XVII.—*Djungaria and the Celestial Mountains.* By P. P. SEMENOF; *being the Preface to the Second Volume of his Russian Translation of* RITTER'S '*Erdkunde von Asien.*" Translated from the Russian, for the Royal Geographical Society, by JOHN MICHELL, Esq.*

THE Second Volume of the Russian Translation of Ritter's 'Asia' comprises a description of the north-western portion of the highland of Asia, *i. e.*, that extensive region which stretches between the Altai and the Celestial Mountains, from the eastern extremity of the latter at Kami (Komul) to the watershed of Lake Balkhash, and contains also a history of the exploration and settlement of Siberia.

The range of country under consideration embraces the whole of the extinct kingdom of Djungaria, or the Chinese province of Tian-Shanbey-Lu (the region to the northward of the Celestial Mountains, consisting of the districts of Ili, Tarbagatai, Gobdo, &c.), and likewise the Russian districts of Alatavsk, Kopal, and Ayaguy, which now constitute the new Semipalatinsk region. The whole of this country, including, that is to say, both Chinese and Russian Djungaria, forms that most obscure and unknown portion of the interior of Asia which contains within it the very centre of the Asiatic continent, namely, the gigantic mountain-group of the Tengri-Tag (a part of the Celestial Mountains), situated at equal distances from the Black Sea on the west, and the Yellow Sea on the east, the Obi Bight on the north, and the Bay of Bengal on the south, and lying in the centre of the straight line connecting Cape Severovostochi, in Siberia, with Cape Comorin, in India.

This region offers, moreover, special interest in physical as well as in ethnographico-historical respects. Physically, it forms a distinct limit between the highland and the depressed portion of Asia, and is remarkable for the contrast it presents between its gigantic mountain-groups of the Bogdo and Tengri-Tag in the Celestial range, which tower far above the limits of eternal snows, and are crowned with large Alpine glaciers, and the low sandy and sterile steppe of the Bedpak-Dala, on the south-west of Lake Balkhash, which bears the character, in common with the other sandy wastes of the Aralo-Caspian depression, of a bed of an inland sea dried up during a very recent geological period. In ethnographical respects this region offers a contrast no less marked between two numerically-preponderating Central Asiatic races—the Mongolian and Turkish—whose rulers are strangers from the far East and West—Chinese and Russians—occupying in the same fluvial plain of the Balkhash small populated oases in the midst of an indigenous population, alien in speech and habits

* See map in 'Journal,' vol. xxxi. p. 356.

to their dominating rulers, who are powerful, not by reason of their numerical superiority, but by the weight of their civilization, and the magnitude of their respective empires—the most colossal on the face of the globe. Lastly, from an historical point of view this country presents features of a no less interesting character. It has served from time immemorial as the point of departure for migrating races from the highlands of Asia, the cradle from whence they spring, to the low and arid steppes of the Aralo-Caspian depression, and to the still more distant and better-favoured regions of the west. It was here, namely, in Djungaria and the fertile and smiling banks of the Ili and Irtysh, that the migrating hordes lingered for some time, loth, as it were, to venture out into the unknown plain before them, stretching far away in the sandy ocean that separates Europe from Asia, until a new tide of popular migration forced them at last to strike their tents and depart westwards from their mountainous halting-grounds. It is here also, in the valleys of Djungaria, that a few existing rude monuments, crude traditions, geographical names and remnants of tribes, who in many cases have lost their native dialect by having intermixed with other races (the result of which appears in the name of Kassak or Kirgjiz Kaisak), serve the scientific explorer as the only links for identifying the obscure and fragmentary allusions concerning these migrated hordes, which occur in Chinese and Russian chronicles.

Although the physical and ethnographical characteristics of Inner Asia have attracted the constant attention of some of the most learned men, such as Humboldt, Ritter, Abel Remusat, and Klaproth, the researches of these leaders of science could only be based on the most meagre data, namely, on the dry and one-sided Chinese narratives which found a place in Chinese literature from the period of the dismemberment of the Djungarian kingdom, in the middle of the last century, and also on the inaccurate, brief, and conflicting accounts and itineraries of a few Asiatics who succeeded in visiting Djungaria and Little Bukhara with caravans. All these materials were collected and carefully collated by Ritter and Humboldt; nevertheless, this region remained, like the interior of Africa, up to the most recent period, completely inaccessible to European science.

Even Marco Polo, the most enterprising and reliable traveller of the middle ages, did not visit this region, but proceeded eastwards to China, by a route that lay southward of the Celestial range. A few other travellers, it is true, passed through Djungaria; these were: Plano Carpini (1246), André Longjumel (1249), and Wilhelm Rubriquis (1252), and they probably journeyed by way of Lake Zaisan to Karakorum, the capital of the Mongol Khans.

The same route was traversed by some of the subjugated

western princes, such as Yaroslaf and Alexander Nevski of Russia, and Getum of Armenia (likewise in the middle of the thirteenth century), for the purpose of paying homage to the great Khan; they, however, either left no description of their journeys, or else their accounts are so meagre and confused—as, for instance, the narrative of Prince Getum—that very few of the places mentioned in them can be identified. Much later, Fëdor Tsakovitch Baikoff, the envoy of the Russian Tsar Aleksei Fëdorovitch, proceeded in 1654 past Lake Zaisan and the upper course of the Black Irtysh, and traversed the whole of Djungaria, reaching the Chinese wall at Huhu-Hotan, from whence he advanced to Pekin. Although Baikoff's march-route (of course not in the form it is inserted in Witson's work, from which it was derived by Ritter, but in the shape we find it in Spasoke's 'Sibirski Vestnik') can, in the present state of our knowledge of the geography of Central Asia, be pretty readily applied to certain localities, still the information it contains is of too meagre a character, and is greatly inferior to native Chinese accounts. The southern border of the country now under consideration, *i. e.*, the gigantic Celestial range, has not been explored by any European traveller up to the present day. The destruction, however, of the kingdom of Djungaria by the Chinese led to its being surveyed under the superintendence of the European missionaries, Felix D'Arocha and Hallerstein, by whom astronomical points were determined, not alone in the towns of Djungaria and Little Bukhara, but also at the very foot of the Celestial range, as at Hangor-Ozen, the modern Konur-Ulen, and on the southern shore of Lake Issyk-kul. As the Jesuits have left no record whatever of their having visited any part of the Celestial range, it must be naturally concluded that they themselves did not diverge from the high roads of Central Asia, but detached a party of Chinese topographers, instructed by them, to the base of the Celestial Mountains.

The first learned Russian traveller who penetrated into the part of Inner Asia now under consideration, was the botanist Sivers, who in his hazardous and venturesome journey to the Tarbagatai in 1793, advanced as far as 47° N. lat. During the succeeding forty years not one of the scientific explorers of Western Siberia succeeded in advancing beyond the point previously reached by Sivers. The journey of K. A. Meyer, in 1826, did not extend beyond the Arkat Mountains, Chingiztàn, and the Karkara district of the Kirghiz Steppe; the travels of Humboldt and his associates, in 1828, did not embrace even Djungaria; their utmost limit was the Chinese picket of Baty on the Irtysh, in 49° N. lat.; and Humboldt's greatest service in connexion with the geography of the interior of Asia consists in the critical elabora-

tion of the materials relating to this subject in his classical 'Asie Centrale.'

Some of these materials, namely, the itineraries of Asiatic traders who had visited different parts of Asia with caravans, were diligently collected at Semipalatinsk by Humboldt; and another portion of his materials was derived from Chinese sources that had been elaborated by the European sinologists, Abel Remusat, Klaproth, Schott, Neumann, St. Julien, Father Hyacinth, &c.

Among the few unscientific eye-witnesses who in the pursuit of trade penetrated into Inner Asia, were some Russians; and among these, in point of lucidity and accuracy of information collected, the first place is undoubtedly occupied by the interpreter Putinsef, who in 1811 visited Kuldja and Chuguchak, the most flourishing towns of Djungaria. The narrative of this journey was published in the 'Siberski Vestnik,' translated by Klaproth, and served Ritter as one of the most valuable sources in elucidating the geography of this region. In addition to Putinsef, we may mention the miner Snegiref, who, towards the end of the last century, proceeded from the Altai to the neighbourhood of Chuguchak, in search of gold; and the noble Madatof, who, in the early part of the present century, successfully reached India, starting from Semipalatinsk, and traversing Lake Issyk-kul, the Celestial Mountains, and Little Bukhara. A short account of Snegiref's journey was printed in the 'Siberski Vestnik;' but with Madatof's expedition, I am acquainted only through official documents preserved in the archives at Omsk, and as no original narrative was discovered by me, it must be presumed that none ever existed. I also found a short march-route at Semipalatinsk, drawn up by the merchant Bubeninof, who in 1821 proceeded from Semipalatinsk to Kashgar. This itinerary will be printed in due season; but, from its brevity and scantiness of information, it is in no respect more valuable than the itineraries already printed and digested by Humboldt and Ritter.

Such was the unsatisfactory condition of our knowledge of the geography of Central Asia in 1831, at the time of the appearance of that part of Ritter's work which relates to it. It was only in the fourth decade of the present century that we became more familiar with Inner Asia from the side of the Djungarian and Kirghiz Steppes, that is to say, with the foundation of the Russian town of Ayaguz, on the upper course of one of the rivers of the Balkhash basin, and after the submission of a portion of the great horde under Sultan Seek, son of Albai Khan. These events gradually rendered, not alone Lake Balkhash, but also the mountainous districts of Djungaria, more accessible to travellers. In 1834 the astronomer Federof was enabled to reach the em-

bouchure of the Lepsa, and determined its geographical position under 46° 2½′ N. lat. He also succeeded in visiting the southern shore of Lake Zaisan, and in making a trigonometrical measurement of Tarbagatai. A little later the relations of Russia with the Kirghiz Hordes became more satisfactory, and in 1840, 1841, and 1842, the learned travellers Karelin and Schrenk penetrated into the mountainous portions of Djungaria, or the snow-clad Djungarian Alataù. Karelin explored the wild valleys of the upper courses of the Lepsa, Sarkan, and Baskan rivers, as high as the snow-line. Alexander Schrenk visited, and it may be said discovered to science, the Lake Ala-kul, crossed over the Djungarian Alataù to the Chinese side, attained the upper course of the Tentek, and reached the snow-line on several occasions. The extreme limit of his journey on the plain bordering Lake Ala-kul was the Chinese town of Chuguchak, in Alpine Djungaria, the hills skirting the banks of the Koksu River, and in the hungry Betpak-Dala Desert, south-west of Lake Balkhash, the River Chu.

Subsequently, the voluntary submission of the remaining portion of the so-called Great Kirghiz Horde in 1844, led to the Russian occupation of that rich and fertile portion of Djungaria which is known under the name of the Semipalatinsk region, from the seven tributaries of the Balkhash that water it. The Russian town of Kopal was founded by Governor-General Prince Gorchakof, in 1846, on a fertile plateau at the base of a snow-capped spur of the Djungarian Alataù. The establishment of this town ensured the development of the already existing relations of Russia with the neighbouring Chinese province of Ili. Although rapidly increasing, the trade with the western Chinese region through the towns of Kuldja, and more especially Chuguchak, encountered obstacles in its legitimate development from its transitive and contraband character, as the Chinese of the western region (Si-Yui) were only able to have secret dealings with the Russians under a semblance of trafficking with the Kirghizes. It was this disadvantageous state of things that led to the mission, with objects partly diplomatic and partly geological, of E. P. Kovalefski, accompanied by Vlangagli, an officer of Mining Engineers.

This expedition started from Kuldja, and skirting the Russian side of the Djungarian Alataù, reached the valley of the Koksu, as far as the upper sources of this river, while on the Chinese side it reached the town of Kuldja on the Ili. The most important result of this mission in commercial as well as in scientific respects, was the establishment of Russian trading-factories at Kuldja and Chuguchak. The opening up of the western Chinese region contributed largely to the increase of our knowledge of the geography of Asia, inasmuch as it threw two learned Chinese

scholars in the capacity of consuls into the commercial centres of Djungaria. The local researches of these sinologists opened a wide field to science. Mr. Zakharof, one of the consuls, has already collected materials of great value relating to the physical geography and cartography of Inner Asia. These materials he has obtained during his stay at Pekin, from rare geographical works (namely, the reports of the survey made during the reign of Tsian-Sun), and from information supplied him by natives of the western region.

The foundation of the town of Kopal, which was in a satisfactory and flourishing condition, owing to the rapid development of agriculture, aided by artificial irrigation, could not, however, secure the Great Horde, now under Russian dominion, against the bold attacks of the Buruts, or the so-called Black or Dikokamenni Kirghizes who infested the valley of Lake Issyk-kul and the neighbourhood of the sources of the Ili (Tekes). This was naturally to be expected from the position of Kopal, which stood on the northern confines of the Horde, whose southern boundary beyond the Ili remained completely unprotected. The unguarded condition of the frontier of the Russian empire induced Governor-General Hasford to occupy the so-called Trans-Ili country extending between the River Ili and the snow-line of the gigantic Trans-Ili Alataù, with a view of securing the left flank of the Kirghiz Steppe, which was under Russian protection, by making it conterminous with the peaceful frontier of China and the natural snowy-mountain boundary. This well-conceived plan was carried out with complete success. In 1853 the first Russian detachment, under the command of Colonel Gutkofski, was despatched beyond the Ili: it, however, met with serious opposition from a strong body of Kirghizes belonging to the hostile tribes of the Great Horde who rested on Fort Tuchubek, on the River Kesken. But in the following year the whole of the region was occupied by a force under Lieut.-Colonel Peremyshelski, who razed the Kirghiz fort to the ground. After this some of the tribes submitted to Russia, while the most inimical fled into Kokanian territory, and to the banks of the Talas and Syr-Daria. The Russian detachment passed the winter in the sheltered valley of the Talgar; and the ensuing year of 1855, General Hasford founded Fort Vernoé, at the base of the Trans-Ili Alataù, at the head of the Almatynka valley, which is picturesquely wooded with apple and apricot-trees.

The occupation of the fertile Trans-Ili region, well adapted for agricultural and gardening purposes, and in all respects beautifully endowed by nature, had the effect of protecting the Great Horde from the attacks of the Buruts, but placed its nearest tribes in the same position as that occupied ten years previously by the Great

Kirghiz Horde. The powerful and numerous tribe of the Bogus, who occupied the picturesque valleys and the table-land between the Celestial Mountains and the Trans-Ili Alatau, received neither countenance nor support from the Chinese, on whom they were nominally dependent, in resisting the fierce attacks of the Sary Bagish tribe, and had at the same time to repel on another quarter the depredatory incursions of some of their neighbours of the Great Horde. Consequently, soon after the occupation of the Trans-Ili region by the Russians, the high Manap of the Bogu tribe, the old Burambai, claimed the assistance of General Hasford against the attacks of the neighbouring tribes, and voluntarily tendered the submission of himself and his tribe to Russian government. This led to the despatch of the first Russian detachment from Vernoé to Lake Issyk-kul, for the purpose of pacifying the two contending tribes, and making a reconnaissance of the hitherto unexplored valley of Lake Issyk-kul. Colonel Khomentofski, the officer in command of this force, and General Silverhelm, who conducted the survey of the newly-organised Semipalatinsk region, were the first educated Russians who beheld this extensive lake and the snowy summits of the Celestial range. Unfortunately, this detachment, in consequence of its critical position amidst the marauding mountain tribes, the animosity of one of which against the Russians was decided, while the friendliness of the other was open to much suspicion, was soon recalled, and the surveying parties were unable to penetrate into the interior of the Celestial mountains. The southernmost point attained at the foot of the Tian Shan, by Ensign Yanovski, the topographer attached to the expedition, was where the Zaùkù rushes out of its narrow defile on the Issyk-kul plateau.

In the same year of 1856 I was sent by the Imperial Russian Geographical Society on an expedition to explore those more accessible portions of Inner Asia which had previously been little visited. Naturally, the great object of attraction for me on this journey was the Tian-Shan or Celestial range. The signification of this stupendous chain, in position the most remote in the whole continent of Asia, although pointed out by Ritter and Humboldt, had not, until then, been investigated by any scientific traveller.* All the learned and critical researches of Ritter

* Atkinson, the English artist, in his travels which were published in 1858, gives an account of his journey from the River Kunchun, in the southern Altai, across the Black Irtysh, to Lake Ubsa-nór; thence southwards past Ulusutai to the neighbourhood of the Chinese town of Barkul, at the base of the Tian-Shan, travelling then parallel with this chain, though at a considerable distance from it, as far as the meridian of Bogdo-Ola Mountain, finally proceeding in a north-westerly direction past Lake Kyzyl-Bash, and reaching Lake Ala-kul in Russian territory. Unfortunately so extraordinary a journey, unprecedented in the history of the exploration of the Asiatic continent, has had no beneficial scientific results

and Humboldt respecting this range, belonged only, even by the admission of the latter, to conjectural geography; or, otherwise, were founded on a comparison of the obscure and con-

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The narrative, which occupies 115 pages of text, characterises the explored region so little that it might with equal fitness be applied to any portion of the Kirghiz Steppe. The critical inquirer finds nothing throughout the whole narrative to convince him of the genuineness of the described journey, which extends over no less than 3000 miles of Chinese territory. This is the more striking as undoubted proofs of the actual performance of journeys of which descriptions have been given may easily be found in the short itineraries and accounts of travels of different ages and nations; as, for instance, in the travels of Huc and Gabet, in the march-routes of Tartar traders collected by Humboldt, and in the more ancient accounts of Baikof, Marco-Polo, the Armenian Prince Getum, in the march-route of the army of Gulagu-Khan (compiled by one of his officers in the thirteenth century), and lastly, in the narrative of the travels of the Buddhist missionaries Fa-Hian and Huan-Tsian in the fourth and seventh centuries. Concise though these accounts doubtless are, the learned critic soon discovers in them such local peculiarities as can only be descriptive of particular spots and localities; and as we become more intimate with the geography of the country to which such accounts apply, the more readily and clearly do we identify the points given in the march-routes. To our great regret we do not find this to be the case in that part of Atkinson's work which relates to Chinese Djungaria. From the commencement, in calling the Sian-Shan Sayan-Shan, he confounds, in name at least, the two principal mountain systems of Inner Asia; and in all the other portions of his narrative, where he does not confine himself to descriptions of the steppes, the chase of wild animals, yurts and social customs of the nomads (descriptions which would apply with equal force and truth to the whole of Central Asia), but wishes to communicate something more definite and locally characteristic, he falls into numerous incongruities. Thus, to cite some examples, he speaks of the Kara-Tyn snowy range, at the upper course of the Black Irtysh, as of a level steppe, intersected by low ridges; again, from the Tannu Mountains, situated at a distance of 120 miles to the north-east of Ubsa-Nór, he sees the Bogdo-Ola, in the Tian-Shan, which is about 750 miles away from this point. Lastly, from the plain at the base of the Celestial range he simultaneously sees not only the Bogdo Mountain, but also the Baishan (Pé-shan)—emitting smoke, by Atkinson's account—which is about 300 miles beyond to the westward, notwithstanding that the snowy Bogdo-Ola group stands out, as is well known, considerably in advance of the main chain of the Celestial Mountains, and the Baishan Mountain rises on their southern slope, that is to say, beyond its gigantic snowy ridge, in the neighbourhood of the little Bukharian town of Kuchà. Similarly, as little confidence do those inconsistencies inspire which occur in the account of the time occupied in performing the various journeys and those which relate to the distribution of the nomad Kirghiz population throughout Chinese Djungaria. As regards ourselves personally, the involuntary doubts respecting the above-mentioned portion of Atkinson's travels are still further strengthened from information we gathered on the spot regarding his journeys from the Cossacks who accompanied him, and from the commanders who provided him with escorts. Atkinson, during his many years' residence in Siberia, visited the neighbourhood of Kopal (which had then just been founded), many valleys of the Djungarian Alatau, the lake Ala-kul, Tarbagatai, the rivers Narym and Kurchum, in the southern Altai, the Teletsk Lake, Tunkinsk Mountains of the Syan Range, Irkutsk, Kiakhta, &c; but as regards his travels over an extent of more than 4000 versts in Chinese territory, *accompanied by three narym, or kurchum cossacks*, I regret to say that I not only could not gather anything to confirm this fact, but even became convinced of its utter impossibility from existing local conditions on the Russian as well as on the Chinese side. On the Russian, because the protracted detachment of three Cossacks, or their voluntary absence from the corps, is a fact that would leave behind it some record in the official archives; while on the Chinese side, the journey, lasting more than six months, of a party, unacquainted

fused narratives and descriptions of Chinese and other Asiatic travellers, commencing from the Buddhist missionaries Fa-Hian and Huyan-Tsian, of the fourth and seventh centuries, to the brief itineraries of the Semipalatinsk Tartar traders of this century. Numerous questions, replete with interest to the science of geography, could only be possibly solved by actual investigation on the spot. The configuration of the country, the direction of the upheaval of the mountain chain, its mean height or the altitude of its mountain passes, the height of the snow-line, distribution of animal and vegetable organisms in this unknown mountain region, the existence of Alpine glaciers or of volcanic action—all these were points requiring either investigation or confirmation.

So far back as 1851 and 1852, during my stay at Berlin, I acquainted Humboldt and Ritter with my intention of proceeding into the interior of Asia as far as the Tian-Shan range. They both encouraged me in my difficult enterprise, but did not conceal their doubts as to the possibility of penetrating so far into the interior of the Asiatic continent. The result of my deliberations with these leaders of science was to strengthen me in my determination of attempting to reach the eternal snows of the Tian-Shan at all hazards. Humboldt attached so much importance to the investigation, even a cursory one, of this range, that I could not look at the undertaking except in the light of a holy mission marked out for me by the Nestor of European men of science.

By the end of the summer of 1856, under the auspices and with the assistance of the Russian Geographical Society, I was already in Vernoé; unfortunately, however, I arrived two months after the visit of a Russian detachment to Lake Issyk-kul.

With a small escort of twelve Cossacks I succeeded, on the 21st September in reaching the eastern extremity of the lake, and had an opportunity of surveying, from Kuké-Kulusun point, the imposing range of the Tian-Shan from the Dirgalan to the opposite extremity of the lake. To visit the chain itself was at that moment impossible. My escort being so small, I was obliged to proceed very carefully, and passed the nights in inaccessible defiles, anticipating every moment to be attacked by hostile bands of Kara-Kirghizes.

Returning to Vernoé, and procuring a larger escort (forty Cossacks), I proceeded through the wild Búam defile at the upper

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with the local dialect and passing through inhabited districts, along established routes and across the picket and frontier lines, could scarcely escape the vigilant eyes of the Chinese authorities. Under all these circumstances combined, and in the absence in Atkinson's narrative of any new data relating to Chinese Djungaria, this work cannot be considered as an acquisition to science until the author adduces more definite information and stronger proofs in corroboration of his accounts, that involuntarily inspire certain mistrust.

course of the Chù, and emerged on the base of the Celestial range, near the western extremity of the Lake Issyk-kul. Here I came upon numerous encampments of the hostile Sary-Bagysh tribe, who shortly before my arrival had had a fierce engagement with a Russian detachment which had been sent out from Vernoé to punish these mountaineers for acts of violence and plunder.

Notwithstanding the hospitable reception of the Sary-Bagyshes, who were commemorating the death of many of their kinsmen that had fallen in the recent conflict, I was not able to penetrate beyond the first exposed rocky spurs of the Celestial range, and to visit its wild defiles, being apprehensive of treachery from the revengeful mountaineers who had lately been so severely punished by the Russians.

However, in the spring of 1857—thanks to the escort kindly furnished me by Governor-General Hasford, who displayed great zeal and energy in the organisation and exploration of the newly-acquired region—I was enabled to realise all my plans. The deadly strife between the two Kara-Kirghiz tribes was then at its height, and the valleys of the Tian-Shan seemed quite inaccessible; a happy combination of circumstances, however, removed this apparently insurmountable obstacle to my journey. A rumour, that spread with extraordinary rapidity through almost the whole of the Mustag (the Turk name for the western portion of the Tian-Shan), of the approach of a strong Russian detachment, armed with terrible instruments of destruction,* for the purpose of assisting the Manap Burambai, produced a sudden panic among the Sary-Bagysh tribe, inducing them to relinquish, not only the camping-grounds they had seized from the Bogus, but even their own native pasturages, from the upper course of the Dirgalan, along the whole border of Issyk-kul, for an extent of more than 200 versts, and to migrate to the upper course of the Syr-Daria (Narym). The Bogu tribe, who had been furiously attacked by the Bagyshes in the spring of 1857, and driven into Chinese limits, expected complete destruction; the sudden flight of their enemies dispelled their fears, and enabled them to reoccupy their former camping-grounds, and even to reap the harvest that had been left standing in the fields by the Sary-Bagyshes. Attributing this favourable turn in their affairs to my approach, they rendered me every assistance in the object of my journey. With such material assistance I was able, in July of 1857, to make a *détour* of Issyk-kul from the south side, and to reach the summit of the

* The exaggerated accounts respecting the strength of my escort was owing to my having really reached Barambais aûls accompanied by 800 horsemen; but these consisted of a body of Kirghizes of the Great Horde under the Sultan Teyek, who had voluntarily joined my detachment. My own personal escort consisted only of 25 Cossaks.

imposing and terrible Zaùkù-Davan mountain-pass. I also succeeded in gaining the sources of the Narym, which belongs to the system of the Syr-Daria or Jaxártes. Shortly after I penetrated, on a more easterly meridian, much farther into the heart of the Celestial range, and ascended one of the most elevated mountain-groups of Inner Asia, that of the Tengri-Tag, which is crowned with a circle of Alpine glaciers, and covered with a dazzling mantle of eternal snows. In the glaciers of the Tengri-Tag I discovered the sources of the Sary-Djaza, which belongs to the system of the Taryn-Gol or Ergeù, the most remote of the considerable rivers of the Asiatic continent.

On my return to St. Petersburg in 1858, the Imperial Russian Geographical Society, taking into consideration the great want of astronomical points in the region visited by me, organised, at my recommendation, and with the co-operation of the Military Topographical Depôt, a new expedition under Captain Golubef, for the purpose of determining astronomical points in Russian Djungaria and on the Lake Issyk-kul. By last accounts Golubef had ascertained the position of three points in the valley of Issyk-kul Lake (on the Tekes River, and at the eastern and western extremities of the lake respectively), but had not succeeded in penetrating into the interior of the Tian-Shan, owing to adverse circumstances, and to the southern shore of the Lake of Issyk-kul being occupied by the hostile Sary-Bagysh tribe. Under such a state of things it would of course, have been extremely rash to advance into the mountains, having hostile tribes in his rear.

All the journeys and researches since the year 1834, enumerated above, have considerably advanced our knowledge of the portion of Asia which we are now considering, and have removed it from the region of hypothetical speculation to a certain basis of scientific investigation. On this account, therefore, the second volume of the Russian version of Ritter's 'Asia' ought to be accompanied by copious and trustworthy annotations.

Unfortunately all the additional materials for these additional notes are but little digested as yet. The travels of Fëdorof, Karelin, Schrenk, my own, the observations of Golubef, the data collected and elaborated by Zakharof, have not yet appeared in print, and only short notices of them have been presented. I am consequently necessarily obliged to withhold the supplementary matter to the second volume, at all events until the publication of my travels, which is now delayed on account of all my time and attention being engaged on questions of pressing and vital importance to Russia.

With regard to the third volume of the Russian edition of Ritter's 'Asia,' containing a description of the Russian Altai, the not-unimportant materials relating to these mountains which were

collected by me on my journey have been partly digested since my return; and I am therefore in a position to proceed at once with the publication of this volume with its supplementary portion.

In conclusion to this preface, I think it necessary to allude briefly to some of the general results of my visit to the Celestial mountains.

The results embrace three questions of the utmost importance to the geography of Asia, namely: *a*, the height of the snow-line in the Celestial range; *b*, the existence of Alpine glaciers; and *c*, the existence of any volcanic phenomena in this region.

On the first of these points I consider it incumbent on myself to dwell at length, in reply to the doubts expressed by Humboldt as to the correctness of the elevation of the snow-line in the Celestial range, as determined by me. The height I fixed it at, namely, 11,000 to 11,500 feet, was ascertained by Humboldt from a letter I wrote to Ritter, and which attracted his particular notice. This letter was published in the 'Zeitschrift für Erdkunde," with some explanatory remarks by Humboldt. The method I adopted for ascertaining the height of the snow-line was not known to Humboldt, who grounded his supposition of an over-estimation of the elevation of the snow-line on certain theoretical or comparative considerations.

Inaccuracies in the determination of the height of the snow-line may arise from two sources: 1stly, from what is taken to be the snow-line; and 2ndly, from an imperfect method of measuring heights.

In the first instance the observer may be deceived by either taking dissolvable for eternal snows, or fixing their limit of height in sheltered ravines or defiles which are hardly reached by the rays of the sun. Had I fallen into these errors in my determination, the result would have been to lower instead of to raise the height of the snow-line, as compared to its true limits. But these sources of error were fully anticipated and averted by me, as my observations were made at points where regular layers of eternal snow occurred, and moreover on mountain-ridges, and not in hollow depressions, in some of which I really did find eternal snows, in some cases several hundred feet below the limit of 11,000.

With regard to the other point, I must observe that the method employed by me in determining heights by the temperature of boiling water is certainly one which is far from being perfect, and which can lead only to approximate results; but the inaccuracy of these results becomes more inappreciable, the greater is the height which is being measured. For inconsiderable elevations this method of measurement cannot be adopted. I may, however, also observe that the other method, namely, that of barometrical determination, can scarcely be expected to give more accurate results

under certain unfavourable conditions, as, for instance, on a journey through an extremely wild and dangerous region, where the traveller is obliged to form his own track, and stands every moment in danger of an attack. Under such circumstances all simultaneous observations of the barometer, at the base and summit of mountains, at fixed stations, or a series of observations at one point, are quite out of the question. Experience has also shown me the complete impossibility of keeping the barometers (I had two with me) from breaking in a country so mountainous as that I traversed, where on each expedition the pack-horses and camels stumbled repeatedly, and were occasionally dashed to pieces by falling over precipices. Hence travellers (Humboldt amongst the rest, on his famous journey in the Andes and the Cordilleras) have invariably had recourse to the method of determining heights by the temperature of boiling water. The results obtained in this manner are regarded by science merely as approximations until they are superseded by more accurate data obtained when the region is more accessible to scientific exploration. Although incomplete, these results are nevertheless of undoubted value to science, as the magnitude of probable errors under such an imperfect method cannot exceed certain limits.

But Humboldt could not have taken exception more especially to the method used in measuring the height of the snow-line in the Tian-Shan, because firstly, he at that time did not know what means were used for this purpose; and secondly, because he himself adopted the same method on his journey in the New World, which was so prolific of scientific results. Humboldt's doubts respecting the probability of the Tian-Shan snow-line being so elevated as I had fixed it to be, were based on considerations of comparative geography, and their soundness or otherwise may be easily tested on account of their being founded on a comparison of the height of the snow-line of 11,000—11,500 feet with its well-ascertained limits in nearly the same meridian (in the Altai 6,600 feet), or in the same parallel (the Pyrenees 8400 feet, and the Caucasus 10,170 feet).

In examining the observations made by any traveller respecting the elevation of the snow-line, the most accurate scientific criticism must remain satisfied of their correctness by the following theoretical demonstrations:—

The height of the snow-line in a given range must be calculated theoretically on the basis of a comparison with other ranges in the same meridian and in the same parallel; the obtained result should then be compared with the figures arrived at by actual observation, and it must then be carefully considered whether the discrepancy that may occur can be at all attributed to climatic conditions and peculiarities of the country.

Humboldt, in his classical work 'Asie Centrale,' supplies us with the requisite figures for arriving at a definite conclusion.

In the same meridian with the Celestial Mountains we find that the height of the snow-line is, viz.:—In the Altai (Tigerski Belki), lat. 51° N., 6600 feet. On the northern slope of the Himalayan range, lat. 32° N., 15,600 feet.

The Celestial Mountains extend, at the part visited by me, between latitude 41° and 42° N., which is consequently mid-way between the Altai and Himalayas. Taking the mean of the figures given above, we shall get 11,100 feet for the height of the snow-line of the Celestial range. In the same zone, parallel with the Celestial Mountains, the height of the snow-line is as follows:—In the Pyrenees (between lat. 42½° and 43° N.), 8400 feet; on Mounts Elburz and Kazbek, in the Caucasus (43° N. lat.), 10,170 feet; on Mount Ararat (lat. 39° N.), 13,300 feet; in the Rocky Mountains of North America (lat. 43° N.), 11,700 feet.

Humboldt, in his observations on my letter to Ritter, refers exclusively to the Pyrenees and to the Elburz Mountain. With regard to the first, they cannot be taken at all into account in determining the height of the snow-line in the Celestial range, as they are situated in a moist sea atmosphere, where the snow-line must be considerably lower than in the continental climate of the interior of Asia. The Caucasus, however, supplies a better point of comparison, if treated with proper discrimination. The height of the snow-line of the Kazbek and Elburz is 10,170 feet, under a latitude of more than 1½° to the northward than that of the Tian-Shan, and with a climate considerably more humid. On Mount Ararat, where the surrounding atmosphere is drier and the latitude 2½° more to the south, we find that the height of the snow-line is 13,300 feet above the level of the sea. If a range of mountains existed between the Elburz and Mount Ararat, under climatic conditions of an intermediate character as compared to those characterising Mounts Ararat and Elburz, and situated under the same parallel as the Celestial range, the height of the snow-line of these mountains would be determined at 11,300 feet.

All these figures computed theoretically by comparing the heights of snow-lines in the same meridian with the Celestial mountains, in different parallels or under one parallel zone on different meridians, coincide very nearly with my determinations.

The considerable elevation of the snow-line of the Celestial mountains is to be explained by the peculiarity of the geographical position of the range, and the character of the surrounding atmosphere. It is generally admitted as a fact that a dry atmosphere has the effect of elevating the line of eternal snow very considerably. Thus, for instance, the snow-line on the southern slope of the Himalayas occurs at 12,180 feet, while on the northern side it rises

to 15,600 feet. This anomaly is only to be accounted for by the southern side of the range being exposed to winds charged with the humid vapours of the Indian Ocean, which settle on the cold mountain slopes in the form of snow, while at the same time the northern slopes of Thibet are reached by the same air, but which is completely free from moisture. The extraordinary dryness of the atmosphere of the Celestial Mountains, compared to the Altai and Caucasus, is strikingly exemplified by the following instances. In the neighbourhood of Riddersk, in the Altai Mountains, the dew falls so heavily that the dress of the horseman is completely saturated when riding through the high grass, while in the sombre forests of the north-western Altai, called locally Taigi, the atmosphere is still more humid, and rain during some summers falls incessantly. Now, during the two years spent by me in the Celestial Mountains and Trans-Ili Alataù, I positively saw no dew, and the fall of rain in these parts—notwithstanding that the summer of 1857 was a remarkably wet one, and the Altai rendered impassable from this cause—was very small. In addition, the very vegetation of the Tian-Shan bears evidence to the dryness of the surrounding air. While the slopes of the Caucasus are clothed with dark and impenetrable forests, which prove so troublesome in the military operations of the Russians, the wooded surfaces of the Tian-Shan are of limited extent, and rhododendrons, which are so widely spread in the moist climates of the southern slopes of the Himalayas and of the Caucasus, do not grow at all in the Celestial range. If to this extraordinary dryness of the air in the Celestial Mountains be added the intense heats and powerful heating of the broad plateaux by the scorching rays of the sun, accompanied by cloudless skies and a rare atmosphere, a natural explanation will then be found for the height of the snow-line being at 11,000—11,500 feet. The few measurements of heights made by other travellers in Djungaria, and moreover by other methods, serve to confirm the accuracy of my figures. Fëdorof determined *trigonometrically*, that is by the most accurate process, the altitude of the highest point in the Tarbagatai at about 9900 feet. The Tarbagatai range extends under lat. 47° N., and is consequently nearer by 1° of latitude to the Tigeretski Belki than to the Celestial range. Computing the elevation of the snow-line of the Tarbagatai theoretically by a comparison of the heights in the Altai and Tian-Shan, we should obtain a result of about 8600 feet, while in reality the true elevation is considerably greater, as throughout the Tarbagatai range the existing snows, with the exception of two patches, are only sporadic, and the snow-line is not below 9500 feet. This case proves that the snow-line rises rapidly from the Altai to the Tarbagatai, owing to the greater dryness of a continental atmosphere. Lastly, the barometrical observations of Schrenk in the Djungarian Alataù, in

lat. 45° N., fixed the limit of eternal snows at 10,700 feet. Calculating then the height of the snow-line in the Tian-Shan by a comparison of that of the northern slope of the Himalayan and of the Tarbagatai ranges, we obtain 11,700 feet, and 11,950 feet if we take in the Djungarian Alataù.

In this manner all the facts of the case, not alone those supplied us by comparative geography and climatology, but likewise those derived from the exact observations of other travellers, tend to confirm my figures, and prove them to be sooner understated than magnified. Humboldt's doubts, therefore, as to the possibility of the snow-line of the Tian-Shan exceeding 11,000 feet in elevation, are disposed of, not only by ocular demonstration, but also on theoretical considerations.

The interesting question relating to the existence of pure alpine glaciers in the Tian-Shan, which is in intimate connexion with that of the height of the snow-line, was solved by me in complete accordance with the previously-expressed opinions of Humboldt and Ritter. I set out without any foregone conclusions on this point, but having experienced the remarkable dryness of the air in the Tian-Shan mountains, and having ascertained on ascending the Zaùkù-Davan that the height of the snow-line was higher than 11,000 feet, involuntary doubts entered my mind as to the possibility of the existence of real glaciers in the Tian-Shan. These doubts were, however, soon dispelled. At the sources of the river system of Sary-Djaza I came across five magnificent Alpine glaciers, and a "mer de glace" exceeding in size that of Chamounix. Notwithstanding some of the peculiarities of the Tian-Shan glaciers, owing principally to their prevalence at not more than about 2500 feet below the limit of the snow-line, while in Switzerland they descend as low as 5000 feet, their existence in the form anticipated by Ritter and Humboldt, on the strength of Chinese accounts, was fully confirmed.

It now remained for me to prove by actual observation on the spot the existence or otherwise of volcanic phenomena in Djungaria, and in the Celestial Mountains, to which Humboldt in his works so often alludes. I started on my journey firmly persuaded that I should find the conjectured volcanoes, or at all events some volcanic forms, and sought diligently (as Schrenk did on Lake Ala-kul) to establish the correctness of Humboldt's surmises with respect to the existence of volcanic phenomena in Central Asia, by which confirmation I knew a traveller would gain greater credit than by an incomplete refutation of the supposition. I was even aware that Humboldt was rather displeased with the researches of Schrenk, who clearly showed that the island of Aral-Tübe, on Lake Ala-kul, was not of volcanic origin. The opinions entertained by Humboldt on the subject of the existence of volcanoes in Djungaria were favourite

ones with him, and I regret that I was not able to confirm his cherished theory. Kullok Peak, another of Humboldt's mistaken volcanoes, was found to have no volcanic origin whatever. The hot springs, and the non-congelation of the waters of Lake Issyk-kul, were not accompanied by any volcanic forms in the Tian-Shan; and furthermore, all the native accounts of phenomena which from their description might be supposed to be volcanic, proved unfounded, and were at once disposed of on my examination of the localities where they were declared to occur. The result, therefore, of my researches on this point was that I became convinced of the complete absence of volcanoes, typical volcanic phenomena, or even volcanic forms throughout the Celestial Mountains. It is true that there existed in Djungaria at one period some "Solfatara," or smoking apertures, from which there was a discharge and deposit of sulphur, and that some of these fissures, out of which the Chinese obtain sulphur, emit smoke even at the present day. But a careful inspection of one of the extinguished pits satisfied me that at all events in that case there was no volcanic affinity. In the neighbourhood of the pits discovered by me in the Katù mountains and in the Ili valley, I could trace no volcanic forms; but ironstone occurred, and owed its formation, as far as I could judge, to the pyrites that were widely spread in the vicinity. There was at the same time a discharge of sulphur emitted in the form of vapour out of numerous fissures, and which left a deposit on the sides. If it be taken into consideration that I found coal-formation largely developed throughout the Ili basin, and that coal is obtained by the Chinese in the neighbourhood of Kuldja in large quantities from very deep seams, the whole process of the formation of sulphur can then in my opinion be reasonably explained by the combustion of some coal-seams in this basin, which would at once set at rest the question of supposed volcanic agency.

I cannot positively affirm that the origin of the other smoking pits of Djungaria, and particularly Humboldt's famous "Solfatara" of Urumchi, is susceptible of the same explanation, although the analogy between all the Djungarian "Solfatara" would appear to be confirmed, native accounts excepted, by the circumstance that the Chinese, who are very expert in recognising such sulphur formations, procure sulphur from the "Solfatara" of Katù, which I visited. With still less certainty can I deny the existence of volcanic phenomena or volcanic forms farther eastwards in the Celestial Mountains. Humboldt, in his observations on the letter I addressed to Ritter, which was published in the 'Zeitschrift für Erdkunde," says that the Sangai, rising in the centre of the Ando-Cordilleras range, the most active of all the volcanoes in the world, forms an island of trachyte not more than two geographical miles

in diameter around it. From this I must of course conclude that the observation of a single portion of the Tian-Shan visited by me cannot serve as positive evidence of the absence of volcanoes and volcanic forms in other parts of this mountain-system. My conclusions on this question generally have already been made public in the letter referred to, but I must likewise observe in addition that all Asiatic accounts of phenomena which might be volcanic in appearance should be treated by men of science with great circumspection, as many of these accounts have already proved fallacious. I would here also remark that the impression produced on me personally by Djungaria and the Tian-Shan, leaves great doubts in my mind as to the existence of volcanoes in this part of Asia; and as I am the only traveller who has visited the Tian-Shan, I cannot accept the belief in their existence as an axiom requiring no proof or confirmation. My conclusion on this point, though only negative, is one of the most important results of my journey.

If in aspiring after truth I have been compelled to express opinions on two points of such vast importance to the geography of Asia which differ completely from those entertained by Humboldt, whose faith in the existence of volcanoes in the Celestial Mountains was as firm as that of Columbus in the existence of the New World, it does not necessarily follow that I cast a shade (in itself impossible) on the spirit of the greatest scientific genius of the age. Science is the eternal aspiration of the whole human race towards truth, and truth can only be grasped at out of a multitude of errors and misconceptions. No men, moreover, are more liable to fall into such errors than the pioneers of thought, who marshal their fellow-creatures to the great goal of truth, and call into existence worlds of new thoughts and conceptions. These giant minds are followed by a train of disciples for whom the path of investigation and final solution of great scientific problems is rendered comparatively easy. Thus there are the men of genius in science, or the master minds, who conceive great thoughts, and the workmen who follow up such of these thoughts as are susceptible of elaboration. Each has his separate functions, but on the most humble labourer in the field of science devolves the sacred duty of pointing out and rectifying any error into which the eminent master may have fallen. And in such a case the obscure advocate of truth should not be crushed by all the weight and authority of genius,—science being a problem open to solution to all humanity, and recognising no individuality or oligarchical superiority.

The science of geography has lately been deprived of two of its most brilliant leaders, Humboldt and Ritter. To follow their footsteps, to extend the circle of their researches, to strive after that eternal truth which they eagerly sought during their mortal careers,

to correct those few errors which are interspersed through the wide field of their inquiries, these are the duties of every votary of science, even of the most humble grade, and will serve as the best testimony of admiration and respect to the great masters. May the present effort be taken as such an expression, and as one of the many proofs that, dying, Humboldt and Ritter have bequeathed to humanity a living record of their great genius.

St. Petersburg, 1st October, 1859.

XVIII.—*On the Island of Mahi, Seychelles.* By Lieut.-Colonel Lewis Pelly.

There are, in all, thirty islands in this group, varying in size from that of Mahi, which is about 17 miles long, by from 3 to 4 miles broad, down to that of islets containing only a few acres of ground.

The group may be divided into two clusters; one to the westward, round Mahi, and the other to the eastward, round the Island of Praslin, which is next in size to Mahi. The general aspect of both clusters is green and cheerful; but that of Mahi is the loftiest, for the peaks along the backbone of Mahi itself may be nearly 2000 feet above the water-line, while Silhouette, a woody, conical isle, lying about 17 miles to the northward of Mahi, rises into one central peak of from 2000 to 3000 feet in height.

The Seychelle Islands (which derive their name from a former French Minister) are a granite formation, cropping up in the centre of a vast bowl of coral. This bowl may have a diameter of some 120 miles: its rim rising nearest to the surface of the water, like one of the Atolls described by Mr. Darwin. Approaching the rim of this coral bowl from any point oceanwards, you strike soundings in from 7 to 8 or 9 fathoms. Here and there, especially on the western quadrant, you come upon 3-fathom patches. And on the northern, as also, I believe, on the southern edge, you find low sandy islands, sprinkled with scrubby brushwood, and differing altogether in appearance, as perhaps in structure also, from the Seychelle group proper. Bird Island and St. Abbs are isolated, uninhabited spots of the description under notice.

Running towards the centre of the bowl, the soundings deepen to 12, to 20, and to 32 fathoms; and give the last-named depth nearly up to North Island, which appears like a detached promontory of Silhouette. It seems, indeed, that the Seychelle Islands are the loftiest summits along the axis of a primitive system of submerged mountains, whose lower scarps and intervening slopes and plateaux support the coral growth now sketched.