

would be of anything like so great a range as that just found, a range from maximum to minimum of about 11 per cent. of the mean heating effect.

XVIII.—*On probable Changes in the Geography of the Punjab and its Rivers : an Historico-Geographical Study.*—By R. D. OLDHAM, A. R. S. M., Deputy Superintendent, Geological Survey of India.

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(With a Map—Pl. XIX.)

Introductory.—Of all the problems with which we are brought in contact when we try to unravel the ancient geography of India, none surpass in interest or difficulty those connected with the rivers of the Punjab and Sind. Both interest and difficulty result from the fact that, previous to the advent of the English, all civilization and every invader have entered India from the North-West, and their difficulty from the changes that appear to have taken place in the courses of these rivers during the last three thousand years. It cannot be said that this subject has been neglected by previous writers on the ancient geography of India, but their efforts have mainly been addressed to the identification of towns or countries, and their references to the rivers are often marked by an ignorance, or neglect, of the fundamental principles of physical geology ; yet the matter is one on which the geologist must be heard as well as the scholar, for, whatever dependence may be placed on history or tradition, the conclusions that are drawn are only valid so long as they are possible, and no one that has not studied the mode of action of rivers on a geological basis can decide whether any particular change in the course of a river, of which there appears to be historical indication, can or cannot have taken place.*

* Throughout the following paper, I am largely indebted to the author of an anonymous essay in the Calcutta Review, on the "Lost River of the Indian Desert", (vol. lix, pp. 1—29, understood to be by Surgeon-Major C. F. Oldham). I am indebted to this writer for having first drawn my attention to the subject, for having suggested most of the opinions supported in the following paper, and for many of the references given below. I have, however, except where the contrary is expressly stated, verified them in every case ; and, to save wearisome repetition, I must request all who wish to see how little I diverge from the opinions expressed by the writer referred to, and to what extent this paper goes beyond the matter he has treated of, to compare the two, promising that the perusal of the article in the Calcutta Review will prove anything but a waste of time.

I. *On the Ancient Course of the Indus through Sind.*—It is generally supposed, and the supposition is supported by authority, that the Eastern Narra marks an old course of the Indus, and that it was down this now deserted channel that the fleet of Alexander sailed. This supposition has been adopted by General Cunningham in his ‘Ancient Geography of India,’ where the capital of the king Musikanus according to Strabo, Diodorus, and Arrian, or of the Musikani according to Curtius, is identified with the town known in more modern times as Aror or Alor. He says that the ruins of Aror are situated “to the south of a gap in the low range of limestone hills, which stretches from Bhakar towards the south for about twenty miles, until it is lost in the broad belt of sand hills which bound the Nára, or old bed of the Indus, on the west. To the north-east it was covered by a second branch of the river which flowed nearly at right angles to the other at a distance of three miles. At the accession of Rajah Dahir in A. D. 680. the latter was probably the main stream of the Indus which had been gradually working to the westwards from its original bed in the old Nára.”

Leaving his fleet at Alor, Alexander* marched against Oxycanus or Portikanus, or, according to General Cunningham’s identification, Larkána, and Sindomána or Sehwan, and from Sindomána he “marched back to the river where he had ordered his fleet to wait for him. Thence descending the stream he came on the fourth day to” a town which the General identifies with Brahmanabad, notwithstanding that by his own confession this lies twenty miles west of the Eastern Nára down which he has just declared that Alexander sailed. General Cunningham’s identification of this town, the Harmatelia of Diodorus, with Brahmanabad seems to be satisfactory, but the more thoroughly this is the case the less likely does it seem that the Eastern Narra can mark the course of the Indus when Alexander sailed down it.

But there are more important objections than this. After leaving Harmatelia, Alexander sailed down the river to Pattala, which General Cunningham identifies with the modern Haidarabad, and from thence he sailed to the sea by two different courses, one of which took him to near Karachi, the other to the Ran of Kachh. It seems clear that Alexander’s historians placed the head of the Delta at or near Patala, which cannot have been much further from the sea than Haidarabad, for Onesikritus says that all three sides of the Delta were equal†; in any case it was below Harmateleia. But as Harmateleia and Brahmanabad are the same, and, as this place lay twenty miles west of the Eastern Narra, the Indus must in some manner have broken westwards from the bed of the Narra

* Cunningham, *Ancient Geography of India*, p. 267 *et seq.*

† Cunningham, *op. cit.*, p. 283.

and wandered over higher ground. In the text there is nothing to shew that General Cunningham appreciated this difficulty, but in the map a compromise seems to be attempted which, the usual fate of such attempts, can hardly be called satisfactory. I say seems, for in this map—as in all the maps illustrating the work, but more conspicuously in this—an attempt has been made to represent, without any distinguishing mark, both the present and the ancient courses of the rivers. On the map in question (No. IX), the “*Narra R. (ancient course of the Indus)*” leaves the existing course of the Indus about thirty miles north of Aror and flows nearly due south to Jakrao, whence a course is marked running S. W. by Brahmanabad to Patala. From Jakrao, another course diverges to the S. E., and, after reaching the latitude of Amarkot, turns S. S. W. and flows into the Ran—or perhaps into a lake, for it is by no means clear whether General Cunningham supposed the Ran to have existed in Alexander’s times—shortly after joining a branch of the Indus which flows S. S. E. from Patala, but whether this eastern line is supposed to mark an ancient course of the Indus or to represent the dry bed of the Narra is not clearly shewn, but either supposition would be equally impossible. The accounts of the Arab historians and geographers shew that from the 8th century the Indus flowed past Mansura, until, in the 13th century, it abandoned this course for one further to the west, which it has since maintained, and the supposition that the Eastern Narra marks the ancient course of the Indus lands us on one of the horns of a dilemma, for, if the Indus flowed down the Narra as far as Jakrao, and the present continuation was then in existence, it is inconceivable that the river should have left this lowland to wander up hill, through the higher land to the west; nor, if this line is meant to represent the present channel of the Eastern Narra, which did not exist in Alexander’s time, is it possible satisfactorily to explain the excavation of this channel. I have not written the above in any spirit of captious criticism, but merely to shew the difficulty that attaches to the elucidation of the ancient geography of Sind if we accept the prevalent idea, inconsistent as it is with the known principles of physical geography, that the Eastern Narra represents an ancient course of the Indus.

§ 2. The Indus in its course through Sind flows between banks that are raised above the general level of the country, which slopes away on either side. This is a feature common to all rivers which are raising the level of their alluvial plains by the deposit of silt, but, at Bukkur, the Indus exhibits a feature which is exceedingly rare, if not without a parallel, in the case of any other river, for here it flows at the higher level through a gap in a low range of hills surrounded on either side by

alluvium at a lower level than that of the river where it passes through the gap. It is difficult to give any satisfactory explanation of this feature if we suppose the Indus to be the only river that ever flowed in this region, but I hope to shew that there are both historical and geographical indications of the former existence of a river which flowed to the Ran of Kach, independent of the Indus, and, if we admit its existence, the following hypothesis may be offered as a possible explanation of the existing peculiarity in the course of the Indus.

In former times, the Indus wandered over the plain which surrounds the Khairpur hills, raising the level of the soil on either bank till it broke away into the low ground on one side or the other, and so by degrees raising the level of every part; during the latest phase of this process, previous to the origin of the existing conditions, it flowed east of its present course and, having raised the level of the ground there, wandered away westwards; by this time the surface of the alluvium had been raised till it was level with a gap in the Khairpur hills at Rohri, and, as the alluvium south of the ridge would probably be at a considerably lower level than on the north side, the waters of the Indus, having once found an outlet through this gap, would soon establish a permanent course for themselves. If then we assume that the other river instead of depositing silt and raising the level of its alluvium was an eroding stream, we may suppose that it gradually worked westwards till it reached the present situation of the Eastern Narra and excavated that channel: the flood waters from the Indus would smooth off the slope between them, and, had the process continued, there can be little doubt that the Indus would soon have broken away into this low lying channel, had not the other river, owing to a change of course in its upper reaches, dried up before this happened. It may seem strange that two rivers should have flowed so close to each other under such different conditions, but it must be remembered that, if the second river was small in comparison with the Indus, it may well have deposited all its silt higher up its course, and consequently have had none to deposit when it reached the latitude of Rohri.

So far I have merely proposed a possible hypothesis to account for the known peculiarity of the course of the Indus, but I hope to be able to shew that there is both historical and geographical evidence of the former existence of this second river.

§ 3. The commonly accepted opinion that the Eastern Narra marks the former course of the Indus is no doubt due to a prevalent tradition to that effect among the natives of the country; but it must be borne in mind that these traditions often arise from an endeavour to explain

known phenomena, and that when they have their origin in historical fact, this has become so modified by the alteration inherent in oral transmission, not to mention that resulting from a change from prose to verse, that it is impossible to separate the original foundation of fact from the superstructure of fable. Nevertheless, as no tradition ever arose without some foundation in fact, whether an historical occurrence or a phenomenon requiring explanation, these legends must not be neglected, but rather regarded as valuable hints as to the direction that research should take, although they can never be appealed to as proof. But even legend throws some doubt on the correctness of the common idea, if we may believe the following quotation from the *Tarikh-i-Tahiri*. After mentioning the size of the ruins of Muhammad Tur, the capital of the Sumra chiefs of Sind, he gives the following account of its destruction: "The cause of the ruin of the above-named city and its dependencies which had flourished between 900 and 1000 years was as follows. Below the town of Alor (Aror) flowed the river of the Panjab which was known as the Hákra, Wahind, Dahan, and by others, for it changes its name at every village by which it flows, after fertilising the land the river poured its waters into the sea." The legend then goes on to say how, as a result of the oppression and lust of Delu Rai, who ruled all the land between the capital and Aror, the Hákra was diverted into the present bed of the Indus.* This exhibits the legend in a form slightly different from that which it now takes; and the mention of Muhammad Tur as well as the names of the river, Hakra, Wahind, and Dahan, none of which are applied to the Indus, but all of which are applied to a dry river bed further east in which the Indus has certainly not flowed within the historic period, all points to the conclusion that the legend originally referred to the drying up of that second river whose existence I have hypothetically inferred. The change that has come over it is easily understood, for to this day part of the flood waters of the Indus find their way into the deserted bed of this river; and, when the memory of the co-existence of the two had passed away, what more natural than to suppose that what had occurred was an alteration in the course of the Indus, which, as usual, came to be attributed to the vices of the ruler of the country so laid waste.

This supposition also fits in with a tradition which, according to the writer just quoted,† is prevalent, on the borders of Bikaner, to the effect that the waters of the Hákra spread out into a great lake at a place called Kak, south of the Mer country. No place of the name of Kak is now known, but we have Kachh, which may be it, and the early Arab Historians mention a piratical tribe, the Kerks or Kurks, who

* Calcutta Review, LIX, 20.

† Calcutta Review, LIX, 17.

appear to have inhabited the shores of the Indus Delta and Kachh ; but, however this may be, the Mers are well-known as a tribe formerly inhabiting the south-west corner of the Indian Desert to the north of the Ran of Kachh, which doubtless is the great lake referred to in the tradition.

Neither the historians of Alexander the Great's invasion of India nor the classical geographers throw any real light on this question. Ptolemy is doubtless the fullest and most complete in his list of localities, but the modern representatives of most of his towns are as yet a matter of dispute. If General Cunningham is right in identifying the Mousikanos of Arrian with Aror, it would support the generally-accepted theory, for Ptolemy places Sousikanos, which is evidently the same place, west of the Indus ; it seems to me, however, more probable that the Kamigara of Ptolemy, which he places east of the Indus, occupied the position known in later days as Aror. The ruins of this city are still known in the neighbourhood as Kaman, and this with the affix *nagar* might easily be corrupted into Kamigara.*

From the date of Ptolemy's geography we lose all sight and knowledge of Sind until the advent of the Arab geographers and historians in the eighth century, from whom some information can be gained as to the course of the rivers in their times.

Unfortunately, the works to which one would naturally first turn are useless, or, worse still, misleading. The Arab geographers had all a very vague and general idea of Indian geography, indeed their works compare ill with our modern knowledge of Central Africa or of that *terra incognita* Central Thibet, their distances are vague and often inconsistent, their bearings are seldom correct, and, to make confusion worse confounded, they were constantly confusing places which had similar names though distinct and distant from each other—a mistake rendered easy by the character in which their books were written, and which betrays itself constantly in the fact that hardly ever do two different authors spell the same name similarly.

Of all the geographers quoted in Sir H. Elliot's History of India but two mention on which side of the Indus the town of Aror was situated : Al Masudi says that it was on the west bank of the Indus,† and Al Idrisi says that the Mihran runs to the west of Dur (Aror).‡ The contradiction here is apparent, not real, for strangely enough all the bearings given by Al Idrisi have been reversed,§ yet I cannot help thinking

* *Ancient India as described by Ptolemy, &c.*, by J. W. McCrindle, M. A., M. B. A. S., London, Calcutta and Bombay 1885, p. 151.

† Elliot's *History of India*, edited by Prof. Dowson, I, 23.

‡ Elliot, *op. cit.*, I, 79.

§ Thus he places the Persian Gulf east of the Delta of the Indus and Sewestan or Seistan, north of Turan.

that in this case his statement is really correct, though constructively wrong. In the extract from Al Istakhri it is merely stated that Alrur is situated 'near the Mihran,' but, in the map reproduced by Prof. Dowson* and extracted from the *Askkálu-l Bilad* (a copy of Ibn Haukul's work), Alrur is clearly placed on the east bank of the Indus, on the same side as Multan and the opposite side to Sadusan and Makran. This map is said to be very similar to that of Al Istakhri, as published by Moeller, and may be regarded as probably more trustworthy than the text, into which clerical errors are so easily introduced.

But if the geographers can give us no definite information on this subject, we can at least obtain a fairly certain answer from the historians, for, in the *Chachnama*,† it is stated that Chach set out from Alor and after many marches reached the fort of Pabiya "on the Biyah," after capturing this fort he crossed the Biyah, and, having passed the Ravi, reached Multan: the same itinerary is given for Muḥammad Kasim's later march over the same country both in the *Chachnama* and by Al Biláduri,‡ and it is certain that the passage of the Indus, had it been crossed, would not have been omitted by a chronicler who was careful to mention the much smaller rivers of the Bias and Ravi. In the case of Muḥammad Kasim, the passage of the Indus at Nirun is recorded, but there is no record of his recrossing it before reaching Aror.

This should be sufficient proof that the Eastern Narra has not been the bed of the Indus, at any rate since the eighth century, but this opinion is so widely held and has been so supported by authority that it will not be amiss to bring forward still further evidence pointing in the same direction.

The Arab geographer Al Idrisi places the head of the Delta, or the place where the first distributory is given off, at Kállári, 'a hard day's journey' of forty miles from Mansura. The exact words of the translation are "at Kállári it divides—the principal branch runs towards Mansura, the other flows northwards (southwards) as far as Sharúsan it then turns westwards (eastwards) and rejoins the chief stream forming henceforward only one river. The Mihran passes on to Nirun and then flows into the sea."§ Further on it says, "Kállári on the west (east) bank of the Mihran is a pretty town well fortified and is a busy trading place. Near it the Mihran separates into two branches; the largest runs towards the west (east) as far as the vicinity of Mansuria which is on the west (east?) bank; the other runs towards the north-west

* *Elliot's History of India*, I, 32.

† *Op. cit.*, I, 140.

‡ *Op. cit.*, I, pp. 122 and 202-3.

§ *Elliot, op. cit.*, I, 78.

(south-east) then to the north (south) and then towards the west (east). Both unite at the distance of about twelve miles below Mansúria."* It will be noticed that the bearings in these two accounts do not agree, probably in the second case we should be satisfied with turning them three quarters of a semicircle, but even then they would not cut in, and in consequence the first set, which are more consistent, must be regarded as more nearly correct; any way it is clear that the river bifurcated at a place called Kállári, forty miles or a 'hard day's journey' from Mansura, that one branch flowed by Mansura, and that the two reunited below Mansura.

At the conclusion of the second account he says that from Kállári to Sharúsan is three days. I refer to this now as the statement is puzzling, but is due to the confusion of two places of very similar names, Kállári and Bállári. On Ibn Haukal's map the town at the bifurcation of the river is called Ballari while Kalari is further north and at some distance from the river. In the text he says that Ibn and Lábri—which Prof. Dowson identifies with Amári and Kállári—are situated east of the Indus, but distant from it. Al Idrisi's two accounts are evidently from different sources, and it is probable that either he or his informant must have confused the Bállári, or Kállári, at the bifurcation of the Indus with the other town of similar name situated to the east, which might well be three days distant from Sehwan.

The first account too is somewhat difficult of understanding, for it is impossible to understand how, from any point one day's journey—even if it be one of four miles—from Mansura, a branch of the Indus could flow south to Sehwan. It is of course a physical impossibility that the Indus should have flowed any distance northwards, and the general reversal of Al Idrisi's bearings has already been referred to. No other authority makes this statement, and the map of Ibn Haukal places Sadúsan on the west bank of the Indus above Bállári, where the river bifurcates; this is altogether a more probable disposition.

We have thus two authorities confirming each other that in the tenth or eleventh century the Indus or a branch of it flowed passed Sadúsan, which we may certainly identify with Sehwan. The Chachnáma seems to shew that the same was the case in A. D. 713, for it says that, when Muḥammad Kasim besieged Siwistan (Sehwan), the river "Sindhú Ráwal" flowed north of his camp.† There can be little doubt that this was either a bend or a branch of the Indus.

It is thus clearly proved that at any rate since the commencement of the eighth century of our era the Indus has flowed west of Aror and the range of hills running southwards, and that, though it is practically

* *Op. cit.*, I, 79.

† *Elliot, op. cit.*, I, 159.

certain that the Indus, or one branch of it, must have at one time flowed through the gap near Aror, it is equally certain that nothing but the flood waters then or since have flowed eastwards past Aror to the Narra, and that for the last 1100 years at least the Indus flowed west of the low range of hills running southwards from Sukkur and Aror. The tract of country between these hills and the range to the west is on the map a simple network of deserted river channels, and it will be hopeless to attempt to determine with accuracy which of these was the river course at any one particular period.

§ 4. Yet, though the Eastern Narra is not a deserted bed of the Indus, it seems probable that as late as the eleventh century it was occupied by a flowing river. My witnesses to prove this are, *1st*, the Chachnama, and, *2nd*, the Beglarnama, both translated in the first volume of Prof. Dowson's edition of Sir H. Elliot's History of India.

When Muḥammad Kasim invaded Sindh, he sent his manganolus up the river to Niran, and, after receiving the submission of that place, he determined to go against Sehwan, and after its capture to "recross the river"* and proceed against Dahir; from this it is evident that he must have crossed one of the main branches of the Indus, thus confirming other accounts which place Niran between the two main branches of the Indus. After the capture of Sehwan, he returned to Niran, where he crossed the Mihran by a bridge of boats, and went against Dahir; after crossing the river and defeating Dahir's troops, whom they pursued 'as far as the gates of Jham,' the Arab army marched on till it reached 'the fort of Bait,' where an entrenched camp was formed. Muḥammad Kasim then advanced towards Ráwar and came to a "lake," but, as this had to be crossed by a boat, it was probably a branch of the river; after crossing he advanced a day's march and came to "Jewar on the banks of the Wadhawah (or according to another MS. Dadhawah).† After his defeat by Muḥammad Kasim, Dahir took refuge in the fort of Ráwar, which was but a day's march from 'Jewar on the Wadhawah,' and which seems itself to have been on the Wadhawah, for, among the administrative arrangements made by Muḥammad Kasim before he marched northwards, it is stated that he placed "Nuba, son of Dáras, in the fort of Ráwar and directed him to hold the place fast and keep the boats ready. If any boat coming up or down stream was loaded with men or arms of war, he was to take and bring them to the fort of Ráwar."‡ From this it is evident that Ráwar was on a navigable stream, and it remains to identify this if possible.

Elphinstone has placed Ráwar on the Indus, but this was clearly

* Elliot, *op. cit.*, I, 158.

† *Op. cit.*, I, 168.

‡ *Op. cit.*, I, 189.

not the case, for it was several marches east of the Indus, three halting places being mentioned in the Chachnama, and the context clearly shewing that these were separated by more than a single stage; besides which the text says that, when it was known that Dahir had been killed "between the Mihran and the Wadhawah," the chiefs and officers of the Rani "took refuge in the fort," thus clearly shewing that, in the opinion of the writer of the chronicle, the Mihran and the Wadhawah were not one and the same river. This would perhaps be of little value if unsupported, but, on examining the latest maps of Sind, I find that the Narra can be traced northwards to Sahara in Lat. $27^{\circ} 15'$, where it ends abruptly, that thence for twenty-three miles its course is obscured and obliterated by the deposit from the flood waters of the Indus: but, in Lat. $27^{\circ} 25'$, Long. $69^{\circ} 18'$, I find a deserted river channel, called on the map the "dry bed of the river Wundun," which is continuous with the dry bed of the Hákra, traceable through Bhawalpur and Bikanir. This similarity of name certainly lends great support to the theory, originally started by the anonymous writer in the '*Calcutta Review*,'* that the Nárra is the old bed of the Hákra which till the thirteenth century pursued an independent course to the sea.

Further evidence of the existence of another river besides the Indus in this region may be found in the Chachnama, where it is related that, on the way from Ráwar to Brahmanabad, Muḥammad Kasim laid siege to the fort of Dhalila, and "when the besieged were much distressed * * * they sent out their families into the fort which faces the bridge, and they crossed the stream of the Najak without the Musalmáns becoming aware of it." At daybreak they were pursued and overtaken as they were crossing over "the river" and "those who had crossed previously fled to Hindustan through the country of Rámál and the sandy desert to the country of Sir, the chief of which country was named Deoraj." But far more important and convincing evidence is to be found in the Beglarnáma. It is there related that, after an embassy to Jessalmer, Khán-i-Zamán (the hero of the chronicle) went towards Nasrpur, and, in the course of his journey, it is incidentally mentioned that he crossed 'the tank Sankra.'† At Nasrpur, being pressed for money, he determined on a marauding expedition against the "Sodhas at the village of Tarangchi." He set out and "crossed the waters of the Sánkra," and "when Dúda and Gházi learnt that he had gone in that direction they rode after him;" but these youths had forgotten to ask the permission of their parents, who rode after them hot haste and reached the Sánkra just as their sons were

* Notes on the Lost River of the Indian Desert, *Calcutta Review*, LIX, 1—27.

† Elliot, *op. cit.*, I, 284.

crossing it; the latter, when they saw that their fathers had come after them, immediately "threw themselves into the stream, swam their horses over, and joined Khán-i-Zamán."*

The Sánkra here is evidently what we now call the Narra, and the name given is the same as Hákra or Sákra, which is applied to the dry bed of the lost river in Rajputana, while the mention of the horses swimming the river shews that this must have been of some depth, quite sufficient to be navigable for country boats.

It seems then that, as late as the beginning of the eleventh century, the Eastern Narra was occupied by a considerable stream of water, and was known as the Hákra, Sákra, Wandan, Dahan, Wadhawah, Dadhawah, or Wahind. These names really resolve themselves into three. Hákra or Sákra is the name still applied to the dry river bed which can be traced through the Western desert, where the letter S is almost invariably changed to H. The next four are also one word, D and W being easily confounded in the character in which these chronicles were written, and the termination 'wah' simply meaning a stream. While the last appears to be a separate name which translated means the "river of Hind," a name which appears of itself to separate this river from the Mihran, the "river of Sind" now known as the Indus. But I have already shewn that the Indus must have flowed west of Aror since the beginning of the eighth century, so that there is little difficulty in accepting the conclusion that the Eastern Narra marks the course of a dried up river which can be none other than that which the names applied to it indicate, the "Lost River of the Indian Desert."

II. *The Lost River of the Indian Desert.*—We lost sight of the dry bed of the old river Wandan in Lat. $28^{\circ} 16'$, Long. $70^{\circ} 33'$. Above this comes a stretch of sixty miles in which the river bed has either been completely obliterated by drifting sand or at any rate is not marked on the Revenue Survey maps of Bhawalpur, but in Lat. $28^{\circ} 46'$, Long. $71^{\circ} 25'$ we again find a dry river bed which, under the varying names of Hakra, Sotra, Choya, &c. can be traced through Bhawalpur, Bikanir, and the Sirsa district till it is lost near Tohána in the Hissar district.

Although the connection of these two dry river beds has not yet been traced (unless we may take a passage† in the essay which has more than once been alluded to to mean that the writer had personally traced the connection), there can be but little doubt that the two were originally continuous and are the sole remaining traces of that great river which, according to the traditions prevalent throughout the desert, once flowed through this now barren tract to the sea, or, according to other accounts, to the Indus at Sukkur.

* *Ibid.*, p. 285.

† *Calcutta Review*, LIX, 17, (1874).

As regards the date of the final drying up of this river the only evidence we have is the couplet, quoted by Col. Todd,* which says that the river dried up in the time of the Sodah prince Hamir. A prince of that name was contemporary with the Bhatti rajah Doosaj who ascended the throne of Jessalmer in A. D. 1044: there is no proof that this was the same Hamir as is referred to in the couplet, but we have already found that the latest mention of the Hákra or Sánkra† as a flowing river is about 1000 A. D., and that it is not mentioned in any contemporary record of later date; it is, consequently, possible that the two Hamirs are one and the same, and that the drying up of this lost river took place some time during the eleventh century.

§ 2. We have next to decide from whence came the water that filled this river bed; the first hypothesis that may be mentioned is that of M. de Saint Martin. He considered that it was the Saraswati of the Vedas whose course had been shortened to its present limits through a diminution of rainfall. This hypothesis is, however, untenable, for there is no historic evidence of such an enormous climatic change as this implies, nor could such an enormous rainfall on the Himalayas have existed during the human period without leaving its traces in the boulder deposits of the streams where these issue from the hills on to the plains.

Another theory, propounded by an anonymous writer in the *Calcutta Review*,‡ is that the Hakra was originally occupied by the Jumna or a branch of it. Whether it may ever have carried any of the waters of the Jumna, I will afterwards consider, but it is certain that it could not have done so since the time of Manu, who mentions the Jumna as joining the Ganges at the modern city of Allahabad; and I have shewn that the Hakra was probably a flowing river at a later period than that.

The third, and to me most probable, theory is that of the anonymous essayist§ whom I have already quoted several times and shall quote still oftener, and who supposes the Hakra to be the old bed of the Sutlej, which, previous to the thirteenth century, did not join the Beas, as it now does, but pursued an independent course to the sea.

This hypothesis was warmly combated by another anonymous writer in the same periodical, and it will be convenient before passing on to the evidence in its favour to consider one argument which has been

* *Annals of Rajasthan*; a sketch of the Indian Desert, chapter I.

† These are the same word, many of these Western Rajputs being unable to pronounce the letter S.

‡ *Calcutta Review*, LX, 351, (1875).

§ *Ibid*, LIX, pp. 1—27, (1874).

urged against it by the writer just referred to, and again by Mr. Wilson in his final report on the settlement of the Sirsa district, *viz.*, that the Hakra is not large enough to have carried the waters of the Sutlej. I will quote Mr. Wilson's own words: "The Sotar is a well-defined valley, varying in width from three to six miles, of no great depth, and usually quite level from side to side, but distinctly marked off from the light-coloured loamy soil of the plain through which it passes by a clearly defined bank or sand-ridge on either side, and still more by its dark rich clay soil free from admixture of sand and producing a vegetation different in character from that of the surrounding country."

* * * "From the appearance of the Sotar valley and the numerous remains of towns and villages which stud its banks all the way to Bhawalpur,* it is evident that at one time it conveyed a much larger volume of water than at present, and probably was the channel of a perennial stream. But though it must have been, as it is now, the largest and most important of all the drainage channels between the Sutlej and the Jumna, it can never have carried a river at all approaching in size to either of these two. The valley is too shallow and shews too few marks of violent flood action for this to have been the case; and there is none of the river sand which would certainly have been left by such a stream. The soil is all rich alluvial clay, such as is now being annually deposited in the depressions which are specimens of those numerous pools which have given the Saraswati its name, 'The river of Pools'; and there seems little doubt that the same action as now goes on, has been going on for centuries, and that the numerous mountain torrents of the Indo-Ganges watershed, fed, not by the snows but by the rainfall of the Sub-Himalayan ranges, wandering over the prairie in many shallow channels, joined in the Sotra or Hakra valley and formed a considerable stream, at first perhaps perennial but afterwards becoming absorbed after a gradually shortening course, as the rainfall decreased over the lower Himalayan slopes, and as the spread of irrigation in the submontane tract intercepted more and more of the annual floods; and the comparatively feeble stream, cutting away all the prominency in its bed, deposited the silt in the depressions, and gradually filled its valley with a level layer of rich hard clay. The same process appears to be still going on, and the bed of the stream is gradually attaining one uniform slope throughout."†

* Mr. Wilson had traced its course outside the Sirsa district on native authority into the Garrah near Bhawalpur. Actual survey has shewn that this information was erroneous.

† *Final report of the Revision of the Settlement of the Sirsa District in the Punjab*, by J. Wilson, Settlement Officer, Calcutta, 1884.

I have quoted this passage as giving a clear statement of the nature of the objection raised, *viz.*, the shallowness of the channel and the difference of its soil from the sandy silt found in the present bed of the Sutlej, and at the same time describing the manner in which it is even now being filled up with an alluvium precisely similar to the existing soil, and different from the sandy silt of the present bed of the Sutlej, thus destroying the objection just urged so forcibly. There is no evidence of the progressive diminution of rainfall assumed by Mr. Wilson, but the other reason—the extension of irrigation—would certainly absorb an increasing proportion of the water, and may account for the fact that the waters of the Gaggar appear to have reached further down this channel about the commencement of the present century than they now do.

Another objection which has been raised is, that the Sutlej flows in a depression below the level of the plain over which the Sotar pursues its course, and that neither it nor any of the dry river channels, to be mentioned further on, which communicate with it have been traced into connexion with the Sutlej. As regards the first, this is a common characteristic of all the rivers of the Indo-Gangetic plain, and it is certain that, as long as the present conditions existed, it would be impossible for any great changes in their courses to take place. But it is equally certain that, when these plains were being formed, the rivers must have wandered over them in channels raised above the general level of the surface, and were consequently liable to constant change of course, and that the present configuration is due to a change of conditions, from one of deposition to one of erosion by the rivers, the exact date or cause of which has not been established.

With regard to the second objection, it implies an ignorance of the conditions under which rivers flowing over an alluvial plain may change their course. In such cases rivers flow in places in a single well-defined deep channel, but in others they spread out over a shallow ill-defined bed or even split up into several distinct channels; it is at such places as this that a river is liable to break away into lower ground on either side, the shallow channel becomes obliterated and gradually merges into the general level of the plain, but lower down, where the river flowed in a deeper and better defined channel, the dry bed remains distinguishable and marks the former presence of the river.

§ 3. We must now consider the historic evidence in favour of or against the supposition that there have been extensive changes in the course of the Sutlej during the historic period.

In the Vedas, the Sutlej is several times mentioned under the name

of Satadru, but only in one case is it mentioned or supposed to be mentioned in connection with the Beas, and that is the 33rd hymn of the 3rd Mandala, where the confluence of the Chitudri and the Vipas is referred to; there are, however, some points in the description which render it open to doubt whether this refers to the confluence of the Sutlej and Beas, and, moreover, it would not prove that the Sutlej did not pursue an independent course at a subsequent period, unless we could also prove that the present configuration of the ground, the distinction of Khadir and Bhangar, of strath and upland, existed in Vedic times.

Coming to a later period, we do not find the Sutlej mentioned by any of the classic historians or geographers. In Arrian's *Anabasis* there is no mention of the Sutlej, though all the rivers, from the Indus to the Beas, are mentioned, and, in the description of his voyage down the Jhelum and Indus, we find the statement that "these four large and navigable streams at last discharge their waters into the Indus, though they do not preserve their individual names until that time. The Hydaspes falling into the Akesines loses its name there, the Akesines takes in the Hydraotes and also the Hyphasis, and retains its name until it falls into the Indus."* Here not only is there no mention of the Sutlej, but the special mention of *four* rivers shews that there was no information extant of the existence of a fifth large river.

In the "*Indica*" of Arrian some other rivers or streams are mentioned; it is there stated that the "Hydraotes, flowing from the dominions of the Kambistholi, falls into the Akesines after receiving the Hyphasis in its passage through the Astryabai as well as the Saranges from the Kekians and the Neudros from the Attakenoi."†

Ptolemy, however, mentions a river Zaradros which he makes to receive the Bibasis (Beas) much in the same place as the junction takes place at present, and furthermore he makes it preserve its name right to the Indus. He also makes the Bidaspes (Jhelum) preserve its name till it joins the Zaradros, although it receives first the Sandabal (Chandrabagha or Chenab) and then the Adris (Ravi). With the exception of a few slight peculiarities of nomenclature, this is practically the same arrangement as obtains at the present day, if we may regard the Zaradros as the Satadru or Sutlej of modern times; and when we find the greatest of the classical geographers agreeing so closely with our modern maps, we may well begin to doubt whether there has been any great change in the course of any of the rivers since his time.

Ptolemy, however, gives one peculiar piece of geography which must not be passed over without notice; in latitude 29° 30', or about

* *Anabasis*, LVI, CXIV.

† *Indica*, cap. IV, McCrindle's Translation, p. 190.

thirty miles south of the junction of the combined rivers, he places a "divarication of the Indus towards Mt. Onindion" and the "source of the divarication" in Lat. 27°, Long. 127°. This, allowing for the vagaries of Ptolemy's geography, would agree fairly well with the commencement of the Sotar, and it may be noticed that many maps which profess to shew the ancient geography of India make the "Neudrus" follow the course of the Sotar for some way and join the Indus about where Ptolemy places this divarication. It is not necessary here to enter into a discussion of the exact meaning of that extraordinary phrase of Ptolemy's "ἡ πηγὴ τῆς ἐκτροπῆς," for it is evident that in this matter he was given to a looseness of language, or an inaccuracy of information, which led him to confuse together affluents and effluents, tributaries and distributaries.*

After Ptolemy, a long night fell upon our knowledge of India, and, when, with the advent of the Arab invaders, the dawn again begins to lift, we find much that is with difficulty reconcilable with Ptolemy's account. We have firstly the marches of Chach and Muhammad Kasim from Aror to Multan, in both of which the "Biyas" is the first river crossed after leaving Arore, thus ignoring the "divarication towards Mount Onindion" of Ptolemy; but a far more noteworthy fact is that, throughout the chronicles translated in the first two volumes of Sir H. Elliot's History of India, the name "Biyah" is invariably applied to the combined Beas and Sutlej rivers. It is needless for me to give instances in detail, for they are numerous, and many of them have already been quoted by the anonymous reviewer so frequently referred to.† The only mention of the Sutlej by any of the historians that I can find is in the description of one of Mahmud's campaigns, where he is said to have crossed the Sihun (Indus), Jelam Chandraha, Ubra (Ravi), Bah (Beas) and Satladur (Sutlej); but, as it is also stated that all the rivers bear along with them great stones, he must clearly have crossed them near the foot of the hills, and consequently above any possible confluence of the Sutlej and Beas. Col. Tod, in his Annals of Rajputana, mentions that the same nomenclature is found in the native annals of the state of Jessalmer,‡ which formerly embraced the whole of what is now Bhawalpúr and Sind east of the Indus as far south as Arore.

So peculiar a nomenclature as this of the greater river losing its

* *Ancient India as described by Ptolemy*, by J. W. McCrindle, M. A., M. B. A. S. London, Calcutta and Bombay, 1885, pp. 91 to 95.

† *Calcutta Review*, LIX, p. 11 *et. seq.*

‡ *Annals and Antiquities of Rajasthan*, footnote to chapter V of the Annals of Jessalmer.

name in the lesser, where there is no special sanctity attached to the latter, can only be explained on the supposition that the Sutlej originally pursued an independent course, that it afterwards joined the Beas, and that the united rivers below their junction, retained the name which had originally been applied to only one, in this case to the lesser of the two.

Another indication that the Sutlej was not originally a tributary of the Indus is the existence of the word Panjnad as an old name of the Indus. This nomenclature is mentioned by Tod as occurring in the annals of Jessalmer* and by the Arab geographer Al Biruni, who, writing in the eighteenth century, says that the Sind after passing Andar, (Aror) bears the name of Mihran, and adds, "In the same way as at this place they call the collected rivers 'Panjnad,' so the rivers flowing from the northern side of these same mountains when they unite near Turmuz and form the river Balkh (Oxus) are called the seven rivers." At the present day this term Panjnad is unknown as a name for the Indus, the corresponding name at present being Satnad, while Panjnad is confined to the Chenab below the confluence of the other rivers of the Punjab, and it seems incredible that so inappropriate a name could ever have been applied had the courses of the rivers been similar to what they now are.

These facts point to the conclusion that the Sutlej was not always a tributary of the Indus, but may have pursued an independent course at any rate to a point much below the junction of the other four rivers, and if this supposition is correct, the natural conclusion is that the Sotar, Hakra, or Wahind marks its ancient course through the Western desert.

§ 4. It remains to be seen how far the physical configuration of the ground supports this supposition. As I have already said, the dry bed of the Sotar can be traced as far as Tohana in the Hissar district, where, as is shewn by the disposition of the minor drainage that issues from the outer Himalayas between the Jumna, the point of junction of the two great fans of the Jumna and Sutlej respectively is situated. Under these circumstances it may have derived its waters originally from either the Jumna or the Sutlej or both.

But the Sotar is by no means the only dry river channel in this region. Between it and the Sutlej there are no less than four other dry river channels, all of which, if any trust may be placed in maps, vary from one to three miles in width, and all of them directly or indirectly join the Sotar. These channels are not marked, on any map I have seen,

* *Annals and Antiquities of Rajasthan*, footnote to chapter I of the Annals of Jessalmer.

above where they enter the Sirsa district, but they can all be traced into communication with each other or with the Sotar. The most easterly of these is known as the Wab, and joins the Sotar fifteen miles from Bhatner; the other three are all known as Naiwal; the easternmost of these enters the Sotar near the ancient fortress of Bhatner, while the two westerly Naiwals, after uniting in Lat. $29^{\circ} 53'$, Long. $73^{\circ} 53'$, appear to join the Sotar at Wullur. As I have said, these channels are not marked on any map to the north of the limits of the Sirsa district, but, according to the writer in the *Calcutta Review*, the easternmost Naiwal was traced northwards, during the preliminary survey for the Sirhind canal, to Chumkour, ten miles from Rupar, the point where the Sutlej leaves the hills. The next of the Naiwals enters the Sotar at Wullur near the boundary of Bikanir and Bhawalpúr, and has been traced upwards as far as the ancient fortress of Bhattinda, and, in the settlement report of the Ludianah district, there is a reference to an old river bed which may be traced from Muchewara to near Talwandi (fifty miles north-east of Bhattinda) and thence onward to the south-west; in all probability these are continuous. The most western of these Naiwals may be traced upwards past Abohar and Marot, and is said to be clearly defined at the village of Urkara, twenty miles south-west of Ludianah and half that distance from the present course of the Sutlej.*

None of the maps mark more than a single dry river channel as entering the Sotar from the east, and, on the most recent large-scale maps of the Sirsa district, this is not marked as recognizable in the same manner as the Sotar and the Naiwals; from this we may conclude that it has probably been deserted for a longer period than the latter. This channel is known as the Chitang or Chitrang, and, on the engraved thirty-two miles to an inch map of India, is conjecturally continued, till it joins the lower end of the drainage channel which derives its name from Feroz Sháh, who converted it into a canal by introducing the waters of the Jumna.

It will be seen from this that the old channels connecting the Sotar with the Sutlej are both more numerous and more recent than the solitary one, of any importance, which leads towards the Jumna, and we may conclude that, at any rate in the latest stage of its history, this lost river of the Indian Desert was the Sutlej.

I may add, though it cannot be regarded as evidence of much value, that the traditions of the district declare that these channels were in turn the bed of the Sutlej river.†

* *Calcutta Review*, LIX, 6.

† *Calcutta Review*, LIX, 6. On the revenue survey maps of Bhawalpúr the words "old bed of the Sutlej" are printed from south to north along the boundary of Bhawalpúr, in the neighbourhood of Wullur.

§ 5. We have now seen that a dry river bed can be traced, practically continuously, from Tohana in the Hissar district to the Eastern Narra in Sind. We find that the drying up of this river cannot be due to diminished rainfall, and that we must consequently look to either the Sutlej or the Jumna for its supply; and, as the latter of these has been known to flow in its present course from the time of Manu downwards, while tradition and history alike point to the lost river having flowed at a much later date than this, we are perforce compelled to look to the Sutlej. We have seen that the supposed mention of the confluence of the Sutlej and Bias in the Vedas is not conclusive; that, though Ptolemy seems to take the former river into the latter much as is now the case, yet, when we come to the time of the Arab invaders of India, we find a peculiar nomenclature of the river, which points to the conclusion that the Sutlej can then only recently have become a tributary of the Bias and so of the Indus; and, moreover, we find a number of dry river channels, all of which lead from within a few miles of the present channel of the Sutlej, and ultimately join the dry bed of the lost river. Taking all these points into consideration, we may well conclude that this Lost River of the Indian Desert was none other than the Sutlej, and that it was lost when that river turned westwards to join the Bias.

III. *The Saraswati of the Vedas.* Probably the most difficult of all these problems relating to the rivers of Northern India is the persistent reference, in the Vedas, to the Saraswati as a large and important river. It is impossible to suppose that rational beings would have selected the insignificant streamlet, now known by that name, whose bed contains no water for a large portion of the year, to associate it on equal terms with the rivers of the Punjab and the Indus, still less to exalt it above them all, to describe it as "chief and purest of rivers flowing from the mountains to the sea", or as "undermining its banks with mighty and impetuous waves." The only conclusion open to us is, then, either that there has been some great change in the rivers of this region, or that the Saraswati of the Vedas has no connection with the insignificant streamlet which we now call by that name.*

The latter of these two is the opinion adopted by Mr. E. Thomas† in an essay on the rivers of the Vedas. According to him, a part of the ancient Aryans, after leaving their native country at the head waters of the Oxus, remained for some time in the valley of the Helmund, references to which were incorporated in their sacred hymns. After a while

* I have already shown that this change cannot be due to diminution of rainfall.

† *Jour. Roy. As. Soc.*, XV (new ser.), pp. 357—386 (1883).

they were again compelled to migrate, and, on reaching the Punjab, tried to revive the seven rivers of their original home; unfortunately, however, there were only six large rivers, but the Saraswati being a stream that lost itself in the lake or tank of Kurukshetra reminded them in a manner of the Saraswati they had left behind them, the name was transferred to it, and thus the seventh river was found. In favour of this hypothesis may be mentioned the fact that, in the Zend, the Helmund is called the Haraqaiti, a word identical with the Sanskrit Saraswati, according to the recognised rules of transliteration, but there is little else that can be produced in favour of this highly ingenious but far-fetched hypothesis. It implies an almost incredible degree of childishness in the ancient Aryans to suppose that they would confuse together a petty streamlet and a large, navigable river simply for the reason that the one ended in a large lake, while the other flowed into a tank or *jhil*.

§ 2. Rejecting the ingenious explanation of Mr. Thomas, there is no alternative but a considerable change in the hydrography of the region. We may at once dismiss all suggestions of any possible change in the number or position of the large rivers within the limits of the Himalayan region; and, as all the rivers of the Punjab are accounted for, we need only consider whether the Jumna, or a portion of its waters, flowing in a channel different from the present one, may not have been the Saraswati of the Vedas.

The configuration of the ground west of the high bank of the Jumna is that of a very broad and gently sloping cone; this is clearly shewn by the general directions of the minor watercourses west of the Jumna, which, as a glance at a sufficiently large scale map will shew, radiate from the point where the Jumna leaves the hills. This feature can only have been produced by the Jumna itself, like the Sutlej, though now flowing in a depression below the general level of the plains on either side, having once flowed over their surface. The Jumna must, consequently, during the period which geologists call recent, have flowed sometimes into the Ganges and sometimes through the Punjab; but it is not possible for geology pure and simple to give the exact date at which the Jumna last changed its course.

Two of these now minor drainage channels, the present Sarsuti and the Chitang, are continuous with the Sotar, and die out after approaching within a few miles of the old high bank of the Jumna; and it is not impossible that one or the other may mark approximately the course of the Jumna, or Saraswati, of the Vedic period.

In this connection, a coincidence may be mentioned which is per-

haps germane; when, about the commencement of the century, the Brahmaputra, a sacred river like the Saraswati, broke away from its old course and flowed west of the Madhopur jungle to join the Ganges, the new channel thus formed was immediately christened the Jamuna, a name it retains to this day, while the old channel now deserted by the main stream is still known as the Brahmaputra. Possibly, a similar explanation may be assigned to the name of the Jumna, which, originally known as the Saraswati, struck out a new course for itself during the Vedic period and, doing so, acquired a new name. If this be so, the native tradition that the old Saraswati joins the Ganges at Allahabad is, unwittingly, a true statement of fact.

The most weighty, and indeed almost the only, argument that can be urged against this hypothesis must be derived from the mention of both the Saraswati and the Jumna in the Vedas, and even in the same verse of the same hymn. It may have been, however, that the Jumna, after leaving the hills, divided its waters, as the Diyung does even now in Assam, and that the portion which flowed to the Punjab was known as the Saraswati, while that which joined the Ganges was called the Yamuna. Possibly this was the hydrography of the country when the Aryans entered India, but the name Yamuna seems to indicate that the easterly flow of the Jumna was established subsequently to their arrival; the silence of the Vedic hymns on this point is not an objection of importance, for the geographical references they contain are few and far between, almost invariably incidental, and seldom go beyond the mere mention of a name.

The above is confessedly but an hypothesis, and is probably incapable of proof or disproof, yet it is one which has been proposed by Mr. Fergusson, who, if not a Vedic scholar, was, at any rate, a careful observer of the mode of action of rivers, and whose essay on the delta of the Ganges is still the standard authority on the physiography of rivers flowing through alluvial plains. If not true, it is at least a possible explanation of the difficulty whose solution is by no means a matter of purely antiquarian interest, for, if the explanation I have put forward is the true one, it is evident that the present distinction between *bhangar* and *khadir* has originated since the Aryan immigration, and, as it is hardly probable that there has been a sufficient change of level since then to account for the erosion by the rivers which has taken place, we must suppose it to be due to the extension of cultivation in the hills, which, by causing the rain to flow more quickly off the hill-sides, has augmented the violence, and consequently the erosive power, of the rivers when in flood, and thus caused them to lower their channels into the plains over which they flowed.

§ 3. It may perhaps be thought that there is some inconsistency in thus claiming the Sotar first as an old course of the Sutlej and then of the Jumna, but this is apparent, not real, for, as I have pointed out, the Sotar takes its rise where the fans of these two rivers meet, and must, as long as they were building up the deposits they are now excavating, have constantly been receiving a supply of water from one or other of the two. It so happens that the last change of course of both rivers, previous to that change of condition which led to their excavating the existing depressed channels, took the one into the Beas, the other into the Ganges, and a dry bed is all that remains of what was once a large river flowing through a fertile land.

Conclusion.—I have now shewn that we may take it as proved that there have been great changes in the hydrography of the Punjab and Sind within the recent period of geology, that there are abundant indications, not amounting to proof, that these changes have taken place within the historic period, and that the most important of them, by which a large tract of once fertile country has been converted into desert, appears to have taken place after several centuries of the Christian era had sped. It is hopeless to expect an authoritative settlement of the question; the physical conditions cannot be said to favour the idea, but they are far from being inconsistent with so recent a drying up of the "Lost River of the Indian Desert."

XIX.—*List of the Lepidopterous Insects collected in Cachar by MR. J. WOOD-MASON, Part II,—RHOPALOCERA.*—By J. WOOD-MASON, *Officiating Superintendent of the Indian Museum, and Professor of Comparative Anatomy and Zoology in the Medical College, Calcutta;* and L. DE NICEVILLE, F. E. S.

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(With Plates XV—XVIII.)

Only one short paper on the Rhopalocera of Cachar has hitherto appeared. It is by Mr. A. G. Butler, and it was published in the Transactions of the Entomological Society of London for 1879. In it but 57 species are recorded, of which four are described as new to science, namely, *Sulpinæ grantii* (which appears to be nothing more than one of the almost innumerable slight variations of *Euplœa klugii*), *Mycæsis lurida* (which is in all probability a seasonal form of *M. perseus* or a form transitional from the one to the other seasonal form of that species), *Lycœna (Zizera) squalida* (to which the same remark applies, *mutatis mutandis*), and *Neptis cacharica*, which has not since been recognized