever heats *Tālīqūn* and plunges it into a fluid, no fly will come near the latter. And when *Tālīqūn* is rubbed with honey and left in the sun, flies will not come near it. And if pincers, prepared from *Tālīqūn*, are used to pull out the hair from a place repeatedly, the hair will never grow again."

The nett result of this comparison of the different passages is that—apart from furnishing an excellent example of the expansion and alteration that has always to be guarded against in Arabic texts—al-Qazwīnī is found assigning to *Tālīqūn*, the very same magical properties he had previously (p. 208) assigned to *Khārṣīnī*. On the other hand, ar-Rāzī, who was probably acquainted with the 'Stone Book,' carefully differentiates between *Khārṣīnī* and the alloy *Tālīqūn*: and we are, therefore, again confirmed in our belief that ar-Rāzī's *Khārṣīnī* was actually some previously unknown metal.

Later, owing to its rarity, the place of the 'improcurable' *Khārṣīnī* was evidently taken by the magical alloy *Tālīqūn*, *alias Haftjūsh*: and the transference must have been made all the easier by recollection of the association of both *Khārṣīnī* and an alloy, with religious worship. We may, indeed, in this connection, add another—and final—suggestion, viz., that the use of an alloy of seven metals for making the image of a deity in ancient Chaldaea explains for the first time the employment in the same way—even up to the present day—of a similar alloy of Copper in India, viz., *Ashtadhāt*. It is worth quoting, in the same connection, another passage from Abū'l Faḍl (*op. cit.*, p. 41), as he clearly recognised at least the chemical relationship of *Haftjūsh* to *Ashtadhāt*.

"5. *Haftjosh*, like the *Khārṣīnī*, is nowhere to be found: it is said to consist of six metals. Some call it *Tālīqūn*, while others give this name to common copper.

6. *Ashtadhāt*, a compound of eight metals, viz., the six of the *Haftjosh*, *Rūh-i-Tūtiyā* and *Kānsī*. It is also made of seven components."

It may be added in support of the suggestion that Hinduism has borrowed the

use of a magical alloy for making images from ancient Chaldaea that al-Mas'ūdī's information regarding the existence of an outpost of Mesopotamian civilisation in the Indus Valley has recently been fully corroborated by the epoch-making excavations of the Indian Archæological Department at Mohenjo-dero and Harappa, the latter site being on the left bank of the Rāvi, near Montgomery, (N.-E. from Multān), and about 400 miles N.E. of Mohenjo-dero.

VIII. ARABIC TEXT OF THE *MADKHAL AT-TA'LIMI*.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

عونك يا لطيف اعلم ان لكل صناعة آلات و لتلك الآلات اسماء يعرفها اهلها و يجهلها غيرهم و للصناعة المعروفة بالكيمياء الآت و عقاقير و لها اسماء يعرفها اهلها و يجهلها غيرهم و لابد لمن يريد الدخول في شيعى¹ منها من معرفتها باسمائها و اعيانها و جودتها و رداوتها و هذا كله فان عرفه الداخلى فيها فبعد مدة طويلة بعد اكتناء² جواهرها و افعالها...³ فى ذلك و قد جمعت من ذلك ما اذا عرفه العارف [كان⁴] فيها كاحدهم و فهم عنهم و الله الموفق للخير بمته و قدرته اول عقاقير هذه الصناعة هى التى يسمونها الاجساد و انما سموها بذلك اعنى بالاجساد لان العقاقير على ضربين فمنها ما يتبخّر⁵ و يطير عند ملاقاته [النار⁶] و منها ما يقوم و يثبت و يسمى اهل الصناعة الثوابت الاجساد لغلظ الجسد و ارضيته و سموها الطيارات ارواحا للطرف الروح و الاجساد هى الشمس و القمر و المشتري و زحل⁷ و المريخ و الزهرة و الخارصينى و القلعي⁸ ما يصير و الاسرب الاسود الذى لا يصير و الخارصينى غريب شبيه بالمعدهم و الارواح النار و الفرار و الزرنيخ و النوشادر فهذه كلها تطير اذا هي جعلت على النار فلذلك سموها ارواحا و منها اثنان يطيران و لا يحترقان و اثنان يطيران و يحترقان فالدان لا يحترقان و يطيران العقاب و الطيار⁹ و الدان يشتعلان و يطيران الكبريت و الزرنيخ و كلما طار من النار من المياة و الرطوبات سموه روحا و كل شئ ثقيل غليظ قائم على النار¹⁰ سموه جسدا و من عقاقيرهم الملح و هو انواع فمنه العذب و منه المر و منه اندرانى و منه نبطى¹¹ و منه البيضى و منه العقاب و منه ملح القلي و منه ملح البول و منه ملح الغورة و منه ملح الرماد و منه ملح هندي و منه طبرزد و منه اندرانى احمر يخرط منه اطباق و صوانى فالملح العذب ما يؤكل و الملح المر الذى يجلو به الصاعقة الفضة و الاندرانى الذى له شفيف و النبطى الذى يبعه ربح¹² النبط و هو فى صلابه الاندرانى¹³ غير ان فيه سواد ازربج [لانه يوجد¹⁴] فى سبخة معادن النبط و الطبرزد صلب ليس له صفا و الاحمر صلب احمر و الهندي ملح اسود مثل الطبرزد فى صلابته و ليس له شفيف و البيضى يجئ معه ربح البيض المسلوق و العقاب الجيد منه ابيض صاف قطاع بضويين¹⁵ يؤتى به من خراسان و من سموقند حريف يحرق اللسان و منه معمول و هو عطار الشعر و منها ملح القلي و له حفة كيف يعمل و كذلك ملح البول و ملح الغورة و ملح الرماد و صفة ذلك و صنعته تكتم الاعد اهلها و العارفين به و العقاب صلبان ضرب هو ما ذكرنا و ضرب يتخذ من الشعرو صفة ذلك تكتم هاهنا و منها البوارق و هى اصناف فمنه بورق الخبز و هو ابيض قطاع و منه الذى يسمى النطرون و هو احمر¹⁶ خير من بورق الخبز و منه بورق الصاعقة و هو الابيض الشبيه بالسبخة التى تظهر فى اصول النحيطان و منه الزاروندى و هو اجودها و لونه الى الحمرة ترابى و منه بورق الغرب¹⁷ و هو يكون فى شجر الغرب و منه

1 Ms. الشى.

2 Ms. اكتناء.

3 Ms. worm eaten: probably the word is افعالها.

4 Omitted in Ms.

5 Ms. بخر.

6 Ms. only ملاقاته.

7 Ms. الزحل.

8 Ms. القلى.

9 Ms. واطيار.

10 Ms. قادم النار.

11 Ms. النبطى.

12 Ms. ربح النبطى.

13 Ms. الادوانى.

14 Conjectural reading: Ms. worm-eaten.

16 Text مصرس but cf. three lines lower.

16 Corrected from Escorial Ms. No. 700. Ms. الى الحمرة.

17 Ms. الغرب: but cf. Syriac text and also Escorial Ms. No. 700.

التفكار وهو معمول وصنعه مكتوبة في كتب الصنعة ومن عقايرهم الزجاجات وهي ضرب من فمها اخضر واصفر
وابيض صنفان صنف يسمى المنجاني وهو الذي فيه عروق خضر وانما سُمي منجانيا لانه يجلب من
منجان¹ وهو بلد بالبحر والصحف يسمى الشب وهو الابيض اللون الخالص فمذه صلب ومذه رخو ومكنه
اذا بللته² بالماء وذلك به العفص لم يسود فكل ما لم يسود فهو زاج ابيض والاصفر على ضرب من فمها زاج العبر
وهو الذي كسره شبيهه بالصمغ وهو خير الزجاجات ومذه زاج الاسكفة وهو الذي فيه عيون³ جوهر وفيه تقارن في
اجناسه ومذه احمر وهو السورى الجيد وهو عزيز قليل والاخضر الذي يسمى قلقند⁴ ومكنه انك اذا
بللته وحكته على الحديد حمرة والقلقطار اصفر واحمر يعمل عمل القلقند والقلقديس شب ابيض رمادي يستعمل
من القلقند فينتقل الى القلقديس وهو اجودها ومن عقايرهم المرتثيثا وهو على الوان واشكال فمنها كانه
سجاجات الدرهم ومذه مدور كانه البنادق ومذه قطع حجارة كبار وصغار غير محدودة الشكل وهي في اجناسها
ضروب فمن ذلك اصفر كالذهب يسمى الذهبي ومذه ابيض يسمى الفضى ومذه احمر يسمى النحاسي
وليسست ججرية لكنها مثل الجواهر ومن عقايرهم المغنيسيا وهو اصناف فمذه تربة سوداء⁵ وفيها عيون بيض
لها بصيص ومذه قطاع فيها تلك العيون ومذه مثل الحديد ومذه احمر واصناف اخرى تتقارب ومن عقايرهم
التوتيا وهو حجر ومذه اخضر ومذه اصفر شبيهه بالقشور وهو ضرب ابيض وهو هذبي وهو عزيز ومذه اصفر
وهو خزري واخضر وهو كرماني ونوع مذه يقال محمودي والنواع اخر لها اسماء والهندي مذهب معمول ومن
عقايرهم الدهنج وهو حجر اخضر ويتخذ مذه الفصوص والخرز وكذلك الفيروزج⁶ الا انه اقل خضرة من
الدهنج ومذه اللازورد وهو حجر لازردي⁷ فيه عيون برافة يتخذ مذه خرز ومذه الطلق وهو انواع مذهب بحري
ويمانى⁸ وجبلي وهو يتصفح اذا دق صفائح بيضا راقا لها بصيص وبريق يجعل في لدخنة مريم ومذه
الجبسين وهو حجر ابيض جبلي ومذه الشاذنه وهو حجر احمر مذه⁹ شبيهي عدسيا والآخر¹⁰ يحمر الذهب ويلونه
لانه جوهر¹¹ النحاس ومذه الكحل وليس هو حجر حجري (sic) لكنه مثل الجواهر وهو حجر¹² الاسر
والمسحقونيا وهو شبيهي يسيل من الزجاج وهو على سبيل الملح صلب ذاتب ابيض قوي¹³ فيه قوة باسة
والشك وهو ضربان اصفر وابيض يؤتى به من معادن الفضة من خراسان¹⁴ وهو لدخان الفضة
والدرص وهو ماء الحديد والسكر¹⁵ وهو حجر عذد الصقارين يكون والراتنج وهو صمغ الصنوبر ومن عقايرهم
الزرننج وهو ثلثة ضرب احمر واصفر واخضر واجودها الصفائحي الذي يستعمله النقاشون وادوها الاخضر
ومذه العقاير المولدة التي ليست باصلية وهي المرتك والمرداسنج (sic) وزعفران الحديد والزنجار
والاسرنج والزنجفر والاسفيداج والدرص والشك والسكر¹⁶ والتوتيا وقد ذكرنا اصل تولدها في كتاب عال

1 Ms. منجاب.

2 Ms. بللت.

3 Ms. عيونى.

4 Another reading, found in the margin of the Ms., is قلقنت.

5 Ms. اسود.

6 Ms. فيروزج.

7 Ms. الزوردي.

8 Ms. cf. *Mafātih al-'Ulūm*, ed. Van Vloten, p. 262.

9 Ms. فيه.

10 From the *Mafātih al-'Ulūm* it would appear, likely that the word خلوقيا has been omitted after the word الآخر

11 Ms. جواهر.

12 The *Kitāb al-Asrār* (Ms. cit., f. 4 v.) as well as *Mafātih al-'Ulūm*, (p. 262) read الاسر

13 Ms. اقوى.

14 Ms. worm-eaten. Probably the words وهو ايضا معمول are omitted.

15 Ms. الشكنه.

16 Ms. والشكندق التوتيا.

المعادن وهو الكتاب التالي لهذا الكتاب فليقرء من هناك * ذكر الآلات فاما الآلات المشهورة فى هذه الصناعة فممنها آلات لتذويب الجسك والاحجار ومنها آلات لتدبيرها فالآلات الذوب الكور والبوظة والماشو¹ والراط والرق الذي يُفغح به وبعد هذا الآله لمن دقق² النظر فى هذه الصناعة فاستمرت به الايام³ والمدة وهذه تعرف من اهل الصناعة⁴ الذين يعملون الاعمال الكبار- فان تعرفها منهم يغني عن التفسير ومنها شبيعى يسمونه بوط بربوط يصلح لعمل الاستنزال ومعنى الاستنزال شبيى يذوب و يذلل من بوظة الي بوظة ويجعل لبوط بربوط بوظة مثقوبة ثقبا اوثقبين فى اسفلها توضع على اخري ويوصل الوصل بينهما بطين ويجعل ما يراد استنزاله فيه وتذيبه قييا فيذوب ويصير فى السفلى ويبقى خبثه ورسخه فوق واشد هذه الاجساد ذوبا الحديد ولا يذوب كالماء الابلاج و ادوية وهذه صفة اذابته⁵ تاخذ من برداة الحديد حاجتك والحق عليها مثل ربعها زرنبيخا احمر مسحوقا يخلط بها وتجعل ذلك فى صرة وتطبخها بطين جيد وتلقيه فى تذور حار ثم تخرجه وتزفه⁶ وتلقى عليه سدسه نظرونا وتلته بالزيت وتجعل له بوظة مثقبة علي بوظة اخري وتاخذ ما يفرزل منه فتذيبه وتاخذ نوشادرا وزاجا⁷ شاميا مسحوقين ملتوتين بالزيت فتجعله بنادق وتطعمه منه وتذيبه مرارا ما شئت فانه يزيد⁸ سرعة ذوب وبياض فان اكثر ذلك ان حتى يتطرق ويصير ذوبه عند ذلك مثل ذوب الفضة ثم المنحاس و اذابته ان يقطع صغارا ثم تجعله فى بوظة فى كور و يطبق الكور بفحم وينفخ عليه حتى يذوب ثم يذر عليه شبيى من بورق الصانعة ويسمى هذا فى كلامهم التطعيم او الاطعام يقولون اطعمه البورق حتى تفتح عينه اى تراه منقلبا⁹ و يذاب¹⁰ الذهب والفضة والرصاص ايسر على الذوب و يذوبان فى مغرفة حديد و اما آلات التدبير والعلاج الذي تعالج به العقائير حتى تصير اكسييرا ومعنى الاكسيير الدواء الذي اذا طعم به الجسد المذاب جعله فضا او ذهباً او غيره الى البياض والصفرة فالقرع والانبيق والقابلة والانبيق الاعمى والاثال والافداح والقنانى والقوارير والصلاية والفهر والمستوفد والاتورن والطابشدان وناخ نفسه والدرج والكورة تفسيره فالقرع والانبيق ما يعمل فيه المراد الانبيق [الاعمى¹¹] الذي على راس القرع غير انه لا ميزاب له ينصب منه الماء الى القابلة ثم ينصب الماء اعنى يجتمع فوق فقط والاعمى هو قرح يركب على القرعة يسيل كل ما ارتفع منها فيه والاثال فيعمل من زجاج او فخار وعمله ان يتخذ طبق من طين الحكمة ومعنى طين الحكمة ان يبدل الطين من الحجر الخالص يوما حتى يختم ثم تجعل فيه مثله دقائق السرقين المنخول بالغربال وشيئا¹² من شعر الدواب المقطع وملحا فى كل رطل طين حفنة وان اردته اصلب فخذنا مسحوقا كالكلحل والاول يجزي وجود عجنه حتى يصير مثل الموم فيتخذ من هذا الطين طبعا على شئ مستور وتجعل تحته رمادا قليلا حتى يرفع اذا اخذ ثم تاخذ اثالا فخارا كان او زجاجا فتكبه عليه حتى تاخذ العلامة وبحري¹³ الوسط ثم يرفع ذلك وقد مكانه ويكون

1 Ms. الماشق. Corrected from the Lucknow Ms. of the *Kitāb al-Asrār*.

2 Ms. دق.

3 Ms. بالايام.

4 Ms. omits اهل.

5 Ms. الاذابة و صفتها.

6 Ms. وتزفه.

7 Sic! Ms. The *Kitāb al-Asrār* in the corresponding passage reads زجاج.

8 MS. برده.

9 Ms. منقلب.

10 Ms. omits و.

11 Ms. has only الانبيق. و. الانبيق has been inserted to make sense and to bring the account in the *Madkhal* in agreement with that in the *Kitāb al-Asrār*.

12 Ms. و شى.

13 Ms. corrupt: perhaps توجد.

قدر الطبق مقدار المكبة التى تجعل عليه و معني المكبة مكبة فخار او زجاج يكون فيها مثل المكبة فوق الطبق و اجعله اطول قليلا فانه ينقص عند جفائه و يمكنك ان تشويه ثم ترد الاثال في مكانه اعنى في الموضع الذي عملته و اترب و اغمره حتى يبلغ المقدار و يسد حواليه بالغمرة و هي الطين و طين الاثال كله ان اردته محكما مرة بعد مرة فان كان اثالا فويبا على النار ففى مرة واحدة قدر غلظ عقد و ينظر ان يكون التطين مستويا لا يكون موضعا رقيقا و موضعا غليظا فاذا جف احسن الجفاف فاقبله فيصير الطين فوق الاثال شديها بالرف و قدر المكبة عليه و سعه ¹ (sic) جيدا ثم تجعل له تحت الرف باربع اصابع اجنحة كما يكون للمقدر حتى يقع على مستودك فاذا انت نصبتة على المستودك اخذت الوصل بالطين كيلا يرتفع لهب النار الى الرف فيفسده عليك و يفسد ما عليه فاما عمل المستودك فتدور تبنيه و تجعل تحت اسفله حفرة كي يقع الجمر فيها و تجعل له بابا واحدا تدخل الحطب منه و يكون له تحت الجناح ثقب يخرج منه الدخان و القرع و الانبيق لكل شى تريد تقطيره و معنى التقطير ان تجعله فيه و تسد الانبيق عليه و تاخذ الوصل بخرق ملطخة بالخطمي و الاشراس و تدعه حتى يجف ثم تركبه ² على مستودك و تجعل له قابلة و معني ذلك ان تجعل ميزاب الانبيق في رطل كي يجتمع ما يقطر منه فيه ثم توفد عليه على قدر فان كان شيئا رطبا فيذار ليذة بفحم او بغيره و ان كان غير ذلك فعلى قدره و هذا يعرف بالتجربة فان الكلام يطول به فان طال ذاك عليه [قطر ماء ³] صار ماء في القابلة و ذلك يسمى مقطرا من اي شى عملته و قد تجعل هذه القرعة اذا اريد الرفق في قدر ماء و توفد تحت القدر حتى يقطر بسخونة الماء او في قدر رماد و قد تعلق القرعة في قدر يحتاج اليها تعليقا بلا رماد و الاماء و يقطر و تعلم هذا و ما اشبهه بالعيان اخف عليك ⁴ فاسال عنه اهله لتراه فان قال قائل فاذا قائل في ذلك مضطرب الى معاينة الآلات و سوال اهلهما عنهما فماذا افادنا الكتاب اذا قيل نه افادنا ذلك جميع ما يحتاج ان يسئل عنه يريه بجميع اوصافه و في ذلك اعظم الذفع لانك لو اردت معرفة الآلات و العقاقير منهم علي غير هذا الترتيب لاتعرفه الا في زمان طويل علي قدر ما يجري ذكره او يحتاج اليه في الاعمال و لم تومن ان يسمونه مموها بان يسي شى بغير اسمه فاذا علمته من الكتاب قصرت المدة و امننت بالكتاب تمويه المخترعين ⁵ و اما الانبيق الاعمي فانه يحتاج اليه في اعمال طويلة تعرفها ان انت ترقيت اليها و الاعمى يحتاج اليه في عقد الاشياء المذكلة و معنى ذلك ان اهل هذه الصنعة يحكرون بعض عقاقيرهم حتى يجعلوها ⁶ ماء فاذا ارادوا عقده صيرة في قرعة و جعلوا عليها قدحا و شدوا رمله بما ذكرت و يجعلون تحته نارا ليذة و فحما حتى يجمد ذلك الماء و يعود حجرا و لعقد الادهان ايضا و لكل شى يطبخ و الاقداح و القوارير يحتاج اليها لثورية الادوية و ذلك ان اهل هذه الصناعة يسقون عقاقيرهم علي صلاية و يجعلونها في قارورة او قدح مطين و يعلونه بأخر و يسدونه اعنى رأس القارورة بما ذكرته او بضروب اخرى ⁷ من السدادات و يجعلونه في نار على قدر ما يحتاج اليه و يسمونه تشوية و القذاني المطيئة يحتاج اليها في تصعيد كل ما يراد يتعلق في صدرها و ذلك ان اهل هذه الصناعة ربما ارادوا تخنيق شى من هذه المصعدات مثل الزبيق و الزينيم و معنى التخنيق ⁸ ان تخنيق في عنق القذينة و ربما كان قليلا فجعلوه في ماوردية مطيئة و يسمونه ايضا ترخيما فاذا ارادوا بلونه

¹ Probably شيدة.² Ms. تركيب.³ This probably should be deleted.⁴ Ms. فيسلم.⁵ Ms. الممخرقين.⁶ Ms. يحكروها.⁷ Ms. آمنو.⁸ Ms. التخنيق.Corrected from the *Kitab al-Asrar* Ms.

خفقولة بلا دهن وان ارادته جوهرا لتوه بالدهن و خفقوة و عمله ان يلقى فيها كلما تريد قدر ربعها و يكون لها جناح على ما ذكرت و يركب على مستوقد فان لم يكن فيها رطوبات و دهانات سد راسها و ان كانت فيها ذلك وضع عليها صوفة حتى تذهب الرطوبة و تبرى الصوفة يابسة ثم يسد و توفد حتى يتخفق في العنق - معنى المصعدات من الميلاء فما يقطر و من [الازواج ¹] فما صعده بالاثال و التصعيد بالاثال ضروب و الذي يصعد فيه علماء الصنعة فهو الزينق و الزرينق و الكبريت و المنشادر تجعل بعد معالجتها فيه و يكب عليه المكبة و يوقد عليها و يصعد فيصير على الرف و علاجها في كتاب التدابير فليؤخذ من هناك و الاتون مثل اتون الفخار سواد لكنه صغير يجعل فيه ما يراد تكليس و توفد حتى يتكلس و معنى الكليس ان اهل هذه الصناعة يجعلون الثوابت و كل شئ يبردون تكليس مثل التراب منها بعلاج و منها بغير علاج في كيزان مطيئة و يجعلونه في النار حتى يتكلس و معنى ذلك انه يصير مثل الدقيق فيسمونه تكليسا و علاج هذا في كتاب التدابير و اما الطابشدان فانون مقلب النار عليه مثل اتون القلائين يجعل فيه ما يراد ان يمس بالنار رجه و يحرق عنه دهانته في سرعة زمان و نافع نفسه فتغور له اسفل على ثلث قوائم مثقب الحيطان و القرار يصب فيه الفحم و تجعل فيه ما تريد و له دكان من الطين يقر عليه الكوة ² و يعلى بالفحم و له طبق يوضع عليه و يشعل النار فيه و يوضع في موضع تصفقه الرياح فهي النار صلبة في تكليس ³ الاشياء و في جمعها و مداخلتها بالدرب و الدرج هو شبه الدرج من طين ⁴ يجعل فيه الجسد الذي يراد تكليس صفائح او ما يراد علاجه مع الادوية سافا سافا و يطبق بطبقة و يوصل و يوقد عليه و الكوة ما يعالج به البرادة او غيرها من المسحوقات ثم يلقى عليه الدرا و يلت بخل و يجمع في خرقة او قرطاس و يصّر ثم يكب ⁵ عليه طين و يجعل كوة و يجفف ثم يشوى في نار ثم يعالج كيف يراد به و في هذا الذي قد ذكرنا من هذه الآلات و العقاير اذا ⁶ عرفها العارف ازداد كل يوم من تجاربه بها (sic) معرفة و على ما لم نذكر تنبيهها على قدر معرفته و تجاربه و قد يحتاج في التعليم بعد معرفة ذلك الى معرفة افعال الاجساد و الازواج و الاحجار و معنى الاحجار هو ما لا يتطرق كلاجساد و لا يفسد ⁷ مثل الازواج بعضها في بعض عبيطة و معنى عبيطة كما هي قبل ان تستعمل و يقع عليه التدبير ليعرف الداخل في الصناعة افعالها فلا يخطئ خطأ نظيعا و قد ذكرنا ذلك في كتاب علل المعادن الذي هو نال لهذا الكتاب و هو المدخل البرهاني ثم يحتاج الى تدوير الحديد الذي لا يدوب و تصليب الرصاص السريع الذوب و تبييض النحاس الاحمر و تصعيد الزينق و اجماده و تصفير الفضة و الشبه حتى يكون كالذهب ليكون طريقة للدخل الي غير ذلك من كتاب التدابير و قد ذكرناها في كتاب الاثبات فاذا كمل ذلك له و عرف جميع ما ذكرنا في كتبنا بعد هذا الكتاب على الترتيب كتابا بعد كتاب و جعل اول نظره في المدخل البرهاني الذي سمينا كتاب علل المعادن ليعرف تكوين الازواج و الاجساد و الحجارة و المعادن معرفة صحيحة ⁸ ثم في كتاب اثبات الصنعة و الرد على منكريها ثم في كتاب الحجر الذي فيه من اى شئ يكون ثم في كتاب التدبير الذي فيه باى تدبير يكون ثم في كتاب الاكسير

¹ Conjectural ; Ms. worm-eaten.

² Ms. الكور. Corrected from Escorial Ms. of *Kitāb al-Asrār* (fol. rov), and the Latin translation *Liber Bubacaris*. Another possible reading, however, is الكوز following the *Mafāth al-'Ulūm* (Van Vloten's ed., p. 258).

³ Ms. في الكليس.

⁴ Ms. طبق.

⁵ Ms. يكبت.

⁶ Ms. وادأ.

⁷ Ms. يفسر.

⁸ Ms. ذكرنا.

⁹ Ms. سعبحه.

الذي فيه بلى قوة يصبغ الدواء و لم و كيف ثم فى كتاب شرف الصنعة ليعرف شرف الصنعة و اهلها و فضلها و فضل المكتسب على المتكلم ثم فى كتاب الترتيب ليعرف دعارى روساء اهل هذه الصنعة و طريق التجربة ثم فى كتاب التدابير ليعرف لم دبّرت الحكماء ما دبّرت وما اضطروهم اليه و كيف تدبير ما يحتاج اليه ثم فى كتاب المعنى ليعرف معنى الذهب و الفضّة من غيرهما من الاجساد معرفة حقيقة ثم فى كتاب الشواهد ليعرف ان الحكماء الماضيين اجمع كانوا لنا موافقين فى رأينا ثم فى كتاب سر الحكماء و حيلهم ليعرف كيف يدفع عامة الناس و خامة اهلهم و اللاندين به و كيف يتخلص ان هو بلى بالملوك او بعوام الناس فاذا عرف ذلك¹ اجمع فقد تمت حكمته فى هذه الصنعة و ينبغي ان يكون للمناظر² فى كتابنا هذه حظ من الكلام الجدلى لانه ان لم يكن له ذلك لم يكذب بلغ اقصى نهايتها³ و لا يكمل نفعه بها * ثم المدخل التعليمي و هو فى الآلات و العقاقير و يتلوه فى الجزء الثانى المدخل البرهانى و يعرف بعلم المعادن و الحمد لله وحده و الصلوة على رسوله محمد و آله و هو حسبنا⁴ و نعم الوكيل و نعم المولى و نعم المعين *

¹ Ms. جمع.² Ms. المناظرين.³ Ms. نهايتها لا يكمل.⁴ Ms. inserts الله after حسبنا.

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A PERSIAN TRANSLATION OF THE ELEVENTH CENTURY
ARABIC ALCHEMICAL TREATISE 'AIN AS-SAN'AH
WA 'AUN AS-SANA'AH.

BY

MAQBŪL AHMAD, M.A., *Lecturer, Islamia College, Calcutta.*
(to which is annexed a Note on the Chemistry of the processes given in the treatise, by
Professor B. B. DATTA, M.A., *Presidency College, Calcutta.*)



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A PERSIAN TRANSLATION OF THE ELEVENTH CENTURY ARABIC
ALCHEMICAL TREATISE 'AIN AŞ-ŞAN'AH WA 'AUN AŞ-ŞANA'AH.

By MAQBŪL AḤMAD, M.A., *Lecturer, Islamia College, Calcutta.*
(to which is annexed a Note on the Chemistry of the processes given in the treatise, by
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PART I—INTRODUCTION.

In 1905, Messrs. H. E. Stapleton and R. F. Azo published in the *Memoirs* of the Society (Vol. I, No. 4—pages 47–70) a paper entitled 'Alchemical Equipment in the Eleventh Century A.D.' which described a previously unknown Arabic treatise, called the '*Ain aş-Şan'ah wa 'Aun aş-Şana'ah* (Essence of the Art and Aid to the Workers), which purports to have been written at Baghdād in 426 A.H. (1034 A.D.) by one Abū'l Ḥakīm Muḥammad bin 'Abd-al-Malik as-Şāliḥī al-Khwārazmī al-Kāthī.

This incomplete Arabic manuscript had been found in a collection of Arabic treatises in the Library of His Highness the Nawwāb of Rāmpūr. As the treatise was incomplete, only a summary was given, a detailed edition being deferred until some other manuscript could be obtained.

Last year (1925), while looking through the Catalogue of Arabic and Persian manuscripts in the collection of His Exalted Highness the Nizām of Hyderabad, Mr. Stapleton noticed that there was a Persian Manuscript at Hyderabad called *Tarjumaḥ 'Ain aş-Şan'ah* (No. 4 of the catalogue of Persian MSS.), and arrangements were made with the Superintendent of the Nizām's State Library for a copy to be made. On its receipt this Manuscript was found to be actually a Persian rendering of the Arabic manuscript previously described, and Mr. Stapleton handed over the copy to the writer for study.

The manuscript can hardly be described as a translation as it is generally more of the nature of a rough summary of the original chapters. Thus Chapters V and VI are disposed of in only a few lines. The importance of the manuscript lies in its rendering of the Seventh Chapter which was almost completely missing from the Arabic original. Even in this case, it is evident, from the only passage with which a comparison can be made, that the author of the Persian has not strictly followed the Arabic original, so that it will be necessary to obtain a proper Arabic manuscript before a definite edition of the text can be undertaken.

The entire manuscript in the copy that has been received comprises 16 foolscap pages of 19 lines to the page. Most of the first page is a summary of the first 3½ pages of the original and does not require further consideration. The translator

then continues "This humble person consulted many books on this Art and some of (the methods in) these books he tested personally, and certain of the methods he learned from eminent teachers. Thus he learned the roots of the Art, but he found that there was no book clearer than the book called 'Ain aṣ-Ṣana'ah wa 'Aun aṣ-Ṣana'ah, by Muḥammad bin ('Abdal) Malik al-Khwārazmī al-Kāthī'. He (i.e., al-Khwārazmī) completed this book by following the illustrations and precepts of the masters of this Art, and himself made experiments. He copied from learned Sages such as the exalted Chief Abū'l Hasan 'Alī bin 'Abdallāh,

Andriyā the Sage,
Mūsā bin 'Imrān al-Kalīm (Moses),
Khālid bin Yazīd al-Barmakī (*sic!*),
Abū Zayd al-Balkhī
Ma'mar al-Jurjānī (*sic!*) and
the Qāḍī Abū 'Umar al-Khwārazmī.

The compilation of this book was finished in Baghdād—the City of Learning—May Allāh protect it from harm!—in the year 421." The date is thus slightly different from the date 426, given in the Arabic original, but as the difference is only in the unit it is not very material. The translation was made for the benefit of a friend, but there is nothing to show when this was done.

The translator then goes on to give a similar list of chapters to that which precedes the list of names of the Sages in the original. The First Chapter deals with the names of substances and their division into 'Spirits' and 'Bodies.' The Second treats of the description of the characteristic properties of these substances. The Third deals with manipulation (*tadbīr*) and experiment (*tajribah*), and the extent of their use. The Fourth is the same in both MSS., i.e., what are the substances required for making silver (*qamar*) and gold (*shams*). The descriptions of the Fifth and Sixth chapters are also the same in both versions, viz. :—the Fifth deals with the Instruments for the substances (reading *adwīyāt* for *adwāt*—'utensils' of the Arabic text): and the Sixth with the substitution of one substance for another. The Seventh chapter is here said to give the proportions of the substances to be used, and the method by which the work is most easily carried out with small quantities; but from the actual translation found later, it will be seen that the translator describes 4, instead of the 2, 'Pillars,' or Major Operations, which are referred to in the catalogue at the beginning of the Arabic MS. The translator also gives what may turn out to be the 'easy processes in every useful branch of the Art' that are mentioned in the Arabic text; and this forms by far the most interesting portion of the Persian text. These processes, however, are given under the separate heading of 'Chapter on Experiment by Testing and the use of Proper Quantities:' and it is quite possible that this portion of the Persian text may be an altogether separate treatise. Reference is also made in it to 'Four Pillars,' but the processes

given are quite different to those previously given in the rendering of the actual text of the 'Ain aş-Şan'ah.

A brief analysis of the seven chapters will now be given before passing on to the translation of the very important Seventh Chapter.

CHAPTER I.

The translator omits Muḥammad bin 'Abd-al Malik's poetry about himself at the beginning of this chapter, which is entitled "On the names of the substances (of this Art) and their classification." The planetary list of the metals that he gives is (1) *Shams* (Gold); (2) *Qamar* (Silver); (3) *Zuḥrah* (Copper); (4) *Mushtarī* (Tin); (5) *Zuḥal* (Lead); (6) *Mirrikh* (Iron) and (7) 'Uṭārid (Mercury).

The 'Stones' are Sulphur, Arsenic Sulphide, *Qilī*, Lime, Sal-Ammoniac, Salt, *Zāj* (Vitriol), *Marqashīshā*, *Maghnāsiyā*, Alum, *Martak*, and *Maghnāṭīs*. The suggestion previously made that Borax was included in the original Arabic list seems therefore to be wrong, *Maghnāṭīs* being the twelfth Stone. The translator adds "These are the roots of the Art and they are the 12 that have been mentioned," which shows that the Arabic text is faulty. The translator goes on to say that some include among the 'Stones' Malachite, Lapis Lazuli, *Shādanj* and *Tūtiyā*, but exclude *Qilī*, Lime, Salt, *Zāj* and Alum. *Ustrunj*, the other substance included in the Arabic, has evidently been omitted by mistake. The rest of the passage given on p. 54 of the previous paper is translated fairly literally in the Persian; but after the words "if it becomes clear water" on the top of p. 55, the following is found in the Persian: "The principal object of this chapter is to distinguish between 'Spirit' and 'Soul.' After the latter has been slain, it revives when 'Spirit' is added to it, and is (then) capable of penetrating into any 'Body.' Mercury, and Sulphur or Arsenic Sulphide, are the two principal 'Pillars' of this Art, and another (pair of) Pillars are Sal-Ammoniac and Silver, or Tin, or Gold, or Copper. And God knows (what is the best)!"

CHAPTER II.

As the qualities of Gold, Mercury, Sulphur, Arsenic Sulphide, Lime, and *Qilī* are omitted, the contents of this chapter in the Persian are much less than those of the Arabic. Under Iron, the reference to its use in sublimations and solutions is also omitted in the Persian.

CHAPTER III.

This is practically the same as in the Arabic. The Persian MS. omits all reference to *Qalqand*.

CHAPTER IV.

Here a considerable number of omissions in the list for the 'Red' are found. There is no mention of gold, mercury, sal-ammoniac of *Khurāsān*, *qalqant*, *tinkār*, *maghnāṭīs*, *natrūn*, or hens' eggs. As regards the weights, there are only minor differences, e.g., the Persian MS. says that 20 *dirhams* of Sal-Ammoniac of *Khurāsān* has to be used for making the 'White,' whereas the Arabic MS. has 22.

As regards the Salt of *Qilī*, the Arabic MS. mentions that, for the 'Red,' 48 *dirhams* are made out of 1280 *dirhams* of *Qilī*; while the Persian MS. says 40½ *dirhams* are made from 1272 *dirhams* of *Qilī*. 'Salt of Dough' is called 'Food-Salt.'

CHAPTER V.

This is stated to give a description of the Instruments, but only a very brief summary in three lines is found. From the mention of a 'second furnace,' and of 'making gold,' as well as the correspondence of the first two items of the extant Arabic with those of the Persian text, it seems probable that the list is actually that of the instruments for the preparation of the 'Red' which is almost missing in the Arabic. The following is a translation of the Persian :

"Among the 'Instruments' for the medicines used in making the 'White' [*sic!*—? 'Red'] are: *Fihv*; *Ṣalāyah*; 2 *Barānī* (jars) with covers for heating; *Qārūrāh* (phial) for making *Za'frān al-Ḥadīd*; glass Cup (*qadah*): large *Qinnīnah* (bottle) for solution; 'second Furnace' (*kūrah*); *Kalbatān* (pincers); *Māshīk* (tongs); *Būtaqah* (crucible): Stone Mortar (*hāwan*): *Qar'*, *Ambīq*, and *Qābilah* of glass (cucurbit, and alembic, with receiver); large *Mirjal* and *Sahlān* (goblet). Put the medicines in a glass *Qim'* (funnel) under a *Sallah* (basket) covered with moistened felt. The period of solution for making gold is 74 [Arabic 73—for making silver] days, excluding the days in which the medicines are prepared (for solution)."

CHAPTER VI.

This brief chapter, which is not found in the Arabic, deals with the substitution of one instrument or substance for another instrument or substance whenever this is necessary.

The following is the list of the contents, so far as they can be read in the very imperfect MS :

<i>Original.</i>	<i>Instruments.</i>	<i>Substitute.</i>
Pots (<i>barānī</i>) of the <i>Uthāl</i> (Aludel)	2 large Jars (<i>deg</i>), one over the other.	
Glass Cup	Earthenware Cup	
<i>Hāwan</i> (Stone Mortar)	Iron <i>Ṣalāyah</i>	
<i>Qar'</i> (Cucurbit)	<i>Bastūqah</i> (an earthenware vessel)	
Receivers	Large Containers (<i>aw'iyah</i> ?)	
<i>Ambīq</i> (Alembic)	A Small <i>Barnī</i> (pot) of suitable dimensions.	
Pot for <i>Tashwīyah</i> (Assation)	A Big Pot.	
	<i>Substances.</i>	
Filings of Silver.	Filings of Tin (<i>Qal'ī</i>)	
Copper of Mauṣil.	Copper of <i>Khurāsān</i>	
Copper of <i>Khurāsān</i> .	Egyptian <i>Rūsukhtaj</i>	
'Flying' Mercury	<i>Rahī'</i> (?) Mercury	
<i>Martak</i>	<i>Murdāsanj</i>	
Golden <i>Marqashīshā</i>	Golden <i>Iqlīmiyā</i>	
<i>Maghuātīs</i>	Filings of Iron.	

CHAPTER VII.

This is the main portion of the Persian text, and includes an account of four operations called 'Pillars.' Only a short préçis need be given of the contents of this section and of the separate chapter, which is termed "Chapter on experiment by test (or proof) and the use of proper quantities," as a full translation has been given below.

The First Pillar. (I) As noted later by Professor Datta, this appears to deal with the formation of an alloy of silver and copper. The glass cup containing the mixture was heated on a furnace, one and half cubits broad by one cubit high, with a hole on each side of it, so that the wind could enter and the smoke come out.

(I) (a) After the First Pillar there seems to be some confusion in the text as the next process is called the Fifth process. This is a method of making Mercuric Sulphide from Mercury and Sulphur. After they had been triturated together for some time with alum, and heated, the resultant Mercury Sulphide was mixed with yellow Arsenic Sulphide, as well, apparently, as the 'silver' obtained in the first process.

(I) (b) This is followed by a process for making 'Water of Tin,' i.e., Tin Chloride, by acting on an amalgam of Tin and Mercury with Sal-Ammoniac. This, and the following section, includes a summary of the description of the *Uthāl*, with its furnace, given in the previous paper. The account of 'Inhumation,' and the accompanying drawing, confirm the accuracy of the conjectural illustration of this process which was also given in the previous paper.

(2) Then follows under the title 'An important preparation to be remembered carefully' what is seen by comparison with the Arabic text to be the *Second Pillar* of Muḥammad bin 'Abdil Malik. It is the mystical purification of sulphur by washing with a solution of Alum ('The Lion of Solomon') made in the intestine of a goat.

(3) The *Third Pillar* deals with the treatment of Arsenic Sulphide which is converted into a substance as white as ivory, which whitens copper, softens it and removes its bad smell. Probably Arsenic Oxide is meant.

(4) The *Fourth Pillar* deals with the treatment of '*Maghnīsiyā*.' Reference may be made to the relevant portion of the note which Professor Datta has been so good as to add to this paper. The process is specially commended as being better than those known previously to any Greek Sage.

(5) Then follows :

The Chapter on Experiment by Testing and the use of Proper Quantities.

This is divided into various sections.

(a)-(d) First Pillar, Second Pillar, Third Pillar (including the preparation of a 'Red Water' from Hen's Eggs and sulphur), and Fourth Pillar. Details can be found in the translation, as well as in Professor Datta's note.

(e) Preparation of 'Red Gum.' This was apparently an oil prepared by distilling Eggs.

(f)–(i) The description is immediately followed by four methods for preparing various 'Waters,' called 'Pillars of Tincturing,' viz. :

- (f) Water of Sulphur ;
- (g) Water of *Martak* ;
- (h) Water of *Marqashīthā* ;
- (i) Water of Mercury. Then follows :—
- (j) The Process of Fermentation (*Takhmīr*), including :
 - (i) The making of 'Zunjufr of the Sages : ' and
 - (ii) Solution of Hair : and finally,
- (k) The Treatment of Sulphur by heat.

Detailed criticism of the contents of the treatise must be deferred until another MS. of the original Arabic has been found, but as al-Kh̄wārazmī quotes al-Balkhī as an authority and the latter was a friend of ar-Rāzī, it is possible that some of the processes mentioned are drawn from one or other of ar-Rāzī's works.

I have to thank Mr. Stapleton, Principal of Presidency College, for giving me the opportunity of describing this interesting Persian translation, as well as for managing to find time, while acting as Director of Public Instruction, to assist in the preparation of this paper, and in supervising the preparation of the illustrations: and also Dr. M. Hidāyat Husain for much assistance in revising the translation. Whatever value the paper may possess has also undoubtedly been increased by the kindness of Professor Datta in appending a note on the Chemistry of the processes described in the Seventh Chapter.

PART II.—TRANSLATION OF THE SEVENTH CHAPTER OF THE PERSIAN
RENDERING OF THE 'Ain aṣ-Ṣan'ah wa 'Aun aṣ-Ṣana'ah.

The Seventh Chapter is on the description of making the 'White' (silver). If you wish to experiment, begin with the First Pillar, viz. : Ceration.

Its test (*'alāmat*) is that if you put a little of it (the cerated substance) on a plate of copper and apply heat, it will melt and flow like wax, and the surface of the copper will be (white) like silver. The whiteness will in this case not penetrate as it would if the 'sharp' (process) had been used. If, however, you drench it with 'White Water,' the cerated substance will penetrate until it comes out of the other side, and both the interior and exterior (of the copper) will be silver.

I. *Process (tadbir) of the First Pillar—and this is sharp (hādd)—*

Take filings of silver . .	..	4 <i>dirhams</i> :
Filings of the Copper of Mauṣil . .	..	1 <i>dirham</i> : and
Fresh Mercury . . . . .	..	2 <i>dirhams</i> .

First put the filings on a *Ṣalāyah* (flat mortar) and scatter over them a little water and wash them. Add mercury and triturate it with 2 *dirhams* of Sal-Ammoniac, in such a way that all trace of the mercury disappears and it becomes

black. A cup of glass like this figure¹ should then be luted with the following mixture: Dung of animals to the amount of one-third of the clay; sweat and the hair of horses: and a little salt. Cut the hair into pieces with scissors (*miqrād*), and make dough out of these things in a vessel for 10 days. Layer after layer of this mixture should be applied to the cup and dried. Then put the medicine into that cup and close its joint with salt, glue, and barley-flour, and dry it: and put some clay on its head. When it becomes dry, put it on a hearth (*ātashdān*), the breadth of which should be $1\frac{1}{2}$ cubits and the height 1 cubit. Fire is then kindled round the cup, which is arranged in such a way that the fire should not come in contact with the cup, and (so) break it. The hearth should have a hole on two sides so that air can pass in, and the smoke can come out of it. Kindle a very gentle fire with a few reeds or a little charcoal, and if the medicine sublimes in the (head of the) cup it must be collected and mixed with the residue. Triturate and sublime it ten times so that no residue remains at the bottom of the pot (*deg*), but all volatilises. Then it will be coagulated like the Stone of Sa'd-ad-din.²

Then take up the 'Sharp Process.' Its characteristic (*'alāmat*) is that the mercury is amalgamated with the 'Tin without Body,' Silver and Copper. Then melt this amalgam with yellow arsenic sulphide and it will become like dregs; and when the mixture is drenched with the 'Water of Tin' and placed on a hot plate, it will penetrate to the other side.

The Fifth Process.

1(a). Take half a *dirham* each of pure Mercury, Yellow Sulphur and Alum of Yaman. Put half the Alum in a stone mortar and above it half the Sulphur, and, above the Sulphur, the Mercury, and above that Mercury (the rest of) the Sulphur, and above the Sulphur (the rest of) the Alum. Pound them gently so that the Mercury may be amalgamated with the Sulphur and the Alum, and go on rubbing until it (the mixture) becomes dry and looks like clay. Then take a glass and having luted it with 'Clay of Wisdom' let it dry; and place it on a hearth as in the accompanying figure (Pl. I, Fig. 1).³ Let it remain there, so that all the medicines may be cooked, and the Mercury may become dense and black like clay. Then pour that 'Water' out of the cup, and take out that clay, and mix with it $2\frac{1}{2}$ *dirhams* of yellow Arsenic Sulphide. Triturate the mixture in a crucible (*būtah*), and put it on one side so that the constituents may mix thoroughly and may become like dregs. This fused Mercury should be mixed with the treated and sublimed silver, and triturated thoroughly. Preserve it.

1(b). Then take up the work of (making) the 'White Water of Tin.' Its char-

¹ The rough figure in the MS. (*vide* p. 449 of reprint *infra*) shows what might be taken as a beaker of a modern chemical laboratory. For the actual apparatus used *cf.* Pl. I, Fig. 1.

² No other reference has been found to this alchemist: but the name may be a corruption of the Mu'in-ad-din mentioned on p. 64 of Messrs. Stapleton and Azo's paper on the Rāmpūr MS. (*Memoirs, A.S.B.*, III, 1910).

³ Although the drawing is placed here the apparatus shown is evidently the same as that used in the previous process of the First Pillar as well as in the next process for making the 'Water of Tin'. The Plate figure is a composite one, as the side openings are not indicated in this place by the copyist but only in the next two drawings of the furnace.

acteristic is that if something is written with it on a plate (*taṣḥt*) or signet stone, and these are made hot, the writing will appear as if it had been written in silver. And if one takes a sheet of *birinj* (brass) and heats it, and puts it in this 'Water' then it will become white, both externally and internally, with the help of Allāh.

Process of (making the) 'Water of Tin' (raṣāṣ)

Take	Tin (<i>raṣāṣ qal'ī</i>)	..	..	..	10 <i>dirhams</i> .
	Pure Mercury	..	..	..	20 ,,
	White Crystalline Sal-ammoniac of <u>Khurāsān</u>	..	..	..	20 ,,

Melt the Tin (*qal'ī*), take it from the fire, and when it becomes cold scatter Mercury over it and leave them until they become mixed. Then again melt them and shake the amalgam over the fire, and then remove it so that it may become cold. Next put it on a *Ṣalāyah* and pour sweet water over it and triturate it. Then wash it, and having added Sal-ammoniac, thoroughly triturate the mixture and put it in a crucible, luted inside with the 'Clay of Wisdom.' Close its mouth firmly, and heat it for one night on a fire of dung, so arranged that 2 *gaz* [probably cubits] of dung will be both under and over the pot. Then open (the pot), and (having removed the mixture), put it on a *Ṣalāyah* and again triturate it (thoroughly). Then replace it in the crucible and after firmly closing the joint, heat it over a fire for three nights in the manner already stated, so that the 'Spirit' may be calcined with the 'Body' (the Tin). If it (the compound) be then placed on a heated plate of copper, the 'Body' will penetrate along with the 'Spirit'; after which it is placed in an Aludel and sublimed. If, however, it does not penetrate, heat it again until the 'Body' penetrates along with the 'Spirit.'

Next, take the pot of the Aludel—the inside of which is (? glazed)—the length of the pot being one cubit (*dhirā'*) and the breadth one span (*dast*). Its lip should be turned down like that of a *qidr* (cooking pot) and be of this shape.¹ Half the pot should be luted with the 'Clay of Wisdom' to the thickness of a thumb, and on the other half there should be made for it [4 handles] of clay. Dry the sides of the Aludel, and make a round hearth like the hearth of the sweetmeat makers. There should be two round holes, one on the right and another on the left side, at the height of the thickness of a horizontal brick.²

Place the pot (*deg*) on the hearth. The distance between the bottom of the pot and the earth should be one span, and the sides of the pot should be at a distance of 4 fingers from the [sides of the] hearth. Place the medicine in this pot. Take a cover (*sifāl*) of unglazed *ghadār*—the glaze being only placed just above the lips of the aludel—and make a hole at the distance of 3 fingers on one side (of the

¹ The rough drawing of the open aludel is the same as that previously given in the text (p. 449): but immediately afterwards occurs another sketch of the furnace (or hearth), carrying the pot of the Aludel without a cover.

² The translator omits the details given in the Arabic of the dimensions of the *Mustauqad* (height 2 spans and breadth 3 spans) but some light is thrown on the previously obscure measurement *Ṣahānah*: vide Messrs. Stapleton and Azo, *Memoirs, A.S.B.*, I, p. 63.

cover). The hole will be the breadth of a packing needle, so that a bodkin of this shape may enter (*vide* Pl. I, Fig. 2). Join the cover (*sarḫūsh*) and the aludel, and cover it (the junction) with a piece of linen or cotton of 3 fingers' breadth, closing it in such a way that half of the cloth is on the pot and the other half on the cover. The cloth will be covered with 'Clay of Wisdom.' Place the apparatus on a brisk fire, keeping the hole open so that the moisture may go out of it. Then close the hole firmly, and after maintaining the fire for one whole day, remove the bodkin from the hole. If any vapour comes out, the treatment is not over; but if no vapour comes out, the treatment is complete. Then leave it till it becomes cold, and open the joint. Put what has been sublimed, together with the dregs, on a *şalāyah*, and mix with it fresh mercury to the same amount as the dregs, and pound them together; and then put them again in the aludel and sublime them 5 times as before on a brisk fire. The first time it (the sublimate) will be black, the second time whitish-red, the third time ash-coloured, the fourth time light gray (*ashmat*) and the fifth time it will be absolutely white. Then take it out and preserve it.

Solution is next dealt with. . . . Take a phial, sufficiently large to contain the medicine. . . . A sieve (*minḫal*) is inserted in a funnel (*qim'*), and after the medicine (the sublimate) is placed in it the funnel is inserted in the phial and over the bottle is placed a basket (*sallah*) or cage (*qafaş*), made of felt, of this shape (Pl. II, Fig. 3). Heap fresh horse-dung over the cage, and change the dung every week. In 40 days it (the mixture) will be dissolved, and white water will come out by the help of Allāh, the Most High. Then take the 'Sharp Water' which was mixed with the prepared silver, and having placed it in a luted cup with half (the volume) of this (new) Water, place the cup in hot ashes as shown in the figure,¹ and let it undergo coction until it consumes this (the mixed liquid) completely. Then place (the product) on a copper plate and heat it. It will flow on the plate and penetrate to the other side and will make it white like silver.

An Important Preparation to be remembered carefully [Second Pillar].

2. Take 11 *dirhams* of Alum of Yaman, and having pounded it thoroughly put it in the bladder of a goat and close the mouth. Take a Cauldron (*mirjal*) and put water into it and heat it, and place the closed bladder in it. Go on with the coction till the Alum is melted and becomes water. Then take 6 *dirhams* of yellow Sulphur and triturate it on a *şalāyah*. Put it in a glass cup, and drench it in the sun with the water which was in the intestine of the goat, and experiment with it on a hot plate. If it is not affected, neither producing smoke nor being burnt, its treatment is complete: otherwise drench it again with that water, and continue the process even 20 times till it becomes fixed, neither producing smoke nor being burnt.

3. Next begin the Third Pillar which deals with the treatment of Arsenic Sulphide. Its test is that it becomes white and stony like ivory and marble. It also whitens Copper, making it soft and removing its bad smell.

¹ A rough sketch of the cup on a sand bath is given in the text.

This is the Process of the Third Pillar.

Take	Pure yellow Arsenic Sulphide	2 <i>raṭls</i> ,
	Filings of soft iron	$\frac{1}{2}$ <i>raṭl</i> , and
	Salt of food, or bitter salt	$\frac{1}{2}$,,

Triturate the Arsenic Sulphide thoroughly in a stone mortar, or on a iron *ṣalāyah*, and sieve¹ it through silk: and pound the salt into small fragments. Convert the filings into *Za'frān* by the following process. Spread the filings on a sheet of paper on a wooden plank and scatter over them sharp vinegar, so as to wet them completely, and then let the mixture dry in the shade. Test by the feel of your fingers if all trace of the filings has disappeared. If the mixture has become soft, then it is all right, but if not, vinegar should again be scattered over it, and it should be shaken and dried and tested, until it is turned into rust. Pound it thoroughly. Next mix with it the arsenic sulphide and salt and put the mixture in a Copper pot. Fill up the pot with vinegar to a depth of three fingers and stir it with a stick. Cover the (mouth of the) pot with paper, so that dust may not enter into it, and place it in the heat of the sun. Shake it every day, in the morning, at noon, and in the evening; and during the night keep it in the house till it becomes dry. Pound the product in a stone *ṣalāyah*. Then having sieved it through silk, place it in 3 jars (*barnā*) the inside of which has been glazed, the length of each jar being 1 span and each having a cover of this shape [*vide* text, p. 452]. It is necessary that the 'Clay of Wisdom' should be applied to all of them as has already been stated. Dry them in the shade and put the medicines in them, and close their joints firmly with clay. Place them for one night on a brisk fire, or in a hot furnace (*tannūr*), so that below and above will be about a cubit of fire. Remove the jars from the fire in the morning, open their mouths and take out the mixture. Put it on a *ṣalāyah*, and after triturating thoroughly, pour on to it a small quantity of sour vinegar. Then dry the mixture and put it again in the jar and heat it thrice.²

¹ MS. *puzad*, 'boil,' for *bizad*.

² The following translation of the Arabic, which is equivalent to the preceding page, will enable the reader to understand how the Persian translator dealt with the Arabic text. These two sections come immediately before the account on the Aludel translated on pp. 62-64 of Messrs. Stapleton and Azo's paper already referred to. The Arabic text (which was not previously published) will be found in Appendix A. "This is the Chapter on the Preparation of the Second Pillar. Take 11 dirhams of *Ṣhaizam Sulaimānī* (the 'Lion of Solomon'), and after powdering and triturating it, put it in the intestines of a goat, and tie their mouths firmly. Take a cauldron (*mirjal*) or large Pot (*tinjir*), and pour water into it and heat, and put into the water those intestines, and subject to coction for several hours, so that the 'Lion' may dissolve and become water inside the intestines. Then take it out and take 6 dirhams of Yellow Sulphur and triturate it on a *ṣalāyah* and put it in a glass cup, and drench it for 2 days in the sun with the water which was inside the intestines. Then test it on a hot plate. If it remains and does not produce smoke and does not burn, then your object is attained. Otherwise continue to drench it with that water and test it till it remains fixed over fire and does not melt, nor produce smoke, nor burn, though this may have to be done 20 times. Then put it on one side.

Next begin the Third Pillar, which deals with the treatment of Arsenic Sulphide. Its test is that the Arsenic Sulphide becomes white and stony like ivory or marble. It also tinctures Copper very beautifully, making it soft and removing its bad and rapidly diffused smell. And Guidance is from Allāh!

The Third Pillar, which is the Chapter on Preparation.

Take 2 *raṭls* of Yellow Arsenic Sulphide which is like fish-scales, *viz.*, the laminated *Aqshizāq* and no other kind; $\frac{1}{2}$ *raṭl*, or 64 dirhams [text 62], of Filings of Soft Iron and it is the Female, and 1 *raṭl*, or 128 dirhams, of sweet or bitter salt. Triturate the Arsenic Sulphide thoroughly in a mortar of stone or iron—no other being desirable: and sieve it through silk.

Then take the three pots of the aludel which are of this shape [*vide* text, p. 452.]. The length of each should be a cubit,¹ their breadth one span, and their lips should project by about four fingers breadth. Cover them with three earthen covers. Make a hole in (each) cover, as has been stated before in the preparation of the 'Water of Raşāş' (Tin). Heat them for a whole day, at first gently, and then gradually increasing the fire to three sticks, each stick being about 4 finger breadths, and of willow (*bid*). When you remove the test stick from the hole of the cover, if you find that volatilisation is still taking place, make up the fire again, but if not, stop the fire. Leave it one whole night so that all becomes cold. Then open the mouth of the aludel and put the mixture on a *Şalāyah* and pound what has already been sublimed with a small quantity of the dregs for three days. Then mix with it (the powder) one ounce of powdered copper oxide (*rūisukhtaī*), and one ounce of Armenian borax which is used by bakers, and put the mixture in bottles similar to rose-water flasks, the neck of which is thin and long—like this figure.² Half of the phial (*qārūrāh*) should be covered with clay. Put in every phial 4 ounces of fennel flowers (*ashniz*). Make a gentle fire of willow over the head of the phial. After keeping the tube in the head (of the phial) open so that all the moisture can escape, close the head and maintain the fire for a whole day. Then leave it till it becomes cold, and open its

Pound the salt. Convert the filings into *Za'frān* by the following process. Spread the filings on a piece of paper placed on a wooden plank and scatter over them sharp salty vinegar, and stir those filings until the lower and upper portions become moist and the vinegar rises over them and flows away. Let them dry in the shade, and test them. If by the feel of your fingers they appear to be pulverised, then it is all right. Otherwise sprinkle vinegar over them a second or a third time until they are felt, when dried completely, to be reduced to powder. Then pound it thoroughly in a mortar.

Next take the arsenic sulphide and salt and the filings which have been converted into *za'frān*, and put them in a vessel (*qarīf*) of oily *ghaḏār* [gloss: large drinking cup (*jām*)]. Mix them thoroughly, and pour over them sour vinegar, until they are completely covered to the depth of 3 joined fingers, and cover the vessel with a piece of paper tied over it so that the wind may not cause dust to enter, and put the vessel in the sun for several days. Shake it each day thoroughly thrice, in the morning, at noon and in the evening, and place it at night under cover. If the day is cloudy and it is winter, put the mixture in a pot called '*Şahr Zūri*', which is made of pottery (*khazaīf*). Kindle a brisk fire below it so that the vinegar may be driven off and the mixture becomes nearly dry. Expose it to the air on a piece of woollen cloth. If moisture or dampness is not found in it, either after exposure to the sun or to fire, take and pound it thoroughly in a stone mortar.

Then having sieved it through silk, take for it 3 jars of pottery, glazed inside, the length of each of them being 1 span, and each having a cup-shaped cover. The top of the jar will enter into this cover as shown below. [The rough drawing shows 3 jars with 3 covers, the diameter of the latter being greater than those of the jars]. Apply the Clay, made from clay mixed with $\frac{1}{3}$ rd each by measure of dried animals' dung and hair from the mane of animals chopped into small pieces, and made into dough for 10 days. Each of the jars and cups will be luted separately with this clay to the thickness of a thumb and be dried in the shade so that the clay may not be cracked. Then fill the jar with the dissolved and triturated medicine, and put the cover on it, and having closed the joint with this clay, dry it thoroughly in the shade.

Next kindle fire in a furnace (*tannūr*) by means of *qimāsh* (linen) etc., so that there may be 2 cubits of live charcoal (in the furnace) and plunge the jar into the middle of the charcoal, and close the head of the furnace. Keep the jar in the furnace for a whole night and take it out in the morning, and let it cool from the fire for 2 hours. Then open the apparatus and take out the medicine, and having placed it on a *şalāyah*, triturate it, and sprinkle over it a little sour vinegar. Dry it and return it to the jar, and repeat the luting and coction thrice. If making the jar of pottery be inconvenient, then take green jars which have been oiled inside and outside, and make the covers of round-bottomed *ghaḏār*. And if coction in a furnace be difficult, bury the jars in the fire of the furnace (*atūn*) used by *hammām* keepers. In this case, make a fire about a cubit below the jar and similarly a cubit above.

M. H. H.

¹ MS. has erroneously *gaz* (yard). The whole paragraph seems to be badly translated, or summarised.

² Omitted, as in the copy only 3 short-necked flasks are shown.

head. You will obtain in the neck of the bottle a product as white as snow, which will whiten copper. More than 2 *ratls* of medicine should not be placed in an aludel at the time of sublimation: if more, it will not be sublimed.

4. Next, perform the process of the Fourth Pillar, i.e., of 'Maghnīsiyā'. The sign that the treatment is complete is that when the *Maghnīsiyā* is sublimed, triturated and coagulated in the same way as the Arsenic sulphide was, and then placed on a heated copper plate, it will liquify and make the copper white like silver (*qamar*).

Process of the Fourth Pillar.

Take $\frac{1}{2}$ a *ratl* of fresh Mercury, 1 *ratl* of food salt and $\frac{1}{2}$ *ratl* of Alum of Yaman. Pound the salt and Alum together. After putting half of that mixture in a mortar (*hāwan*), place the mercury in a linen cloth and scatter dung over the medicines. Then put the other half of the medicines on the mercury, and pound the mixture for a whole day. Then take out the mixture and put it in the second Aludel and close its head with salt, glue (*khitmī*), and the flour of barley, these in turn being covered with clay. Then kindle a medium fire (underneath) from morning till noon, and leave the aludel till it becomes cold. After opening its head, mix what has been sublimed with the dregs and pound them both thoroughly. Put it (the mixture) in an aludel and sublime it thrice. Then take it out of the aludel and pound it.

Take 1 ounce of ordinary Mercury, 4 ounces of the best Mercury (?), and $\frac{1}{2}$ an ounce of the 'Body' of *Maghnīsiyā*, total 102 *dirhams* (*sic!*),¹ neither more nor less, and pound it so that all the ingredients will mix together. Then drench them with the dissolved 'Water of Tin' (*Raṣāṣ Qal'ī*) which remained in the glass cup (*jām*), and dry it in the sun, and triturate it. Take a funnel (*Qim'*), a bottle (*Qinnīnah*), a sieve (*Minkhal*), and a basket (*Sallah*) or a felt-covered cage (*Qafaṣ*). Place the medicine in the sieve, the sieve in the mouth of the funnel, the funnel in the mouth of the bottle, and the bottle in a ditch. Wrap the basket in felt (*namad*), and place it over the bottle. Then cover it with horse dung as shown (*vide* Pl. II, Fig. 4). Change the dung every week as has been said before, until it (the medicine) is dissolved. In 33 days it will be pure water. Take this water and proceed with (the process of) its coagulation.

Method of Coagulation of this Water.

Put this water in a luted glass cup (*qadah*), and place on it another cup of similar shape, also luted. Close the joint firmly with barley flour, glue, and roasted salt, and lute it with the 'Clay of Wisdom.' Dry it thoroughly on hot ashes over a gentle fire for some time, as shown in the figure.² When the water has coagulated, it will become a hard stone.

Take this stone and triturate it, and after throwing one *dirham* of it on to 2700 *dirhams* of Mercury, Lead (*Usrubb*) or Tin (*Qal'ī*), subject it to the process of

¹ The total should be 58½ *dirhams*.

² The figure is omitted, as the drawing is incorrect, only an open pot on an ash-bath being shown.

'*Istinzāl*' over a strong fire. What collects at the bottom of the (lower) crucible (*būtah*) will be pure silver. Project one (? *dirham*) of this elixir on to 1350 *dirhams* of Copper of Mauṣil, and pure silver will be produced which will be everlasting and in no respect defective. Be assured that no City, nor any Greek Sage, had any better process than this. I have explained this fully, and intentionally repeated almost all the processes, so that all will understand clearly and be in no doubt or hesitation regarding them. When anyone will experiment, he will be able to project it (the elixir) on the 'Bodies' if Almighty Allāh wills.¹

5. *Bismillāh ar-Rahmān ar-'Rahīm.*

*The Chapter on Experiment by Testing and the use of proper quantities.*²

(a) Know that when you intend to take up the work of this chapter, begin, in the name of Allāh, with the First Pillar. This is the treatment of *Za'frān-Hadīd*. The sign (that the treatment is complete) is that if, after it has been treated, a small quantity of it is projected on to molten silver, the silver is turned into gold. When it is beaten with a hammer (*mitraqah*), it will become white, and when left, it will again assume the colour of gold.

Process of the First Pillar.

Take $7\frac{1}{3}$ *dirhams* of iron or steel filings, and, after mixing triturated and heated Arsenic Sulphide, pound them together. Take a jar (*barnī*) with a cover, and having luted it, let it dry. Place in it the filings and Arsenic Sulphide, and having closed its mouth firmly heat it for one night. Take it out in the morning and let it become cold. Then open the joint and remove the medicine. Pound the latter thoroughly and subject it to the process of *Istinzāl* in the *Būt-bar-Būt* of this shape (Descensory :— for figure *vide* Pl. III, Fig. 5). Then take out the medicine and having pounded it thoroughly, again treat it in the same way until it is purified. Thoroughly pound it again and having placed it in a bottle (*qārūrah*), add to it four ounces of distilled vinegar. Leave the bottle in the heat of the sun for 20 days, shaking it every day so that all may be dissolved to water. Then put it in a cup, and place the cup on hot ashes until the water is coagulated. Then take out the solid and triturate it and leave it. It will be red like *wars*.³

(b) Then take up the process of the Second Pillar ; viz., the treatment of *Zanjār*. The sign (that the treatment is complete) is that when it is triturated for six hours it becomes like dough ; and when dried and broken into pieces its interior will be found to be red. Pound a small quantity of it. Pouf a little water on to a silver plate and having added this *Zanjār*, place the plate over a fire and leave it there for as long as it takes to count 100. Then remove it and wash it : after which it will be seen that the silver has become red like copper.⁴

¹ After this a gap of over $\frac{1}{2}$ a page occurs in the transcript. What follows is possibly an entirely different treatise, though structurally its contents are similar to what has gone before.

² Or 'skillful manipulation' (*hasabah*).

³ Probably 'saffron.'

⁴ Owing probably to the formation of a film of Cuprous Oxide. B. B. D.

Process of the Second Pillar.

Take 3 ounces of the *Zanjār* of Ḥims (Emessa), and pound it with grape vinegar for 2 hours, and add more vinegar whenever it is dry till it becomes soft like dough. Then take $10\frac{2}{3}$ *dirhams* of steel filings and scatter them over it (the *Zanjār*), and having thoroughly triturated the mixture, preserve it.

(c) Then take up the Process of the Third Pillar, as well as that of the 'Red Water.' This Pillar deals with the treatment of Copper. Its sign is this. Take 2 *dirhams* of molten copper and one *dirham* of amalgamated silver. Put one *dirham* of these two *dirhams* of molten copper in the bottom of a crucible (*būtah*) and over this, one *dirham* of pure silver, and over this again, one *dirham* of molten copper. Then place the crucible in a furnace and leave it till the silver has become yellow and tintured without the silver having undergone any increase (in weight?). Repeat this melting two or three times, each time washing it with the water of yellow and green vitriol till it has become purified and the colour (*rūī*) and smell has disappeared. It will be good for the 'Work,' one helping to melt the other; and it will also confer lustre.

If this silver is melted once again with a similar quantity of copper it will have a still better appearance but it will be difficult for the 'Work.' If, however, it is heated and melted again and distilled vinegar is poured on to it it will become soft and be more useful for the 'Work.'

Process of the Third Pillar.

(i) Take four ounces of the red Copper of *Khurāsān* and two ounces of yellow Sulphur. Melt the copper and add the yellow sulphur little by little, removing all the burnt copper until all the copper is burnt and no trace of sulphur is left. This copper is called 'the Male.' It has no shadow, i.e., if it is melted with anything it imparts only a little colour.

(ii) After this engage yourself in the treatment of the 'Red Water,' and the drenching of that Copper. Its characteristic is this that if you take a quill full of that water and make a dot on a white (silver) *dirham*, it will make the silver yellow like gold, and after a while it (the silver) will become black as if it had been burnt.

Process of the 'Red Water.'

Take the yellow of two Hen's eggs and an equal weight of yellow sulphur, and triturate this mixture thoroughly. Then take a cucurbit (*qar'*) of glass—or an earthenware jar—and put this medicine into it and place an Alembic on top as in the accompanying figure (*vide* Pl. III, Fig. 6). The Cucurbit should be a cubit (*dhirā'*) long and the length of the Alembic should be one span (*dast*) or more. Close (the joint between) the cucurbit (and Alembic) with barley flour, roasted salt, glue and clay. Distil by means of fuel as in the following process:—

Take a cauldron (*mirjal*) and place it on a stove (*ātashdān*), and fill it with water through the holes which have been left open for this purpose. Then place the cucurbit in it (the cauldron) and lute the exterior of the cauldron well. Beneath

the (spout of the) Alembic there should be placed a Receiver, and the mouth of the Alembic should be joined with the mouth of a bottle (*qinnīnah*), the joint being closed with barley flour, glue, salt, etc., so that the smell of the substance may not escape. Keep a strong fire below the cauldron. Whenever the water decreases, add hot water—if cold water be added the cucurbit will break—and continue the fire till the (volatile) moisture (of the medicine) has disappeared, the remaining fluid being thick and red. It will be clearer and less red when it is cold.

Then place the burnt copper in a luted cup and pour this 'Red Water' over it in such a way that it is more than covered by the water. Place the cup in the heat of the sun or on hot ashes, (removing it) thrice and then trituring it. Put it in an earthenware jar (*barnī*) and heat it one night on an oven (*tannūr*). Take the mixture out in the morning and after pounding it, put it in a cup and drench it (with the Water). Put it again in the jar and heat it thrice till it becomes red like *Zunjufr* (Mercury Sulphide). Finally pound and preserve it.

(d) After this, take up the Fourth Pillar which deals with the treatment of the Golden Red Stone, i.e., the Red Ruby. Its characteristic is that sometimes it comes out as a light-coloured (*sabak*) ruby, and sometimes it comes out yellow. Both of them are useful. It is called the 'Red Sulphur.' If a small quantity of it is pounded, and thrown on to melted silver, the silver is blackened.

Process of the Fourth Pillar.

Take eight *dirhams* of flaked yellow Arsenic Sulphide and three *dirhams* of Sulphur of Irāq. Triturate the sulphur separately and pound the arsenic sulphide separately in a stone mortar (*hāwan*). Put one-third of the sulphur (i.e., 1 *dirham*) in a glass cup and lute the cup with 'Clay of Wisdom.' Make three handles for the cup,¹ and place it on a stove, and put the arsenic sulphide on the sulphur, and the rest of the sulphur on the arsenic sulphide, and invert another unluted cup on the first one. The figure is this.² Make a hole in the bottom of the upper cup, and place them on a stove, and insert a long iron rod in the hole of the upper cup in such a way that it does not reach the bottom of the lower cup, though it can stir the contents. The figure is this (*vide* Pl. III, Fig. 7). Close the joint of the cups, and of the stove, firmly. Maintain a gentle fire till both the sulphur and arsenic sulphide are melted like water, and leave them till they become cold. Then open the head (of the cup) and take out the (mixture of) medicines which will resemble either a red or yellow ruby. Finally triturate and preserve it.

(e) After this, take up the preparation of the 'Red Gum.' The test (*'alāmat*) of it is that if you put the weight of a sesame seed of that 'Red Gum' on a (silver) *dirham* and heat it, it will become yellow: but when the fire is strong, the colour disappears and the silver will return to its former state (of whiteness).

¹ قدح را سه گوشه The drawing shows a round cup with handles, but the phrase really means a 'triangular cup.'

² Omitted as it is shown in the next figure.

Preparation of the 'Red Gum.'

Take 20 eggs and separate their yellow, and beat up their whites thoroughly with the hand. Put the white of the eggs in a glass cucurbit and connect an alembic firmly with the pot. Place the cucurbit in a cauldron (*mirjal*) in the same manner as has been described in the process for the distillation of the 'Red Water' and make up a strong fire so that the white of eggs will be distilled. Keep it in a bottle (*qārūrah*). Then take the yellow of the eggs and beat it thoroughly with the hand in a pot, and distil it on a dung fire so that its water will be distilled glittering like quick-silver (*simābi*), and the red tincture will remain in the cucurbit. Separate that water and preserve that tincture, for it is the dregs. Place them in a copper cucurbit as shown in the figure,¹ and keep fire below it so that its oil (*rauḡhan*) will be distilled and the dregs will remain in the cucurbit. Then take this oil (*duhn*) and the dregs, and cover them with the white distilled water. Keep the mixture in a luted cup, and place it on a hot fire so that the water becomes red. Then place the tincture of the oil and the dregs in a bottle and preserve them. If this substance is buried in dung, it is better. It is also permissible to heat the yellow of eggs and the dregs of the white (of eggs) in a cucurbit and cover them with distilled water of the white of eggs.

(f)-(i) Afterwards take up the preparation of the Pillars of Tincturing. They are four in number. The first is the 'Water of Sulphur.' [The second—the 'Water of *Martak*'—is omitted here from the text.] The third is the 'Water of *Marqashūshā*,' and the fourth is the 'Water of Mercury.'

(f) The test ('*alāmat*') of the 'Water of Sulphur' is that if the sulphur be heated it will become a stone like *al-qilī* and light ashes, and when it is melted and rubbed on rings, the (colour of the) latter will become like gold, though the colour will not be very lasting.

Preparation of the 'Water of Sulphur and Alkaline Salt.'

Take 2½ ounces of Sulphur and 5 *raṭls* of *Qilī*, and after trituration put them in a *Ṣaḡhriyah* (?*Sāḡhar*—a large drinking cup) and pour water into it. Boil it till two-thirds have disappeared and one third remains.² Leave it till it becomes cold. Then alkaline salt³ will appear coagulated on the top of the water. Take this salt and dry it in the shade. Mix two ounces of this salt with sulphur (and alkaline salt)⁴ and pound the mixture. Put this in a luted bottle (*qārūrah*) and dry it. Close the mouth of the bottle with *Qilī*, white of egg, salt, glue and 'Clay of Wisdom.'

Heat the bottle on hot ashes or over a gentle dung fire. Open the mouth of the bottle the next day. Put it (the contents of the bottle) in a luted glass cup

¹ The figure is the same as that given in Pl. III, Fig. 6, except that the spout of the Alembic is shown ending in a knob, and apparently a grate is indicated in the stove.

² Literally "four *dāngs* have disappeared and 2 *dāngs* remain." A *dāng* is one-fourth of a *dirham*.

³ As according to the 4th Chapter of the Arabic version of the '*Ain-aṣ-Ṣan'ah*, 5 *raṭls* of dried *qilī* plant will produce 2½ oz. of crude Sodium carbonate, this will be a mixture of Sodium polysulphide and sulphide. B. B. D.

⁴ Presumably this phrase should be deleted.

(*qadah*) and pour II ounces of sweet water into it, so that it (the medicine) will be dissolved to a red liquid. Take it and preserve it.

(g) Then take up the preparation of the 'Water of Martak.' Its test is this that if it is cooked and purified, and a *dirham* is placed in it, the coin becomes red; but that colour is not lasting.

Preparation of the 'Water of Martak.'

Take I ounce of *Martak*, 3 ounces of red or yellow Arsenic sulphide, and 3 ounces of dry Quicklime (*nūrah*). Triturate them thoroughly and keep them in a luted cup. Pour thrice its weight of water on to the mixture and boil it till the water becomes red. Then filter it and preserve it in a bottle.

(h) Then take up the preparation of the 'Water of *Marqashīshā*.' Its test is that when writing is made with it on clean sword blades, or on glass it will become black, and when this blackness is removed, it will appear as if gilded with gold. This will not disappear unless it is rubbed away.

Preparation of the 'Water of Marqashīshā.'

Take 2 ounces of golden *Marqashīshā* and triturate it with distilled vinegar, or boil it for one day with distilled vinegar. Dry it and pound it. Place it in a cucurbit and put the latter in a cauldron. The cauldron should be filled with water. Distil once, and preserve it (the unaltered residue).

(i) Then follows the preparation of the 'Water of Mercury.' Its test is that if sublimed, calcined, reddened, and dissolved Mercury is kept on a silver plate the latter will remain red as long as it is not cleaned.

[*Preparation of the 'Water of Mercury.'*]¹

Take 2 ounces of 'Flying Mercury,' 2½ ounces of Alkaline salt and 5 ounces of Egyptian Painters' Vitriol. Pound the Vitriol and the alkaline salt, or food salt, in a stone mortar (*hāwan*). Put half of this (mixed) medicine on a *shalāyah*. Rub the Mercury through fine linen (*kirbās*), and squeeze this mercury over the medicine. Then scatter the other half of the medicine over the mercury, and triturate it (the mixture) for a whole day so that all trace of mercury will disappear. Then place the mixture in an aludel, half covered with clay. Put (a cover of) *ghaḍār* (greenish clay), such as is used by potters, on the mouth of the aludel. There should be a hole at a distance of 4 fingers from the top (of the cover), the size of the hole being such that a stick of the thickness of a packing needle can enter. Put the medicine in the aludel, (the latter being) as shown in the figure.² Close the joint of the Aludel with salt, glue and barley flour, and place the Aludel on a stove (*atahdān*). The height of the stove should be 2 spans, and its breadth 3 spans. The stove should contain two openings, one on the left and the other on the right (of the door). The Aludel should be mounted on the

¹ Title omitted.

² Only a rough drawing of a closed empty aludel is given in the text, with handles, indicated on the lower portion, half way up.

stove according to the figure.¹ There should be a distance of one span between the bottom of the Aludel and the ground. The space between the sides of the Aludel (and those of the oven) should be four fingers for the flame to play in. After maintaining a gentle fire from morning till noon, take out the stick from the hole. If anything like dust has collected on the stick, continue the fire, but if not, stop the fire, and leave it (the apparatus) until it becomes cold. Then open the joint, and after placing on the *Ṣalāyah* what has been sublimed triturate it. Repeat the sublimation from morning till night. Then again take out what has sublimed and triturate it and sublime it a third time from morning till noon. Then take it out and preserve it.

(j) Next take up the Process of Fermentation (*Takhmīr*) and it is as follows:—

Take 2 ounces of *Qalqand* and put it in a luted earthenware *kūzah*² and, after inserting the stopper and closing the mouth, heat for one night. Place the medicine in a crucible³ and place another crucible (*būtah*) over it. Then after closing the joint firmly, blow up the fire till the crucible becomes red. Then leave it till it becomes cold and open the mouth of the crucible. If the medicine is not reddened, return it to the crucible and kindle fire till the medicine is red. Take this medicine and preserve it.

(j) (i) Next take 1½ ounces of yellow Sulphur and after triturating it with the reddened *Qalqand*, keep the mixture in a luted cup. Boil six ounces of 'sublimed' (*mus'ad*) and distilled vinegar in a cucurbit with 'un-sublimed' vinegar as in the figure,⁴ and heat it thoroughly so that the smell of the sulphur and *qalqand* will disappear and the vinegar will be tintured. Finally filter the vinegar.

Then take sublimed mercury, and having placed it on a *ṣalāyah* drench it with sufficient vinegar to consume it. Triturate it until it is dry and keep it in a luted jar (*barnī*). Close the mouth of the jar, and joint (of the cover), firmly with 'Clay of Wisdom.' Dry it, and heat it in an oven in such a way that the distance between the fire and the bottom (of the jar) is one span (*dast*). After leaving it till it becomes cold, take out the mercury and put it on a *Ṣalāyah*. Drench it with this vinegar, and, having triturated it, let it dry. Put it again in a jar, and heat it thrice. It will then be reddish yellow. This is what is called 'Reddened Mercury' and what the Sages term the '*Zunjufr* of the Sages.'

(j) (ii) Next take some 'Dissolved Hair' and wrap it in a piece of coarse cloth. Stretch this cloth over a glass funnel (*qim'*) and place this funnel in the neck of a large glass bottle (*qinnīnah*) and the bottle in a basket (*sallah*), and the basket in a cage (*qafaṣ*). Dig a ditch in the ground, the depth of which should be 2 cubits⁵ and the breadth also 2 cubits. Make a depression in the earth (at the bottom of the

¹ In this second drawing, however, the pot is shown inserted almost completely in the oven.

² One meaning of *kūzah* is a long narrow-necked earthenware bottle.

³ Manuscript erroneously reads *kūzah* for *būtah*.

⁴ Simply a pot on what is apparently a sandbath is shown.

⁵ The word used is *gaz*, the usual meaning of which is 'yard': but from the Arabic it is evident that the Persian translator used this word as the equivalent of the Arabic *dhirā* (cubit).

ditch) sufficiently large to accommodate the bottle. Scatter over the dissolved hair the medicine, that is, the reddened, calcined, and sublimed mercury, and put the basket (and the cage) over it (*viz.*, the bottle containing the funnel and the medicine) as is shown in the figure (*Vide* Pl. II, Fig. 4).

Place fresh dung round it (the cage), and add fresh dung every week. This solution (*Hall*) takes 21 days, and the water will be red like ruby. Take this water and preserve it.

(k) *On Heating, and the number of times (a substance should be heated).*

In the case of the heating of Sulphur, after manipulating it according to the process which has been mentioned before,¹ pound it thoroughly. Wrap it in a silk cloth and put it in a pot (*deg*). Scatter over the bottom of the pot distilled white of eggs, of thrice the weight of the sulphur; or, if you pound the sulphur with distilled white of eggs of thrice the weight of the Sulphur on a glass *şalāyah* before putting it in the silk cloth, it will be better. Then kindle fire beneath the pot, so that the substance will be dried while it is being heated. This coction should be done thrice, the first time very gently, as has been previously stated. When it is perfectly cooked and dried, put the Sulphur again on the *şalāyah* and triturate it as thoroughly as possible. When this medicine is made into a paste with water, and gold is gilded with it, it adds brilliancy to the gold after the latter is heated in a fire and then plunged into cold water.

¹ The copyist adds 'Most probably not in this book, but in some other book.'

PART III—NOTE ON THE CHEMISTRY OF THE VARIOUS PROCESSES DESCRIBED
IN THE '*Ain aş-San'ah* : AS WELL AS IN THE ATTACHED PERSIAN TREATISE.

BY PROF. B. B. DATTA, M.A., PRESIDENCY COLLEGE.

I.

The '*Ain aş-San'ah*, as its name implies, contains the essentials of the chemical knowledge of the 11th century A.D., with some practical hints for aiding the workers. The seventh chapter of the book in particular contains easy processes in every useful branch of the Art as it prevailed at that time.

The scope of chemical science in the Middle East was then almost entirely confined to a study of the common metals and their compounds. Experimental operations were guided mainly by the possibility of effecting the transmutation of baser metals into gold and silver—the avowed object of the alchemical art. It is therefore not at all surprising that the methods described in the chapter under consideration are apparently concerned with producing passable imitations of silver from cheaper materials, especially copper, or with bringing about external and superficial changes in colour in the cheaper and baser metal. The contents of the treatise remind one of those of the Egyptian papyrus manuscripts on the same subject described by Berthelot in his *Archéologie et Historie des Sciences* (pp. 266–307) with this difference that, whereas the latter were intended for the guidance of artisans, the Arabic works are essentially practical treatises on natural philosophy, written in the cause of the advancement of science, and not therefore primarily for the purpose of amassing wealth by fraudulent means. From the elaborate details given in the '*Ain aş-San'ah* it seems fairly obvious that the author had actually personally tested the various processes he describes.

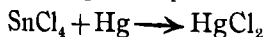
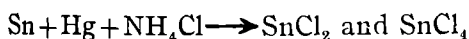
1. The first part of the Seventh Chapter describes four 'Pillars' or Major Operations by which copper was supposed to be changed into silver, but, in reality, into (1) an alloy of Silver and Copper ; (2) a white fusible Sulpho-arsenide of Copper ; (3) a white Arsenide of Copper ; and, finally, (4) some Amalgam.

The chemicals used in the First 'Pillar' are Silver, Copper and Mercury in the proportion of 4 : 1 : 2. Evidently an amalgam containing silver and copper was formed at first, from which an alloy of silver and copper separated by the slow volatilisation of the mercury as the amalgam was gently heated ten times in a closed vessel. The two parts of Sal-Ammoniac that were added formed small amounts of Chlorides of Silver and Copper and also assisted in the formation of an amalgam. Care was taken that the flames of the furnace did not come into actual contact with the vessel, so that the temperature was kept below red heat. This was also necessary because the vessel was made of glass. The proportion of Ammonium Chloride taken was not sufficient to convert more than a small portion of the filings

of the metals taken especially as much of it must have been lost by volatilisation and washing. An eutectic mixture of Silver and Copper containing 73 % of Silver melts at 778°C so that the alloy formed may not have actually melted. But Silver Chloride melts at 460°C and Cuprous Chloride melts at 434°C. Hence (as was actually found by a repetition of the experiment) a fused homogenous mass of the Chlorides containing the metals is formed and this fused mass is carried away from the bottom of the vessel by the vapours of Mercury and Sal-Ammoniac and also by creeping and spurting. The alloy itself is probably what is referred to as the 'stone of Sa'd ad-din,' but the Persian text seems corrupt as such an alloy could not be 'all volatilised' by heating in a glass cucurbit over a gentle fire.

1(a). In the next operation, called the Fifth Process, some accessory chemicals, such as Mercuric Sulphide, were prepared. To get the mercury to enter readily into combination, it had to be finely divided, and this was achieved by triturating it with alum and sulphur. The mercuric sulphide thus formed was heated with yellow arsenic sulphide, after which apparently the 'silver' from the previous operation—after it had been treated and sublimed—was added. Possibly Sulphoarsenides of the metals used were the ultimate products.

1(b). The preparation of the Chlorides of Tin is next dealt with. This method is similar to the modern processes of making SnCl_2 and SnCl_4 by the action of Mercuric Chloride on Tin. The reactions may be thus summarised :



$\text{HgCl}_2 + \text{Ag} \longrightarrow \text{Ag amalgam}$ (which readily fuses when placed on a hot copper plate and 'silvers' the copper).

2. The Second 'Pillar' appears, as stated previously, to be only an attempt to purify sulphur by washing with a solution of Alum mystically endowed with the spirit of an animal by preparation in the intestine of a goat.

3. The substances used for the Third 'Pillar' are Iron filings, orpiment, salt and vinegar. The iron filings are acted upon by vinegar and thus become soft as the metallic particles disappear. Afterwards Copper oxide and borax are added, along with fennel flowers (possibly for reduction). White arsenic is formed which, when heated with Copper, produces white fusible Copper Arsenide.

4. The Fourth 'Pillar' describes the preparation of HgCl_2 as a hard stone by the 'coagulation' of its solution. Two kinds of mercury are used for this experiment, probably (1) that occurring in the native state in mines and (2) the other prepared artificially from cinnabar. Mercury is acted upon by 'Water of Tin' and the " 'Body' of *Maghnīsiyā* "—the latter substance being also possibly one of those prepared in a previous 'Pillar.' The mercuric chloride is used in conjunction with mercury, and lead or tin, apparently with the ultimate formation of an amalgam.

According to modern ideas of chemistry, the methods described above will appear to be full of superfluous and unnecessary steps. But it must be remembered that it was Boyle in the 17th century who first developed the theories of elements and compounds, as well as of analysis and synthesis, and thus laid the correct

foundation of our modern science of chemistry. Before these principles were laid down, even great minds would necessarily waste their energies on superfluous detail, as they were not governed by correct theories, and hence their efforts were bound to be somewhat ineffective.

The anthropomorphic view of matter based on *Sufism*, which, in turn, may very possibly have been based on *Vedantism* (the identity of organic and inorganic substance—both being in turn a manifestation of God) seems to have been responsible for these and similar errors. Material substances were assumed to be composed of 'Body' and 'Spirit,' and just as 'Spirit' migrates from one human body to another in its different rebirths and thus attains final perfection, so, for the synthesis of the noble metals, it was thought necessary to go through successive stages and use substances containing 'Spirits' and 'Souls' of different degrees of perfection such as Mercury, Sal-Ammoniac, Arsenic Sulphide and Sulphur. It may be recalled in this connection that as late as the third quarter of the 17th century John Mayow still used the word 'Spirit' in referring to the substance common to both air and nitre, which brought about combustion.

II.

The appendix that follows the Seventh chapter is entitled "Experiment by testing and the use of proper quantities" (or "skilful manipulation"). The methods given in the *'Ain aṣ-Ṣan'ah* produce a homogenous substance of silvery appearance, whereas in the appendix the production of a white or yellow deposit on a metallic surface by an externally applied substance is described.

- (1) First Pillar. $\text{Fe} + \text{As}_2\text{S}_3 + \text{vinegar} \longrightarrow (?)$ Basic Ferric acetate mixed with unchanged Arsenic sulphide and precipitated sulphur.
- (2) Second Pillar. *Zanjār* of *Ḥimṣ* (verdigris) + vinegar + Iron filings \longrightarrow Basic Ferric Acetate.
- (3) Third Pillar. $\text{Cu} + \text{Ag} + \text{vitriol} \longrightarrow$ A soft white alloy of Copper and Silver.
 - (i) $\text{Cu} + \text{S} \longrightarrow \text{Cu}_2\text{S}$.
 - (ii) Yellow of eggs + S \longrightarrow A 'Red water'; $\text{Cu}_2\text{S} + \text{'Red water'} \longrightarrow$ A red product.
- (4) Fourth Pillar. $\text{As}_2\text{S}_3 + \text{S} \longrightarrow$ Red or Yellow Ruby (Realgar As_2S_2).

The 'Red Gum' of the Fourth Pillar was apparently some organic substance which left a yellow deposit on silver when gently heated but which disappeared on strong ignition.

Next, various 'Waters' are dealt with. They are the solutions of 'Spirits' produced by various reactions, i.e., Sulphur (either free, or combined in the case of *Marqashīshā*), Arsenic Sulphide and Mercury.

- (1) 'Water of Sulphur': Sodium polysulphide, formed by heating sulphur with the ashes of sea plants.
- (2) 'Water of *Martak*':—
 $\text{PbO} + \text{As}_2\text{S}_3 + \text{CaO} \longrightarrow$ basic Arseno-sulphide of Lead and Calcium.

(3) 'Water of *Marqashīshā*' :—

$\text{FeS}_2 + \text{vinegar} \rightarrow$ A solution of Sulphuretted Hydrogen, mixed with particles of the Golden pyrites.

(4) 'Water of Mercury' :—

Mercury, Salt and vitriol were exposed to air and heated. Presumably Mercuric Oxide was the product; but apparently it was dissolved in some way not specified before use.

The chapter concludes with a description of :—

- (1) The process of 'Fermentation'; and
- (2) The preparation of some compound of Albumen and Sulphur.

The process of 'Fermentation' is divided into three stages :

- (a) the heating of *Qalqand* (impure copper and ferrous sulphate). The product was presumably a mixture of Cu_2O and Fe_2O_3 :
- (b) the dissolving of the red product in strong acetic acid: and trituration and heating of mercury with this solution until a reddish yellow product was formed. This was probably Mercuric Oxide, mixed with the oxides of Copper and Iron; and
- (c) Combination of 'Dissolved Hair' (i.e. NH_4Cl) with the 'Reddened Mercury' of the previous operation, thereby forming in all probability a solution of Mercuric Chloride, reddened by suspended Mercuric Oxide.

In the final process, prepared Sulphur is heated with 3 times its weight of "distilled white of egg." The product was used for 'gilding' gold. Sulphur changes the copper present in a gold alloy to Cu_2S , and thus, instead of being pale yellow, the gold becomes reddish yellow.

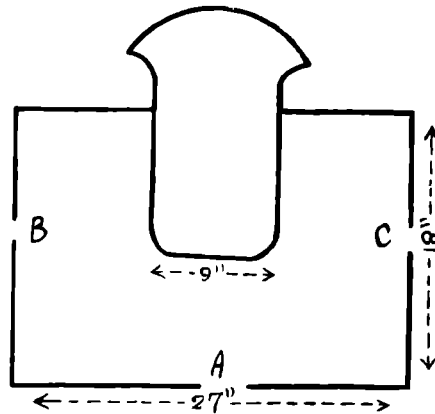


FIG. 1.—Aludel and Oven used in the Process of the 'First Pillar' (p. 425).

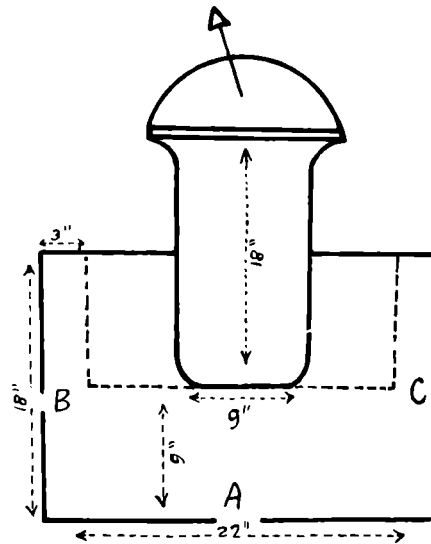


FIG. 2.—Aludel and Oven used in the Process for making 'Water of Tin' (p. 426-7).

A—Grate (*dar atash*), B and C— Exits for smoke.

Note.—The Oven is shown oblong in the Ms. drawing but it is difficult to understand how there was only a space of 3" between the *Uthal* and the sides of Oven unless either (a) the latter was conical or (b) there was a well in the top as shown by the dotted lines, only the bottom of the pot being heated, as stated in ar-Rāzi's *Kitāb al-Asrār*.

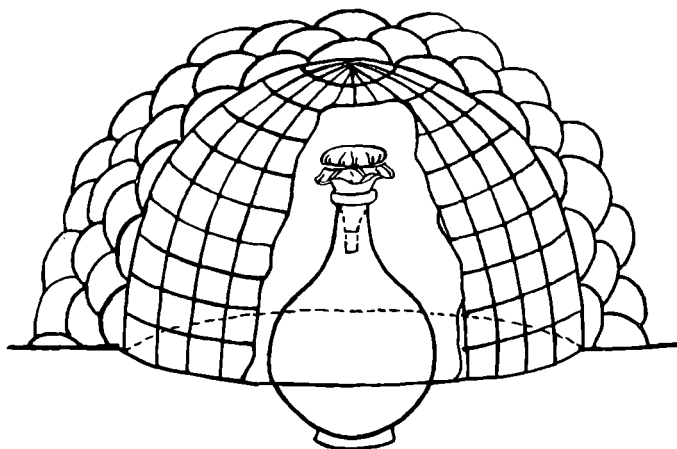


FIG. 3.—Apparatus for carrying out the Process of Solution under Dung.

Note.—The Ms. drawing is so bad that except for the fact that the bottle was apparently fitted into a hole in the ground (as in a later description), it is of little use. The illustration is made by comparing the description in the text (p. 427) with the account of the 10th century apparatus described on p. 170 of Berthelot and Duval's translation of the Syrio-Arabic Ms., given in Vol. II of Berthelot's *La Chimie au Moyen Age*: *vide* also p. 61, note 3, and Plate I, Fig. 5 of Messrs. Stapleton and Azo's *Alchemical Equipment in the 10th Century A.D.* (*Mem. A.S.B.*, Vol. I, No. 4, 1905). The funnel is erroneously shown with its head tied up.

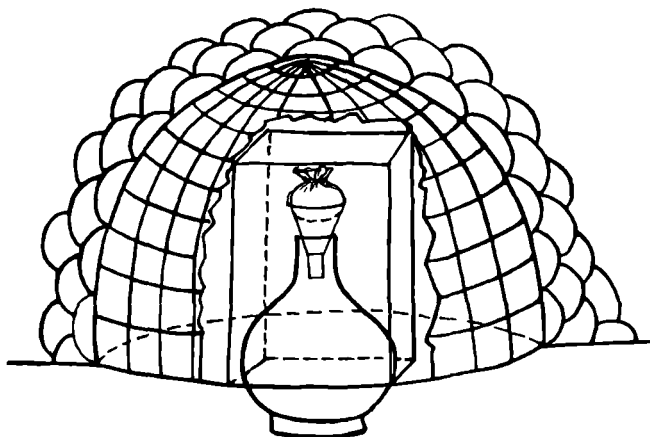


FIG. 4.—Apparatus for Dissolving the "Body of *Maghāsiyā*."

Note.—In the drawing in the Ms., the external cage is shown square and the basket apparently round. The reconstruction follows the text (pp. 430 and 436-7), as well as the description given in Messrs. Stapleton and Azo's paper.

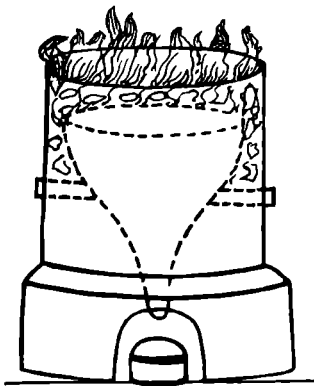


FIG. 5.—Descensory (p. 431).

Note.—The drawing in the Ms. simply shows a square with a small circle underneath (to indicate the top and bottom crucibles), the whole being enclosed in what is apparently intended to be a square furnace. The drawing here given is a tentative adaptation of the Descensory Furnace given on p. 741 of Geber's *Liber Fornacum* (1572, Basle ed.).

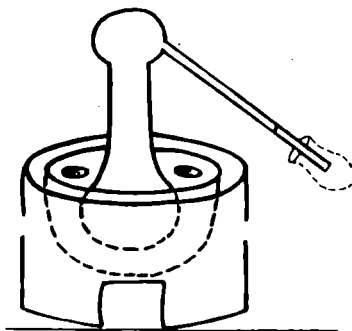


FIG. 6.—Alembic heated on a Water Bath.

Note.—This drawing is somewhat conjectural, as it is a combination of two very rough drawings, the second of which is almost unintelligible. The details of the Water Bath are supplied from the description of the 'Process of the Red Water' (p. 432).

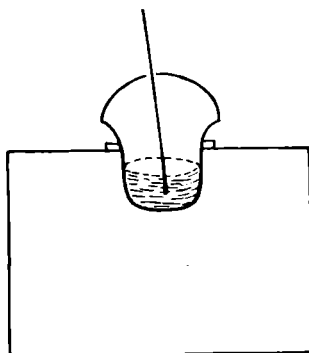


FIG. 7.—Apparatus used in the 'Fourth Pillar' (*vide* p. 433 of translation: p. 456 of text) for heating together Sulphur and Arsenic Sulphide. *Note.*—In the original only a short stirring rod is shown instead of the long one mentioned in the text.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الحمد لله الذي علم الانسان ما لم يعلم - و فهمه معرفة الاشياء ما¹ لا يفهم - و صلى الله على خير الامم و سلم تسليما كثيرا - اما بعد بدانکه در زمان پیشین علما و حکما بسیار بوده اند - و اکثر خلایق بطلب علم مشغول - و اهل علم معزز و مکرم بودند و پادشاهان و امرا و وزرا اهل علم و حکمت را تربیتها می کردند - و نوازشها بجای می آوردند - و اعزاز و اکرام می نمودند - بدان سبب رونق عالمان بود - چنانچه بر پادشاهان حکم می کردند - و پادشاهان در جمیع امور بایشان مشورت کرده اند و متابع قول ایشان گشته - و درین زمان احوال علماء و فضلاء و حکماء معکوس و مغلوب و بی رونق و بیعزت شده است - بدان سبب علما گم شدند - و آنها که باقی مانده اند علم خود را مخفی و پوشیده داشته اند - چنان شده است گویا علم مندرس است - و این بیان روشن است - و خللهای آن همه را معلوم شده تا اگر کسی طالب علمی باشد بسالها استادی مشفق² بدست نتواند آورد - و از کتب حاصل کردن³ علوم پوشیده⁴ دشوار است خاصه علم صنعت شریفه که آن علم انبیاء و اولیاء و خاصان⁵ حق است - که حق جل جلاله⁶ هر نا اهل را بدان راه ندهد⁷ و اولیا را راه دیگر نموده اند که هرچه بدنیا تعلقی دارد بر دل ایشان سرد گشته است و ازان اعراض کرده اند - و ترسیده که مبدا بسوی عمل دنیا و شغل آن محبتی در دل باز پدید آید که سر گناهان شود که حُبُّ الدُّنْيَا رَأْسُ كُلِّ خَطِيئَةٍ پس اگر کسی را حق جل جلاله قوتی بخشیده باشد هرچند با طول دنیا مشغول باشد دنیا او را از راه نگرداند و تغییری در آن پدید نیاید - آن سعادت عظیم و دولت بزرگ باشد - بنابراین مقدمه عزیزی التماس کرد در علم صنعت شریفه مستوره - و این ضعیف کذب بسیار مطالعه کرده بود درین باب - و بعضی تجربه کرده و بعضی از⁸ استادان بی نظیر مشاهده کرده و اصول این علم شریف را دریافته - هیچ کتاب لطیف تر و روشن تر از کتاب عین الصنعة و عون الصنعة که تالیف محمد⁹ بن عبد الملک الخوارزمی الکاتبی نیست¹⁰ رحمه الله - و ترتیب درین کتاب تمام نموده و قاعده اهل حکمت راست و بی رموز¹¹ ظاهر و مکشوف کرده و خود سعی و تجربه کرده - و نقل از حکمای بزرگ مثل رئیس اجل ابو الحسن علی بن عبد الله¹² و از اندرینا الکیم و موسی ابن عمران الکیم و خالد بن یزید البرمکی و ابی زید البلخی و معمر الجرجانی و القاضي ابو عمر الخوارزمی می کند و تالیف این کتاب در مدینه¹³ العلم بغداد حمایه¹⁴ الله من الآفات در سنه اهدی و عشرين و اربع مائة کرده و برهفت باب نهاد - چون این ضعیف بر صحت این کتاب اطلاع یانت حقائق و دقائق آن معلوم شد که اصلی دارد و این کتاب عین الصنعة بعربی بود - و آن عزیز را عربی فهم کردن

1 ما يفهم. 2 Ms. متفق. 3 Ms. کردند. 4 Ms. here inserts شد. 5 Ms. خالصان.

6 Ms. هر نا اهل.

7 Ms. راه نیابد.

8 Ms. بعضی ز استادان بی نظیر شاهد کرده.

9 Ms. محمد ابن الملک الخوارزمی الکاتبی.

10 Ms. است.

11 Ms. ظاهر و مکشوف کرده.

12 Ms. حمایه الله.

13 Ms. منیه العلم.

14 Ms. حمایه الله.

دشوار بود جهت آن بزبان فارسی کرد تا انتفاع از آن تواند یافت **إِنْ شَاءَ اللَّهُ تَعَالَى** - **باب اول** در اسماء عقاقیر این صنعت و تنبیه بر ارواح و اجساد - **باب دوم** در بیان طبائع¹ عقاقیر این صنعت - **باب سوم** در تدبیر آن و تجربه و اندازه هر یک - **باب چهارم** در بیان آنچه از برای قمر کدام سازگار است و از برای شمس² کدام - **باب پنجم** در ذکر آلات^{2a} ادویات - **باب ششم** در بیان آنکه دارو در عوض کدام دارو شاید - **باب هفتم** در بیان چگونگی ترکیب و ترتیب آن بر طریق سهل تر و آسان تر و کم طرح * و بدانکه عقاقیر این صنعت شریف مشهور³ است و ادویه آن معروف - و هم کودکان آنرا شناسند و در دکان همه عطاران باشد - اما اگر استادان آنرا آزموده اند نامی دیگر کرده تا از جهال مخفی باشد - بخدا سوگند بر شما که چون برین اسرار مطلع شوند از جهال و نادان پوشیده و مستور دارند⁴ و از مستحق و از اولاد و احباب دریغ ندارند - و من نصیحت می کنم شما را هر کسبیکه نصیحت قبول نکند پشیمان شود - و هر کسبیکه نصیحت قبول نکند زبان کند و بی شک⁵ پشیمان گردد *

باب اول در اسماء عقاقیر و عدد آن

بدانکه اسماء این عقاقیر هفت گانه اینست - شمس و قمر و زهره و مشتری و زحل و مریخ و عطارد - و احجار دوازده است کبریت و زرنیخ و قلی و نوره و نوشادر [و ملح] و زاج و مرثیشاه و مغنسیا⁶ و شب و مرتک و⁷ مقناطیس - و اصول⁸ صنعت اینست و این دوازده است که گفته شد - و بعضی باین ادویه ضم کنند دهنج و لاجورد و شادنج و توتیا و مسقط کنند قلی و نوره و نمک و زاج و شب و این جمله سه جنس است - روح و نفس و جسد - پس ارواح زببق و نوشادر است و آنچه بدین ماند - و نفس کبریت و زرنیخ و آنچه بدان ماند - و اجساد زر و نقره و آهن و مغنسیا و آنچه بدان ماند - پس هرکه خواهد که اکسیری ترکیب کند باید که از روح یکی و از نفس دو و از جسد یکی - مثلاً چنانچه زببق یکدام کبریت ابیض یا زرنیخ ابیض در دام - و آهن یکدام - پس جسد باید که ربع اجزاء باشد بعد از آنکه جسد را حل میکرده باشند - پس اکسیری که در وی روح نباشد که آن زببق است و نفس که آن کبریت است یا زرنیخ یا جسدی محلول آن بکاری نیاید - و روح و نفس بی جسد رنگ کنند⁹ اما در سبک آن رنگ برود - اما چون جسد با آن باشد آن رنگ هرگز نرود - و صبورترین در آتش مغنسیا¹⁰ است و تیکه چون آب شود - و اصل درین باب جدا کردن است میان روح و نفس - آنکه بمیرانیدن نفس - و آنکه روح در آن در آوردن تا زنده شود - و در هر جسد دخول کند - زیراکه زببق و کبریت یا زرنیخ دو رکن بزرگ اند درین صنعت - و در رکن دیگر نوشادر و نقره یا قلعی یا زر و مس و الله اعلم *

¹ Ms. طلیح.

² Ms. و از برای هر یک کدام.

^{2a} Ms. Corrected from the title of chapter V. آلات و ادویات آن.

³ مشهور آن است.

⁴ Ms. پوشیده و ستور داری و مستحق و از اولاد.

⁵ Ms. بی شک و پشیمان.

⁶ Ms. مغین.

⁷ مرتک مقناطیس.

⁸ Ms. احوال صنعت این است و این ده است.

⁹ Ms. کنده.

¹⁰ Ms. مغنی.

باب دوم در طبایع این عقاقیر از گرم و تر و نرم است و دروی دهنیت - و اندکی از وی در اکسیر بس است چنانکه

خمیر یا به در خمیر؟ و اکسیر یعنی داروی تمام شده

نقره سرد است و تر و نرم و دروی دهنیت است و اندکی از وی در اکسیر بس است - مس گرم است و خشک و نزدیک بفقره - و باز و نقره و قلعی و اسرب و آهن بیامیزد¹ و رنگ قبول کند و زبیق او را سخت کند و شکندده کند و او در نوعیت سرد و گرم - سرد از موصل و شام آورند² - یعنی رنگ و کس او اغبر است و او را سرد گویند - و آن خالص بفقره است - و گرم از بصره و خراسان آورند - و رنگ او سرخ بود چون آتش - و او را گرم گویند - و او³ خاص است بزر - و آهن سرد و خشک است و قوت او در عمل نقره و زر نیک است - و در رنگها جواهر و از رنگ اکسیر زراست - و آن دو نوع است نر و ماده یعنی پولاد - و نر⁴ خاص است بفقره و فولاد خاص است بزر و براده ماده⁵ را چون بکند سرخ شود - و قلعی⁶ سرد است و تر⁷ و دروی دهنیت نیست - اجساد را سفید کند اما شکندده کند - و او عدوی جمله اجساد است - و بوی سفید کند و نوشادر گرم و خشک است و قابض⁸ است - در جوف اشیاء در آید و اندرون را پاک کند - و نمک گرم و خشک است - و او زر و نقره را نیک گرداند - و از وی زردی⁹ (زر زیاده) (شود)¹⁰ و سفیدمی نقره و اجساد را پاک گرداند - و زاک گرم و خشک و قابض - و او چند جنس است - قلقطار و سوری و قلقدیس و قلقند و همه را فعل یکی است و اجسام را سیاه کند - و زر را سرخی دهد و نقره را سفیدی بخشد - و اقلیمیا و مرتشیشاه گرم و خشک است و بکبریت آمیخته¹¹ است و آن چند نوع است - ذهبی و فضی و حدیدی و نحاسی - و چون مکس شود سفید شود چون آرد - و در صنعت بسیار در آید¹² - و مغنسیا گرم و خشک است و رنگ کفنده است - نشاف است - و سنج را بخورد و اجساد را سفید کند و قتیقه سفید شده باشد - یا سفیداج شده باشد یا مصعد - و اگر زنده باشد همه اجساد را سیاه کند و شکندده کند - و آن دو نوع است نر و ماده - و آنکه سیاه باشد سنگ¹³ و سست و ماده است - و دیگر نراست و چون آنرا بشکنی میانش سفید باشد با شعاع - شب نشاف است و قابض و اجساد را سفید کند و پاک کند و نقره را سیاه کند و زر را سرخ کند - و آن دو نوع است شب حمرة و آن شب یمانی است و آن صاف باشد و سفید - و شب سواد و آن اغبر است - و مرتک سرد و خشک است و صباغ - و سرکه او را حل کند - مقطاطیس گرم و تر است آهن را رباید در غایت حرارت - اگر بشرح خواص احجار مشغول گردیم دراز گردد - این قدر کفایت است - والله اعلم *

¹ Ms. نیامیزد.

² Ms. اندند.

³ و او را.

⁴ Ms. نرم.

⁵ Ms. براده مادر.

⁶ Ms. قلعی و اسرب و آهن.

⁷ Ms. نرم.

⁸ Ms. بیض.

⁹ Ms. و روی.

¹⁰ Ms. کند.

¹¹ Ms. انجته.

¹² Ms. دادربد.

¹³ Ms. و سنگ.

باب سوم در تدبیر

بتقریر¹ آن مصنف فرماید کمتر ترا آنچه در بایست ازین عقاقیر جهت تجربه از آنچه تقریر کردم از سرخ سه مثقال و نیم و آن پنج درم است - نقره خالص چهار درم - مس سرخ خراسانی پنج اوقیه - و آن پنجاه و سه درم و دو دانگ است و مس موصلی یکدرم - روی سختهج بصری یک اوقیه و آن ده درم است و چهار دانگ - زنجارِ حمص سه اوقیه و سی و دو درم است - نرم آهن و آن ماده است هفت اوقیه و آن هفتاد و چهار درم و چهار دانگ هست - آهن فولاد و آن نر است دو اوقیه - و آن بیست و یکدرم و دو دانگ - رصاص قلعی ده درم - زینق یازده اوقیه و آن صد و هفده درم است - کبریت زرد عراقی نه اوقیه و هفت درم و زرینخ اصغر براق² دو رطل و ثلثین و آن دویست و نود و هشت درم است و چهار دانگ - و قلی³ ده رطل از برای چهار اوقیه و نیم و از روی نمک گیرند - و نوره سه اوقیه و آن سی و در دام باشد - و نوشادر خراسانی دو اوقیه و آن بست و هفت درم است و دو دانگ - و نمک پاک دو رطل و آن دویست و پنجاه و شش درم است - زاج مصری سه اوقیه و آن سی درم است - و اقلیمیاء ذهبی یا مرثیشیاء ذهبی دو⁴ اوقیه و آن صد و پنجاه و سه درم است و دو دانگ - و مغنیسیا ماده سیاه و سنگ بست و شش درم - و شب یمانی هفت اوقیه و نیم و آن هفتاد⁵ درم و دو دانگ باشد - تفکار نیم اوقیه و آن پنج درم و دو دانگ باشد - مرتک یک اوقیه و آن ده درم و چهار دانگ باشد - سنگ مغناطیس شانزده فیراط و آن یکدرم و دو دانگ باشد - بوره ارمینی سرخ دو اوقیه و آن بیست و یکدرم و دو دانگ باشد - نظرون هشت درم و دو دانگ - تخم مرغ پنجاه عدد - مجموع آن در هزار و هفتصد و پنجاه و سه درم و چهار دانگ است - اگر کسی خواهد که این میزان زیاده کند بر همین میزان چنانکه از یکی زیاده کرده⁶ بهمان حساب از دیگری زیاده کند تا راست آید *

باب چهارم در بیان ادویه که ببیاض بکار آید و در حمزه نیز

چنین گوید محمد بن عبد الملک الکافی رحمه الله - ادویه که در باب بیاض بکار⁷ آید و آن دوازده است و ما بیان کنیم آنرا با اقل اوزان و اکثر قیمت - براده نقره چهار درم - براده نحاس موصلی یکدرم - زینق هشت اوقیه و نیم و آن نود درم باشد و چهار دانگ - رصاص قلعی ده درم - نوشادر خراسانی بیست⁸ درم - کبریت زرد هفت درم - شب یمانی هفت اوقیه و نیم - و آن هشتاد درم باشد و دو دانگ - براده آهن هفت اوقیه و آن هفتاد و چهار درم و چهار دانگ باشد - زرینخ زرد صفایح دو رطل و آن دویست و پنجاه و شش درم باشد - نمک طعام دو رطل - روی سختهج بصری یک اوقیه - بوره سرخ دو اوقیه - مغنیسیا ماده سبک بیست و شش درم - این جمله هشت صد و سی و نه درم باشد و چهار دانگ - اما آنچه در حمزه بکار آید شانزده حجر است - ما آنرا بیان کنیم⁹ با اقل اوزان

1 Ms. تقریر.

4 In Arabic text ten, in place of two.

6 In Arabic text twenty-two

2 Ms. الشیرق.

5 In Arabic text eighty.

9 Ms. و اما ان را بیان کنیم آن را تا اقل اوزان

8 Ms. قلمی. Corrected from Arabic text.

0 Ms. گردد.

7 Ms. بکار بود.

و اکثر قیمت - زنجار سه اوقیه - براده فولاد دو اوقیه - مس سرخ خراسانی پنج اوقیه - کبریت زرد نه اوقیه زردیغ چهار اوقیه¹ و نیم و آن چهل² و هشت دانگ - نمک قلی چهار اوقیه و نیم - و آن چهل درم و چهار دانگ است - و آن³ هزار و دویست و هفتاد و در درم - قلی توان کوفت (!sic) - مرتک یک اوقیه - نوره در آب نرسیده سه اوقیه - اقلیمیاه ذهبی یا مرقشیشاه ذهبی ده اوقیه - زاج مصری پنج اوقیه *

باب پنجم در بیان آلات ادویه باب بیاض

از آنجمله فهر - صلابه برنی در عدد با فهر پوش از برای تشویه - قاروره از برای زعفران حدید - قدح آبکینه و قنینه بزرگ برای حل - کوره درم و کلبتان - و ماشک - و بوطقه و هاون سنگین و قرع انبیب و قابله زجاج - مرجل بزرگ - و سحلان⁴ فرش ادویه را در قمع آبکینه [در] سله نمد گرفته - مدت حل در باب ذهب هفتاد و چهار روز بغیر⁵ روزی که ادویه در وی حاصل کند *


باب ششم بدل کند در وقت ضرورت

بدل اثال برنی بزرگ دیگ را دو باره کند و بدل قدح زجاجی قدح خرف - بدل هاون صلابه حدید - و بدل قرع بستوقه⁶ - و بدل قوابل و به سیز اوعیه ستبرا (sic) و بدل انبیب برنی کوچک و انرا وزنی بود که بسازد - و بدل برنی تشویه برنی ستبر - و بدل براده نقره براده قلعی - و بدل نکاس موصلی نکاس خراسانی و از نکاس خراسانی روی سختج مصری و از زیدق طیری زیدق رحیح؟ و ازو بدل مرتک مرداسنج - مرقشیشاه ذهبی اقلیمیاه ذهبی - و بدل مغناطیس براده حدید *

باب هفتم در بیان بیاض

اگر خواهند که بعمل مشغول شوند ابتدا کن برکن اول تشمیع - و علامت بفوق آن باشد که اندکی⁷ از آن بر صفحه مس نهی و گرم کنی بآتش بگذارد⁸ و روان شود چون شمع و رویش سفید کند چون نقره اما غوص نکند که بکاد بیامیزد و بآب ایض تسقیه کند - آنکه غوص کند از روی دیگر بیرون آید و داخل و خارج آن نقره بود *

تدبیر رکن اول و حاد

بگیرد براده نقره چهار درم - براده مس موصلی یکدرم - زیدق تازه دو درم - اول براده⁹ را بر صلابه کند و اندکی آب بروی چکاند و بشوید آنکه زیدق بر سر آن کند - با نوشادر دو درم نیکو سحق کند چنانکه اثر زیدق نماند و سیاه شود آنکه بگیرد قدح آبکینه برین صورت مدور  بگل گیرد¹⁰ که مثل آن ثلث گل سرگین دوآب و موسی و عرق آسپ و نمک اندکی و موسی را بمقراض خرد ببرد و در اجانه خمیر کند

¹ In Arabic text 'four ūqiyah' ² In Arabic text forty-two. ³ Ms. جنست و زرهزان و دویست و هفتاد و درم.

⁴ Arabic Text reads من ذلك مبرد لسحل الفضة والنحاس و الحدید

⁵ Ms. بغیر.

⁶ Ms. بستور.

⁷ Ms. ابتدکی.

⁸ باتش بگذارد و روان شود.

⁹ Ms. براده اول براده را.

¹⁰ Ms. بگل کرد.

مدت ده روز - و آن قدح را ملازم بسازد و خشک کند و دارو در قدح کند وصل آن بگیرد بزمک و خطمی و آرد جو و خشک کند آنکه بر سر آن گل کند و چون خشک شود بر سر آتشدانی نهد که در عرض مستوقد یک بدست باشد و نیم و بلندی مستوقد یک بدست و گرداگرد قدح باید که در آتش بگردد - اما چنان سازد که آتش بقدح باید نرود تا نشکند - و مستوقد را از دو طرف سوراخی بگذارد از برای در آمدن هوا و بیرون شدن دود - آنکه آتش کند آتشی نرم نرم بدو عدد نی یا دو فحم و هرچند که ادویه بر قدح نشیند با ثقل جمع می کند و سحق می کند و تصعید کند تا آنکه در دیگ نه نشسته ده نوبت تصعید کند تا آنکه منعقد شود چون حجر سعد الدین مشغول شود بعمل حاد - و علامت او آنست که زبیق بگذارد و ملغمه شود بی جسد قلعی و نقره و مس¹ آنکه پیامیزد این ملغمه را برزنیخ زرد و بگذارد و چون خبث شود و چون بماء الرصاص تسقیه کند در صفحه گرم نهد نفوذ کند بجاناب دیگر*

تدبیر الخامس

بگیرد زبیق خالص نیم درم و کبریت زرد نیم درم و شب یمانی نیم درم آنکه نیمه شب را در هاون سنگی کند و بر بالای آن نیمه کبریت و بر بالای آن زبیق و بر بالای آن زبیق کبریت و بر بالای (آن) شب² نرم نرم کوبد و زبیق درمیان کبریت و شب ملغمه شود و باید که بساید که چون خشک شود باید که چون گلی باشد آنکه بگیرد قدح آبکینه در گل حکمت گرفته - و خشک کرده بر آتشدانی نهد برین صورت³ و روی اندازد که ادویه بگذارد و زبیق بماند غلیظ و سیاه چون گل آنکه آن آب از وی بریزد آن گل را بستاند و دو درم و نیم زرنیخ زرد با آن پیامیزد و نیک سحق کند و در بوته کند و بگذارد تا نیکو بگردد و چون خبثی شود آنکه این زبیق گداخته را با نقره مدبر و مصعد پیامیزد و نیکو سحق کند و نگه دارد - آنکه مشغول شود بعمل ماء الرصاص الابيض - و علامت او آنست که چنان شود که اگر ازان بقلم بر طشت یا بر نگیں نویسد و گرم کند چنان نماید که گویا بنقره نوشته اند و چون بر صحیفه برنچ بگیرد و گرم کند و درین آب زند داخل و خارج آن سفید شود بعون الله تعالی *

تدبیر ماء الرصاص

بگیرد رصاص قلعی و آن ده درم - زبیق پاک بیست درم - نوشادر خراسانی بلورجی سفید بیست درم - آنکه قلعی را بگذارد⁴ و از سر آتش فرود آرد تا اندکی سرد گردد و زبیق را در وی ریزد و بگذارد⁴ تا یکدیگر پیامیزد آنکه باز بگذارد⁴ و حرکت دهد و فرود آرد تا سرد شود و بر صلایه کند و آب شیرین در وی کند و صلایه کند آنکه بشوید آنکه نوشادر بر وی اندازد بغایت نیکو سحق کند آنکه در بوته⁵ کند اندرون اندوده - و مطین کند بگل حکمت و سرش بگیرد و وصل محکم کند و یک شب تشویه کند بآتش سرگین چنانکه زیر و بالای آن یک در گز باشد و آنکه بکشاید و بر صلایه کند و نیکو سحق کند و هم چنین در بوته⁵ کند و وصل محکم کند و سه شب تشویه کند چنانکه گفته شد تا روح با جسد مکلس شود و چون بر صحیفه مس گرم کرده نهند جسد با روح میبرد

¹ Ms. adds. لیکن بدوشاه چون گلی شود در یک ساعت

² Ms. adds.

³ See Plate I, Fig. I.

⁴ Ms. بگذارد.

⁵ Ms. بوته.

در اثال کُذد و تصعید¹ کُذد و اگر نمیرود باز تشویه کُند تا آنکه جسد با روح برود آنکه بگیرد دیگ اثال² اندرون
 از کاسی دوده؟ درازی دیگ یک ذرع و فراخی دیگ یک دست و مهرش باز گردیده چو بر تدری برین
 صورت³ - و نیم دیگ در گل حکمت گیرد و به ستبری عقد انگشت بزرگ و بر حد⁴ [نصف چهار] گل آن را بسازد
 و گرداگرد دیگ خشک کُند و آتشدانی بسازد چنانکه حلوا گران مدور سوراخی از میمن و سوراخی از یسار باشد -
 به بلندی بسطبر یک اجر خفته و دیگ را بر آتشدان ترکیب کُند و باید که از زیر دیگ تا زمین یکدست باشد
 و گرداگرد آن از آتشدان چهار انگشت باشد آنکه دارو در وی کُند و بگیرد غصارة سفال غیر مدهون که دهی آن بر
 قدر لب اثال باشد و درین غصارة از یک جانب بقدر سه انگشت بهم نهاده سوراخی کُند بمثقب چندانکه سطحی
 جوال درزی تا چوبی دران جا کُند برین صورت⁵ - و سرپوش را باثال وصل کُند و کرپاسی یا کتانی که عرض آن
 سه انگشت باشد بدان وصل کُند چنانکه نیمی بر دیگ و نیمی بر سرپوش باشد و بر سر آن گل حکمت گیرد
 و آتش کُند تیز و سوراخی کشاده دارد تا رطوبت او بیرون رود آنکه سوراخ بگیرد محکم و یکروز تمام آتش کُند
 آنکه چوب از سوراخ بیرون آورد و نظر کُند اگر بخار بیرون می آید تمام نشده است اگر بیرون نمی آید تمام شده
 است - آنکه بگذارد تا سرد شود و وصل بکشاید و آنچه مصعد شده باشد با ثفل آن بر صلایه کُند و بوزن ثفل زینق
 تازه بآن بیامیزد و نیکو صلایه کُند و باز در اثال کُند و تصعید کُند برین مذوال پنج بار بآتش تیز که در اول بار سیاه
 باشد و دوم بار اصب و سوم بار اشهب و چهارم بار اشمط و در پنجم بار ابيض چون ذرات - آنکه بگیرد انرا و دار
 و مشغول شود بحل⁶ بگیرد شیشه بزرگ که دارو در وی بگذرد منخل باره میان قمع نهد
 و دارو بر سر آن کُند و قمع در شیشه نهد و بر سر شیشه سله در نهد گرفته یا قفص در نهد گرفته نهد برین صورت⁷
 و سرگین آسپ تر بر سر قفص کُند و هر هفته سرگین بدل میکند و سرگین تازه می کُند که در چهل روز حل
 شود و آبی سفید بزیر آید بعون الله تعالی - آنکه بگیرد حاد را که با فضه مدبر آمیخته بود و در قدح کُند مطین
 و نیمه این آب درو می کُند و بر خاکستر گرم کُند برین صورت⁸ و می پزد تا آنکه آن را تمام بخورد آنکه بر صفحه
 مس نهد و گرم کُند بگذارد و بر صفحه روان شود و بجانب دیگر نفوذ کُند و چون نقره سفید گرداند تدبیر بگیرد انرا نگهدار
 نیکو - آنکه آنست که بگیرد از شب یمانی یازده درم و نیکو صلایه کُند و در روده گوسفند کُند و سر روده بر بندد و بگیرد
 بمرجل و اب درو می کُند و گرم کُند و آن روده گوسفند گره زده دروی اندازد و می پزد تا آن شب بگذارد و اب شود
 آنکه بگیرد کبریت زرد شش درم و بر صلایه سحوق کُند و در قدح ابکینه کُند و از آن آب که در روده است تسقیه می کُند
 در افتاب و تجربه میکند بر صفحه گرم اگر ثابت شد و دود نمی کُند و نمی سوزد رسیده است و گرنه از آن آب تسقیه
 می کُند و تجربه می کُند تا آن زمان که ثابت شود و دود نکند و نسوزد اگرچه بیست بار باشد *

رکن سوم

آنکه تدبیر رکن سیوم کُند و آن تدبیر زرنیخ است و علامت رسیدن او آنست که زرنیخ سفید شود و حجری
 شود چون عاج و رخام و مس را سفید کُند و نرم کُند و بوی از وی ببرد *

¹ و ادویه در وی کُند Text adds

² اندرون او کاسی و دوده Text adds

³ The figure of the open pot of the aludel previously given on p. 449 is here repeated.

⁴ Arabic text reads المستوفد علی القعوده فی حد النصف اربع ملازم من طین لقعوده علی المستوفد (cf. Mem. A.S.B., vol. I., p. 70.)

⁵ Vide Pl. I, Fig. 2.

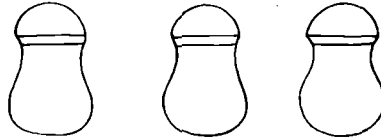
⁶ صغ البیاض

⁷ See Plate II, Fig. 3.

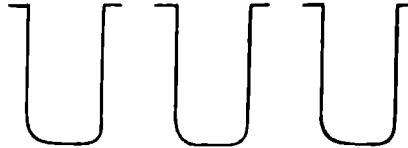
⁸ A rough sketch of the cup on a sand bath is given in the text.

این تدبیر رکن سیوم

بگیرد زرنیخ زرد و صفیخ دورطل - براده حدید نرم نیم رطل - نمک طعام یا نمک تلخ نیم رطل - زرنیخ را سحق کند در هاون سنگین یا در¹ اهن صلایه بغایت نیکو و بحریر به بیزد (a)¹ و نمک را خورد بکوبد و براده را زعفران کند و ان چنان است که براده را بر سر کاغذی پهن کند بر سر تخته و سرکه تیز بران بیفشاند چنانکه جمله تر شود بر سرکه و بسایه خشک کند و تجربه کند بدست اگر چنانکه بمالد اثر براده ظاهر نشود و نرم شده باشد نیکو و الا دیگر باره سرکه بر سرش می ریزد و می جنباند و خشک کند و تجربه کند تا آنکه زنگاری شود صلایه کند نیکو و با زرنیخ و نمک بیامیزد و در ظرفی نحاسی کند و سرکه بر وی کند چندانکه بالای آن بر آید بمقدار سه انگشت و بچوبی می جنباند و سرش بکاغذ بگیرد تا گرد در وی نرود و در افتاب بدهد و هر روز بامداد و نیم روز و شام می جنباند و شب در خانه می نهد تا آنکه خشک شود آنکه که در هاون سنگین صلایه کند بحریر به بیزد آنکه در سه برنی اندرون برنی را که آب داده هر یک طولش بمقدار شبری و هر یک را سرپوش برین صورت



باید همه را در گل حکمت گیرد چنانکه شرح آن داده شده است و در سایه خشک کند و ادویه درو می کند و رملش محکم کند بگل و یک شب در آتش توان نهد یا در تفور گرم کند² که زیر و بالای آن مقدار یک گز آتش باشد و بامداد بیرون آرد و سرش بکشاید و ادویه بیرون گیرد و بر صلایه اندازد و نیکو سحق کند و اندکی سرکه



ترش بر آن میریزد آنکه خشک کند و باز در برنی کند و تشویه کند تا سه بار آنکه بگیرد سه دیگ اثال برین صورت درازی هر یک یک دست³ و پهنائی وی یک شبر و دهفتش باز گردیده بمقدار چهار انگشت بهم نهاده و سه سرپوش خرف اندوده و درین سرپوش سوراخی کند چنانکه بیان کرده شد پیش ازین در تدبیر ماء الرصاص و یک روز تمام آتش کند اما باید که از اول آتش نرم نرم می کند و اندک اندک زیاده می کند تا قدر سه چوب هر چوبی بقدر چهار انگشت بهم نهاده از چوب بید و هر گاه که چوب از سوراخ قحح بیرون باید کرد اگر بیدند که مصعد می شود دیگر آتش کند اگر مصعد نمی شود آتش بس کند و یک شب بگذارند تا تمام سرد شود آنکه سرش کشاید و بر صلایه اندازد آنچه ازوی مصعد شده باشد با اندکی از ثقل صلایه کند تا سه روز آنکه یک اوقیه دریستخچ مسحوق و یک اوقیه بوره ارمینی که خبازان بکار میدارند بیامیزند و در شیشهها کفند مانند گلاب دان کردن باریک و دراز برین صورت⁴ و نیمه آن در گل گیرد و در هر قاروره چهار اوقیه اشغیز بکند و سر قاروره با چوب بید آتش اهسته می کند و لوله سرش کشاده دارد تا رطوبت تمام برود آنکه سرش بگیرد و آتش کند یک روز تمام

¹ Ms. omits در.

^{1a} Ms. بیزد.

² Ms. omits کند.

³ Ms. reads دست یک گز.

⁴ Omitted as, in the copy, only three short-necked flasks are shown.

و بگذارد تا سرد شود و سرش بکشاید - که در گردن شیشه گرفته شده باشد سفید¹ شود چون برف - و این مس را سفید کند و در حال تصعید کردن در اثال باید که از دو رطل زیاده نکند که اگر بسیار باشد مصعد نشود پس ازین تدبیر رکن چهارم کند² که ان تدبیر مغنسیا است - و علامت رسیدن آن این است که چون مصعد و مسعوق و معقود شد ز زینج بر صفحه مس نهی و گرم کنی بر روی روان شود و سفید کند چون قمر *

تدبیر رکن چهارم

³ بگیرد زینج تازه نیم رطل نمک طعام یک رطل شب یمانی نیم رطل شب و نمک را صلایه کند و نیمه⁴ ان دارو در هاون کند و زینج⁴ را بکریاسی کند و بر سرگین ادویه را بیفشارد و باقی ادویه بر سر زینج کند و صلایه کند نیکو یکروز تمام انکه بگیرد و در اثال ثانی کند و سرش را وصل کند بزمک و خطمی و آرد جو و بر سر آن گل گیرد و آتش میانه کند از بامداد تا نیم روز انکه بگذارد تا سرد شود و بکشاید و آنچه مصعد شده باشد با ثعل بیامیزد و هر دو را صلایه کند نیکو و⁵ در اثال کند و تصعید کند سه بار انکه بیرون کند و صلایه کند و یک اوقیه زینج معمول معمول چهار اوقیه جسد مغنسیا نیم اوقیه این جمله باشد صد درم و در درم و ازین وزن زیاده و کم نکند این جمله را صلایه کند تا بیکدیگر بیامیزد و تسقیه کند آب محلول از رصاص قلعی باقی مانده بود در جام ابگینه در افتاب خشک و صلایه کند و بگیرد قمع و قنینه و قطع منخل و سله یا قفس⁶ در نمد گیرد قطع منخل در میان قمع نهد و ادویه بر سر ان کند و در دهن قنینه را دران گوئی که در میان چاه کنده است نهد و سله در نمد گرفته بر سر آن⁷ بدهد و سرگین اسپ بر سر آن کند برین صورت⁸ که در ذیل است و هر هفته را سرگین بدل می کند چنانکه گفته شد تا انکه حل شود در سی و سه روز آبی شود صاف بگیرد انرا بعقد آن مشغول شود *

تدبیر عقد آن است

که بگیرد آن آب را در قدح ابگینه⁹ و مطین کند و قدح دیگر مانند آن بسر آن نهد و هر دو قدح ابگینه کند مطین و قدح دیگر مانند را وصل محکم کند بآردجو و خطمی و نمک بریان کرده بر سر آن گل حکمت گیرد و خشک کند نیکو و بر سر خاکستر گرم نهد بآتش نرم برین صورت¹⁰ چند ساعت آنکه که منعقد شود و حجری شود سخت انکه بگیرد ازین حجر و سحق کند و یکدرم بر در هزار و هفت صد درم زینج یا اسرب یا قلعی اندازد و بگذارند تا استغزال کند بآتش قوی تا در بوته ایستد قمر خالص باشد و با یکی ازین اکسیر بر هزار و سه صد و پنجاه مس موصلی طرح کند که قمری آید خالص که هرگز تغییر نشود و ناقص نشود و بدانید که در همه بلاد و نزدیک هیچ حکیم یونانی ازین درست تر و ازین بلند تر نیست و من شرح کردم این را شرحی روشن تمام و در اکثر تدابیر سخن مکرر کردم عمدتاً تا فهم کند نیکو و بشک و شبه نیفتد و موقوف نگردد و چون تجربه کند تحقیق شود طرح آن بر اجساد انشاء الله تعالی *

¹ Ms. omits. شود.

² Ms. reads و معنیا.

³ Ms. has here مغنسیاء.

⁴ Ms. reads رواکر پاسی.

⁵ Ms. reads و اثال کند.

⁶ Ms. reads با سبده.

⁷ Ms. adds نگون.

⁸ For reconstructed drawing vide Pl. II, Fig. 4.

⁹ Ms. reads کند مطین.

¹⁰ The figure is omitted as the drawing is incorrect, only an open pot on an ash-bath being shown.

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

باب التجربة للامتكان والحسبة

اما بعد بدانکه چون خواهيد که باين باب عمل کنيد ابتدا¹ کنيد بتمام خدای تعالی برکن اول و ان عمل زعفران حديد است و علامت او آن است که چون تدبير کرده شود نقره را بگذارند و اندکی بر آن بگذارند زر گردد و چون مطرقة بر وی زند سفيد شود و چون بگذارند رنگ زر گردد *

تدبير رکن اول

بگيرد براده حديد [و] فولاد وزن هفت درم و دو دانگ و زرينخ را سحق کند و نیکو به پزد و با براده حديد بياميزد و صلايه کند و بگيرد برني با سرپوش و مطين کند و خشک کند و براده [و] زرينخ را در وی حل کند و وصل محکم کند و یک شب تشويه کند و ببامداد بيرون آورد و بگذارند تا سرد شود و وصل بکشاید و ادويه بيرون گيرد و نیکو صلايه کند و استنزال کند بوته بر بوته برين صورت² آنکه بگيرد و انرا نیکو صلايه کند و یکبار ديگر هم برين صورت بگذارند تا صافي شود آنکه نیکو صلايه کند و در قاروره کند و چهار اوقيه سرکه مقطر در وی کند و در افتاب گرم بگذارند و هر روز چند بار مي جنبانند تا جمله آب شود محلول ببيست روز - آنکه در قدحي کند و در خاکستر گرم نهد تا منعقد شود و بيرون کند مانند ورس سرخ انرا سحق کند و بگذارند *

آنکه برکن دوم

مشغول شود و آن تدبير زنجار است و علامت او آنست که چون انرا سحق کند شش ساعت تا چون خمير شود و خشک کند و بشکند و ميانش سرخ باشد اندکی ازان زنجار صلايه کند و یک نقطه آب بر صفحه نقره چکانند ازين زنجار بر سر آن اندازند و بر سر آتش نهد و بگذارند و چندانکه صد عدد شمارند آنکه بردارد و بشويد نقره را سرخ کرده باشد چون مس - تدبير رکن دوم بگيرد زنجار حمص سه اوقيه و بر صلايه کند بسرکه انگوري دو ساعت و هرچند که خشک شود سرکه بروی ميپزند تا آنکه نرم شود چون خمير - آنکه بگيرد براده فولاد ده درم و چهار دانگ و بروی اندازد و نیکو صلايه کند و بنهد آنکه مشغول شود برکن سيوم و آب سرخ آن تدبير نحاس است و علامت او آنست که چون او را سوزانیده باشي بگيري ازوی در درم و از نقره ملغم یک درم و ازان دو درم نحاس سوخته یکدرم و در بوته فروش کفي و بر بالای آن یکدرم نقره بهتر و بر بالای نقره یکدرم از نحاس سوخته بنهي در کوره نیکو بگذاری نقره³ زرد شده باشد و رنگ گرفته بی آنکه نقره را زياده کند⁴ آنکه آن نقره را بگذاری تنها تا دو سه بار و هر بار آب زاج زرد و سبز ريزد که ان صافي شود - و روی آن و محکش ازوی دور شود از برای عمل نیکو باشد یکی را یکی بگذارند در جلا خوب اید و اگر آن نقره بوزن نحاس اول یکبار ديگر بگذاری بهتر باشد اما در عمل سخت باشد پس اگر او را گرم گذند تا بگذارند و درو سرکه مقطر ريزد نرم شود و در عمل نیکو باشد *

¹ Ms. ابتدا کن.

² For reconstructed figure of apparatus vide Pl. III, Fig. 5.

³ Ms. inserts after نقره the words را بنهي.

⁴ Ms. شود.

تدبیر رکن سیوم

بگیرد مس سرخ¹ خراسانی چهار اوقیه کبریت زرد در اوقیه پس مس را بگدازد و آن کبریت زرد اندک اندک بخورد² و از مس هرچند سوخته باشد جدا کند تا چندانکه مس تمام سوخته شود و کبریت نماند و این را نکاس ذکر گویند که او را ظل نباشد یعنی اگر او را با چیزی بگدازند رنگ کند اما زیاده نکند - بعد ازین مشغول شود بعمل ماء الاحمر و تسقیه آن نکاس - و علامت او آنست که از آن آب بقلم برداری³ و یک نقطه بر درم سفید نهی فقره را زرد کند چون زر و بعد از ساعتی سیاه شود چنانکه گوئی سوخته است *

تدبیر الماء الاحمر

بگیرد زرد⁴ نخم مرغ در عدد و بوزن آن کبریت زرد جمله را سحق کنی نیکو و بگیری قرع آبگینه یا برنی و این دارو دروی کنی و انبیب بر سر آن ترکیب کنی برین صورت⁴ و طول قرع باید که چندان بود که استخوان ذراع و درازی انبیب یک دست باشد یا زیاده و قرع را وصل کنی بآرد جو و نمک بریان و خطمی و گل - تقطیر کنی بحطاب برین صورت و آنچه آن باشد که بگیرد مرجمی و بر آتشدانی نصب کند و آب در وی کند از سوراخی که رها کرده باشد از برای آب - انگه قرع را بنهد و حوالی آن بگل بگیرد محکم و در زیر انبیب قابله بنهد و سر انبیب را در دهن قنینه نهد و وصل کند بآرد جو و خطمی و نمک و غیر آن تا بوی نرسد و در زیر آن آتش کند قوی و هرچند آب کم شود آب گرم کرده درین ریزد که اگر آب سرد ریزند قرع بشکند و آتش میکند تا آنکه آب منقطع شود آبی باشد غلیظ سرخ چون سرد شود صافی شود رنگ او کم شود انگه بگیرد مس سوخته را و در قدح مطین کند و ازین آب سرخ بر سر وی ریزد چنانکه آب بر بالای او آید و در انتاب نهد یا بر خاکستر گرم نهد تا سه بار انگه صلایه کند و در برنی کند و یک شب در نفور تشویه کند و بیامداد بکشاید و صلایه کند و در قدح کند و تسقیه کند و باز در برنی کند و تشویه کند تا سه بار که چون زنجفر سرخ گردد انگه صلایه کند و بنهد بعد از آن مشغول شود برکن چهارم و این عمل حجر احمر است ذهبی یا قوتی سرخ و علامت او آنست که بیرون آید مانند یاقوت سبک و گاه باشد که سبز بیرون آید هر دو نیک است و انرا کبریت احمر گویند و اندکی از آن صلایه کرده بر قمر گذاخته اندازند فقره را سیاه کند⁵ •

تدبیر رکن چهارم

بگیرد زرنیج اصغر ارقی هشت درم و کبریت عراقی سه درم کبریت را سحق کند جدا و زرنیج را جدا در هاون سنگین صلایه کند نیکو - و ثلث کبریت را در قدح آبگینه کند مطین بطین حکمت و قدح را سه گوشه بسازد که بر آتشدان نشیند انگه زرنیج را همه بر سر کبریت کند و باقی کبریت بر سر زرنیج کند و قدح دیگر غیر مطین بر سر آن ترکیب کند برین صورت⁶ و قدح بالا را در بنش سوراخی

¹ Ms. adds فرسی. ² Ms. adds او میدهد. ³ Ms. reads برداری. ⁴ For reconstructed figure *vide* Pl. III, Fig. 6.

⁵ A large and unintelligible drawing, apparently of the alembic with its furnace, is shown opposite the last four lines of the text.

⁶ Omitted, as it is shown in the next figure.

کند و بر آتشدان نهد و در قدح بالای آهني کند دراز چنانکه بقدح زيرين نرسد چنانکه توان چنانيدن برين صورت¹ و وصل قدح و آتشدان محکم کند و آتش نرم کند چندانکه کبريت و زرنیغ گذاخته شود چون آبی و بگذارد تا سرد شود و سرش را بکشاید و ادویه بيرون گيرد چنانکه ياقوت سرخ یا سبز باشد انکه انرا سحق کند و جدا بنهد بعد از ان به تدبير صمغ حمراء مشغول شود و علامت او آنست که بگيرد ازو بمقدار کفچد و بر سر دم نهد و گرم کند گرداگرد او ماند زرد شود چون آتش تيز کند رنگ برود و بحال خود باز آيد *

تدبير صمغ حمراً

بگيرد بيست عدد بيضه و زردی ازوی جدا کند و سفیدی را بدست بزند نیکو و در قرع ابگينه کند و انبيق بر وصل محکم کند و قرع را در مرجل نهد بر ترکیب بران صفت که بيان کرده شد در تطير ماء الاحمر و آتش کند قوی تا مقطر شود و نگهدارد در قاروره انکه زردا تخم را بگيرد و بدست بزند نیکو در قرع و بآتش سرگين تطير کند تا آتش مقطر شود و رنگ او درين قدح بماند سرخ چون سيمابی مائي یا شعاع آن - اب را جدا کند و آن رنگ را نگهدارد که آن ثفل بود و در قرع مس کند بدین صورت² و آتش در زير آن ميکند تا انکه روغن او مقطر شود و ثفل درين قرع باقي ماند انکه بگيرد آن دهن را و ثفل که درين قرع باقي مانده است و آب بياض مقطر بر سر آن کند چنانکه بر بالای آن بر آيد و در قدح کند مطين و بر سر آتش گرم نهد تا آب سرخ شود انکه بگيرد صبغ دهن و ثفل در قاروره نگهدارد و اگر در زير سرگين دهن کند بهتر باشد و اگر زردا تخم و ثفل بياض البیض در قرع کند و ماء بياض البیض مقطر بر سروی کند روا باشد بعد از ان بتدبير کفهای رنگ کردن مشغول شود و آن چهار اب است اول آب کبريت دوم اب مرتک سيوم آب مرقيشيشاء چهارم آب زبدق - و علامت آب کبريت آنست که چون اکبريت را تشويه کند چون قلی حجری شود³ و رمادي سبک چون⁴ بر انگشتري بمالد ماند زرد باشد اما انرا بقا نباشد *

تدبير ماء الكبريت و ملح قلی

بگيرد کبريت در اوقيه و نیم و بگيرد قلی پنج رطل و سحق کند و در صغره کند و آب دروی کند و چندان بجوشاند که چهار دانگ برود و در دانگ بماند و بگذارد تا سرد شود و نمک قلی بر سر آب بسته شود انکه این نمک را بگيرد و در سایه خشک کند و ازوی در اوقيه و از کبريت و نمک قلی را با هم بياميزد و در صلايه کند و در قاروره کند مطين و خشک کند و سر قاروره بقلی و بياض البیض با نمک و خطمی با گل حکمت بگيرد و تشويه کند در خاکستر گرم یا بآتش سرگين نرم و بکشایند روز ديگر و در قدح ابگينه مطين⁵ کند و قدر يازده اوقيه آب شيرين دروی کند که آن حل شود و آبی شود سرخ بگيرد و نگهدارد انکه تدبير آب مرتک کند و علامت او آنست که چون طبع کند و صاف کند و بگيرد دم را در سرخ شود و آن رنگ را بقا نباشد *

¹ For figure vide Pl. III, Fig. 7.

² Vide note 1, p. 434 of translation for defects of this figure which is also found reconstructed as Fig. 6, Pl. III.

³ Ms. reads چون حجری شود.

⁴ Tent has چون بر زردا بو انگشتري.

⁵ Ms. omits کند.

تدبیر آب مرتک

بگیرد مرتک یک اوقیه و زرنیخ احمر یا اصفر سه اوقیه و نوره آب نا رسیده سه اوقیه هر دو را سحق کند نیکو و در قدح مطین کند و آب درون کند سه برابر آن و بجوشاند تا آب سرخ شود انکه صاف کند و در قاروره نگهدارد و بعد از آن بتدبیر آب مرقشیشاء مشغول شود و علامت او آنست که از آن بر شمشیرها جلا داده یا در ابگینه بفریستند سیاه شود و چون آن سراد ازو پاک کند چنان باشد که گویا زر اندودند و پاک نشود مگر بارتداع *

تدبیر آب مرقشیشاء

بگیرد مرقشیشاء ذهبی دو اوقیه و سحق کند بسرکه مقطر یا بجوشانند بسرکه مقطر یک روز و خشک کند و صلایه کند و در قوع کند و قوع را در مرجل نهد و پر آب ¹ کند و تقطیر کند یکبار و نگهدارد بعد از آن تدبیر آب زینق کند و علامت او آنست که چون زینق مصعد و مکلس و محمر و محلول شود از آن بر صفحه نقره بیدازی چون زر سرخ باشد مادام که پاک نکنی *

تدبیر آب زینق

بگیرد زینق طبری دو اوقیه نمک قلی دو اوقیه و نیم زاج نقش گران مصری پنج اوقیه انکه زاج و نمک قلی یا نمک طعام را در هاون سنگین صلایه کند انکه نیمه آن ادویه بر صلایه کند و زینق را در کرباسی سحق کند و بر سر آن بیفشارد و نیمه دیگر بر سر زینق و یک روز تمام سحق کند تا چندانکه اثری از زینق نماند انکه در دیگ اثال کند و نیمه دیگ در گل گرفته و غضاره سفالین بر سر آن نهد چهار انگشت بهم باز نهاده نرورتر سوراخی کند بمقدار آنکه چوبی بسطبری یک جوال درزی دروی در آید و آن ادویه در اثال کند برین صورت ² و وصل محکم کند بنمک و خطمی و آرد جو و بر آتشدانی بفهد که بلندی آن دو دست باشد و فراخی سه دست و در در یکی از چپ و یکی از راست ³ و اثال برین ترکیب کند برین صورت ⁴ و باید که از زمین تا زیر اثال دستی باشد و گرداگرد اثال فضا باشد به مقدار چهار انگشت کشاده باشد تا تابش گرداگرد دیگ بر آید آنکه آتشی نرم نرم کند از بامداد تا پیشین و چوب از سوراخ بیرون می کند و هرگاه که بر چوب بیند که چیزی بنشینند چون غبار آتش میکنند و چون بیند که چینی نمی نشینند آتش بس کند و بگذارد تا سرد شود و وصل بکشاید و آنچه مصعد شده باشد بر صلایه نهد و سحق کند باز تصعید کند از بامداد تا شب و باز بیرون کند و سحق کند و تصعید کند بار سیوم تا نمرورز انکه بستاند و نگهدارد و انکه به تخمیر مشغول شود و آن آنست که بگیرد قلقت در اوقیه و در کوزه کند در گل گرفته و سرش بگیرد و وصل کند و یک شب تشویه کند و بوته دیگر بر سر آن نهد و وصل محکم کند ⁵ و می دمد تا بوته سرخ شود و بگذارد تا سرد شود و سر بوته بکشاید بیرون گیرد اگر دارو سرخ نشده باشد باز در بوته نهد و آتش کند تا آنگاه که سرخ شود و بگیرد و نگهدارد انکه بگیرد کبریت زرد یک اوقیه و نیم

¹ Ms. omite.

² Drawing omitted (vide for description note 4, p. 436).

³ Ms. adds از راست و یکی از چپ.

⁴ Drawing omitted (vide for description note 6, p. 455).

⁵ Ms. adds در کوزه نهد.

و با قلقت محمّر سحق کند نیکو و در قدح مطین کند و شش اوقیه سرکه مصعد مقطر بقرع در سر آتش نهد با سرکه غیر مصعد برین صورت ¹ و بیزد انرا نیکو تا طعم کبریت و قلقت بیرون آید - و سرکه رنگین شود انکه سرکه را صاف کند و بگیرد زبیق مصعد را و بر صلایه نهد و ازین سرکه تسقیه می کند چند آنکه می خورد و صلایه می کند انکه خشک کند در برنی مطین و سرش بگیرد و وصل محکم کند بگل حکمت و خشک کند و تشویه ² کند در تنور چنانکه زیر و بالای ان یکدست آتش باشد انکه بگذارد تا سرد شود و زبیق را بیرون گیرد و در صلایه نهد و ازین سرکه تسقیه می کند و سحق می کند و خشک می کند و در برنی می کند و تشویه می کند چنین سه بار انکه رنگ زرد شود و سرخ اینست زبیق محمّر که حکما گفته اند و انرا زنجفر حکما گویند - و قمع ³ ابگینه و قنینه بزرگ و قطع مذحل شعر و سله در نمد گرفته با قفص در زمین جانی بند عمق آن دو گز و فراخی آن دو گز و در زمین ان گوی دیگر بکند چند آنکه قنینه در وی بگنجد و بر بالای قطع مذحل ادویه بریزد - یعنی زبیق محمّر مکلس مصعد و سله بر سر آن نهد برین صورت ⁴ و سرگین تر بسرکه گرداگرد آن کند و هر هفته سرگین تازه می کند که در بیست و یک روز حل شود و آبی شود سرخ مثل باقوت انرا بگیرد و نگهدارد *

در بیان آتش کردن و عدد او

اما طبع کبریت مدبر بندبیری که قبل ازین گفته در تدبیر یاد کردیم و نیک بساید و بحربری در دیگی کند سه مقدار از بیاض البیض مقطر زیر وی ریزد اگر کبریت و بیاض البیض مقطر سه مقدار وزن او در صلایه زجاج کنی و در دیگی برنی نافع تر آید بعد از آتش در تحت وی بر افروز تا در حال طبع خشک شود و این طبع سه بار باید نرم که در کمال نرمی باشد اول که گفته شد چون درین طبع کمال یافت و خشک شد پیش دیگر بار بر صلایه کند چند آنکه عیاری گردد چون خواهد این دارو بآب خمیر کرده بر زر طلاء کند و در آتش بتابد و در آب سرد اندازد رنگین بیرون آید *

نمّت بالخیر

¹ Rough sketch omitted. Simply a pot on what is apparently a sand-bath is shown.

² Ms. reads تشویه. ³ Ms. قمع ابگینه و قنینه بزرگ.

⁴ The same figure occurs here as was found previously under the Fourth Pillar, i.e., treatment of Maghnuisiyā (vide Pl. II, Fig. 4).

APPENDIX A.

(Extract from a previously unpublished portion of the Arabic text of the 'Ain-ş-Şan'ah wa Aun-ş-Şana'ah—translation of which will be found as Note (2) p. 428 *supra*.)

هذا باب تدبير الركن الثاني

وهو ان تاخذوا من الشيطم سليمانى وزن احد عشر درهما فتدقوه وتسحقوه وتجعلوه في امعاء شاة وتربطوا راسه ربطا جيدا و تاخذوا مرجلا او طننجيرا وتصبوا فيه الماء وتجروه وتلقوا فيه ذلك الامعاء وتبخره ساعات فان الشيطم ينحل ما في جوف الامعاء ثم تخرجوه و تاخذوا من الكبريت الاصفر وزن ستة دراهم وتسحقوه على صالية وتجعلوه في قدح زجاج وتسقوه من ذلك الماء الذي في جوف الامعاء يومين في الشمس وتجروه على صحيفة محمية فان ثبت ولم يدخن و لم يحترق فقد بلغ و الا فلا تزال تسقونه من ذلك وتجروه الى ان يثبت على النار ولا يذوب ولا يدخن ولا يحترق و لو في عشرين مرة ثم تعزله - ثم تبدوا بالركن الثالث وهو تدبير الزرنينج و علامته ان يبيض الزرنينج و يصير حجرا مثل العاج و الرخام و يصبغ الذكاس صبغا حسنا و يلينه و يذهب برائحته الممتدة الزفرة و من الله التوفيق *

هذا باب تدبير الركن الثالث

وهو ان تاخذوا من الزرنينج الاصفر الذي يمثل هذه الفصوص و هو الاقشيزق الصفايح لا غير وزن رطلين و من برادة الحديد الزمان و هو الانثى وزن نصف رطل و هو اثنان و ستون درهما و من الملح الطيب او المرظلا و هو مائة و ثمانية و عشرون درهما فتسحقوا الزرنينج في هاون حجرا او حديد فلا يصلح غيرهما سحقا ناعما و تنخلوه بالحريزة و تدقوا الملح و تجعلوا البرادة زعفرانا و هو ان تاخذوها فتفرشوها على ورقة من كاغذ فوق لوح من خشب و ترشوا عليها خلاصا رشا مالعا و تعلقوها حتى يتربط السفلائية و الفوقائية و يعلو عليها النخل و يجرى منها و يجففوها في الظل ثم تجربوها فان انسحقت من اصابعكم و الارششتم عليها النخل مرة اخرى و ثالثة حتى ينسحق بين الاصابع اذا جفت جفانا جيدا ثم تسحقوها في الهاون سحقا جيدا و تاخذوا الزرنينج و الملح و برادة الزعفران و تجعلوها في ظرف غضارة مدهون جام كبير و غبروها و تخلطوها كلها و تغمرها بغل حامض حتى يعلو عليها بمقدار ثلث اصابع مضمومة و تسوطوها و تغطوا الظرف بورقة و تشدها عليه حتى لا يطيرها الريح و تغبروها و تضعوها في الشمس اياما و تسوطوها كل يوم ثلث مرات سوطا جيدا بالغداة و الظهر و العشاء و تثبتها في الليل تحت السقف و ان كانت الايام متغيرة و الوقت شتاء فتجعلوها في قدر شهرزرى و هو من القدور الخزفية و تود تحتها بذرا هادئة حتى ينشف النخل و يجف قليلا و تذرنها في الهواء على قطعة منارية فاذا لم يبق فيها نداوة ولا رطوبة اما من الشمس و اما من النار فتاخذوها و تسحقوها في الهاون الحجري سحقا جيدا و تجففوها بالحريزة و تاخذوا لها ثلث برانى من خرف مدهونة الدواخل طول كل واحد منها

شبر و لها اغطية شبه بالافداح يدخل روس البراني فيها على هذه الصورة - فتطيفوها بالطين المعمول من الطين ومثل ثلثة كيلا من سرجين الدواب اليابس وشعر اعرافها القطع صغار المخمر عشرة ايام كل واحدة من البراني والاقداح على حدة تطيئنا بغلظ الابهام وتجففوها في الفمي كئلا يتشقق الطين عليها ثم تكبسوها بالادوية المسحوقة المصلولة و تركيبوا عليها اغطيتها وتستوثقوا من اوصالها من هذا الطين وتجففوها في الفمي تجفيفا محكما ثم توفدوا لها تنورا بالقماش وغيره حتى يستجمع فيه من الجمر ذراعان ثم تدفونها في وسط الجمر نغطوراس التنور و تثبتوها فيه ليلة كاملة تخرجوها بالغداة وتبردها ساعتين من النار ثم تفنكوها - وتخرجوا منها الادوية وتضعوها على صلاية وتسحقوها وترشوا عليها قليلا من الخل الحامض وتجففوها وتردها الى البراني والتطيين والتشوية على هذا ثلث مرات فان تعذرت البراني المخزفة فناخذوا لها براني خضرا مدهونة الدواخل و الخوارج وتجعلوا اغطيتها من كعاب الغضار و ان تعذرت التنور المتشوية فتدفنها في نار اتون الحمام فتجعلو تحتها من النار مقدار ذراع و فوقها كذلك *

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