ABSTRACT

OF THE

REPORTS OF THE SURVEYS

AND OF OTHER

GEOGRAPHICAL OPERATIONS

IN

INDIA

FOR

1869–70.

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PREFACE.

The following Annual Abstract of the Survey and other Geographical Operations in India during the year 1869–70, is arranged on the plan of the "Memoir on the Indian Surveys," which gives a brief history of these operations up to that date, and which has recently been printed by order of the Secretary of State in Council. References are given in the Abstract, to the pages in the Memoir at which the previous history of each operation is given, or where other information is furnished respecting work in progress, or the former services of officers. The following Reports contain the full details of the work which is briefly described in the Abstract:—

I. General Report on the Operations of the Great Trigonometrical Survey of India 1869–70, by Colonel J. T. Walker, R.E., F.R.S. (Roorkee, 1870.)

II. General Report on the Revenue Survey Operations of the Bengal Presidency, Upper and Lower Circles, for 1869–70, by Colonel D. C. Vanrenen and Major John Macdonald. (Calcutta, 1871.)

III. General Report on the Topographical Surveys of India, and on the Surveyor General's Department: Head Quarters Establishment for 1869–70, by Colonel H. L. Thuillier, R.A., F.R.S., C.S.I. (Calcutta, 1871.)

IV. Annual Report of the Geological Survey of India and of the Museum of Geology for the year 1870, by T. Oldham, L.L.D., F.R.S., Superintendent of the Survey. (Calcutta, 1871.)

V. Administration Report of the Government Observatory at Madras for 1869–70, by N. R. Pogson, Esq., Government Astronomer.

VI. Reports on the condition and proceedings of the Government Observatory at Colaba, from January to December 1870, by F. Chambers, Esq., Acting Superintendent.

VII. On the Normal Rainfall of Bengal, by Henry F. Blanford, Meteorological Reporter to the Government of Bengal. (J. A. S. B. xxxix., pt. ii., p. 243.)

It is hoped that a glance over the abstract will serve to indicate the more important and interesting operations of the year, previous to a careful examination of the detailed Reports with their valuable appendices; and that the abstract will continue to be useful for purposes of reference.

CLEMENTS R. MARKHAM.

Geographical Department,
India Office, April 1871.

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ABSTRACT

OF THE

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1869–70.

I.—Indian Marine Surveys, 1869–70.

During the year 1869–70 the history of Indian Marine Surveying has not presented the absolute blank which has characterized all previous years since the abolition of the Indian Navy. Local requirements, both on the east and west sides of India, have led to the execution of some surveys of very limited extent and upon no general system.

During the Orissa famine the want of charts of that part of the coast was very seriously felt. In 1851 Captain Fell had compiled a chart, in three sheets, of the Coromandel coast from Pulicat to Bimlipatam,[1] and Lieutenant Sweny completed another part of the east coast, from Point Calimere to Pulicat in 1860.[2] But the coast near the mouths of the Mahanuddy was still without proper charts. In the season of 1869–70 the small screw steamer "Gemini" was employed in surveying the various creeks and harbours in Orissa. The Jumboo and Mahanuddy from the sea to Toldundah, and all the work in the vicinity of False Point was completed in the end of September, as well as Davy river; and the Dumrah was expected to be finished by the middle of April. The resulting charts have been lithographed.[3]

A new survey of the coast of Chittagong was also completed during the season of 1869–70, and the results were sent to the Hydrographer for insertion in the charts. This survey is a revision of that made by Captain Lloyd.[4]

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[1] See "Memoir," p. 26.
[2] See "Memoir," p. 27.
[3] Administration Report of the Bengal Presidency for 1869–70, pp. 173–175.
[4] "See "Memoir," p. 25.

The Captains of the British India Steam Navigation Company's vessels have long complained of the scanty charts of the Persian Gulf, and represented the necessity for charts on much larger scales than that of Captains Constable and Stiffe,[1] which, though admirable at the time it was made, does not now meet the requirements of the increasing traffic. The Bombay Government have during the present season employed Mr. Girdlestone, of the Topographical Survey, and formerly a midshipman in the Indian Navy, to survey the reefs and channels between Bahrein Island and El Katiff, on the main land, in the south-west corner of the Persian Gulf. Colonel Thuillier speaks in very high terms of the valuable services of Mr. Girdlestone and of his ability as a surveyor, and excellent results may, therefore, be anticipated from his labours in the Persian Gulf. Still it is needful to remember that such work ought not to be conducted in this isolated manner, but under a general system which would secure the methodical treatment of all the nautical surveys in the Indian Seas.

The publication of the Wreck Charts, originated by Colonel Fraser,[2] has been continued, and that for the year 1867 has now been received at the India Office. They indicate the nature of the loss, whether complete or partial, but it would be a useful addition to give the tonnage and the value of the cargo. In 1866 the number of wrecks given is 27, and in 1867 the number is 33; but this can only allude to square rigged vessels, and cannot include the losses incurred among smaller coasting craft, which represent a branch of native industry capable of great development.

In 1861, all the material at the India Office for the construction of charts and plans was handed over to the Admiralty. The number of manuscript charts and plans was 264, of which 210 may be considered obsolete. Of the remaining 54, the number that has since been partially utilized is 18. There remain 36 valuable charts and plans of Indian coasts and anchorages at the Admiralty, which have not yet been published, and the advisability of utilizing them is now being investigated. Meanwhile, the "Memoir on the Paumben Pass and Adam's Bridge," by Captains Powell and Ethersey,[2] which should have accompanied their charts, but which has hitherto remained in manuscript, has been printed. It contains material to supplement Mr. Franklin's "Instructions

[1] See "Memoir," p. 36.

[2] See "Memoir," p. 16.

for Navigating the Gulf of Manaar and Palk Strait," published in 1861.

The Secretary of State has, in a Despatch in the Geographical Department, dated March 30th (No. 7), 1871, requested the Government of India to take the whole question of marine surveys into consideration, and to furnish him with their opinion and with suggestions as to the best means of placing these surveys on an efficient footing. The great ocean and coasting trade of India renders the provision of accurate charts, on adequate scales, a very important part of the duty of the Government, and the adoption of effective measures for securing the due execution and continued revision of marine surveys and charts has now become a necessity.

II.—The Great Trigonometrical Survey of India, 1869–70.

The Great Trigonometrical Survey has been proceeded with on five series during the season of 1869–70, and the completed work is represented by 73 principal triangles, covering 11,555 square miles. The British Burmah Series, which was the most expensive, has been suspended. Considering the amount of surplus revenue which British Burmah contributes to the Indian exchequer, it may be assumed that this important work will soon be revived.

In 1866–67, Lieutenant Thuillier completed the East Calcutta Longitudinal Series as far as the eastern frontier,[1] in the face of no ordinary difficulties, and he then commenced the Meridional Series, on the meridian of 90°, called the Brahmaputra Series, to complete a basis for the surveys of Nuddea, Jessore, and Dacca. During the season of 1869–70 he carried it forward for 56 miles, following the course of the Jamoona branch of the Brahmaputra River. The country is quite flat and much cut up by streams, and one of the parties, under Lieutenant Larminie, suffered very severely from fever.

Mr. Shelverton commenced the continuation of the Bombay Longitudinal Series from the Beder base line to the Vizagapatam base in 1868–69,[2] and during the last season he continued to work towards the coast, chiefly in the valley of the Godavery. This was the region in which Everest and his whole party were struck down with malignant fever half a century ago.[3] The country is densely wooded, is little better known now than it was in the time of

[1] See "Memoir," p. 113. [2] See "Memoir," p. 115. [3] See "Memoir," p. 55.

Everest, and has not yet been mapped. Mr. Shelverton and several of his men were struck down by fever. Five of the men died, but their leader recovered sufficiently to be able to resume operations, and gallantly remained at his post. He had a relapse, and died in the midst of his labours a few weeks later, adding one more to the long list of gallant men who have sacrificed their lives in the cause of science. Mr. Shelverton was an excellent surveyor, and a man of uncommon energy and determination. His name is identified with several of the most important operations connected with the Great Trigonometrical Survey, and his loss will be much felt.[1]

The Belaspur Series, on the meridian of 82°, is intended to form a basis for the survey of the country between the parallels of Calcutta and Bombay,[2] and was commenced by Mr. Keelan in the season of 1869–70. It was carried southwards for a direct distance of 95 miles.

The Bangalore Meridional Series is intended to revise the work of Colonel Lambton,[3] and is divided into two sections. The northern section, under Lieutenant Rogers, was advanced 65 miles; and the southern one, under Major Branfill, was pushed forward 75 miles. But there was a check and some delay owing to its having been found impracticable to carry the principal triangulation over the Pulney Hills. The route round the foot of the hills has, therefore, been adopted.

The Topographical Survey of Kumaon and British Gurwhal, under Major Montgomerie,[4] has made good progress. A series of triangles was extended to the junction of the two great branches of the Alaknunda, and then up the valleys of Dauli and Vishungunga, the ground being very mountainous, and the stations 12,000 to 17,000 feet above the sea. Orders were also received to make a survey of the new Hill Sanatarium at Ranikhet, and of the Kosi valley which leads up to it, with a view to the proposed transfer of the seat of Government to Ranikhet. The whole area covered by the Sanitarium, about 24½ square miles, was triangulated, partially contoured, and sketched on a scale of 12 inches to the mile. The contours were not filled in by eye, but the heights of a very large number of points were determined trigonometrically, and reflecting levels were employed in getting the run of the lines between the

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[1] See "Memoir," p. 110.
[2] See "Memoir," p. 115.
[3] See "Memoir," p. 112.
[4] See "Memoir," p. 16.

stations. Thus a degree of accuracy has been obtained in the delineation of the contour lines, which has not hitherto been equalled in maps even of the highest class of merit. The maps have not yet been received by the Secretary of State.

The Topographical Survey of the south-east part of Kattywar,[1] under the thoughtful and judicious supervision of Lieutenant Trotter, has been completed as far as Diu, and the Guzerat survey has been commenced under Colonel Nasmyth. The work in Guzerat has chiefly consisted of preliminary triangulation, and the errors in the measurements of the Bombay Revenue Survey have been found to be so great that no portion of it can be accepted as reliable for topographical purposes. The limits of villages do not agree on different maps, and even the courses of large rivers do not coincide in contiguous maps, so that no use can be made of them.[2]

Latitude observations[3] have been taken on the meridians of 75° and 78° by Lieutenants Heaviside and Herschel. The former sets of observations consist of 34 to 36 pairs of north and south stars at five stations, observed with the astronomical circle. Lieutenant Herschel observed at two groups, each consisting of three stations, near Bangalore and Coimbatore. The results at several stations of a group serve to show whether there is any essential local deflection, and such was found in both groups. Lieutenant Herschel observed with the zenith sector designed by Colonel Strange, with which he was well satisfied.[4]

A levelling party,[5] under Mr. Lane, made a circuit of 572 miles by Goruckpore, Fyzabad, Oudh, and the North-West Provinces, and the discrepancy on closing operations was 0·14 of a foot.

The pendulum observations[6] on the Great Meridional Arc, conducted by Major Basevi, were completed in the previous season. During 1869–70, Major Basevi swung the pendulums on the coast in nearly the same latitudes as the pendulum stations inland, selecting positions far from mountain ranges, that the results might not be affected by such variations of gravity as are met with in the vicinity of mountains. He also observed at Minicoy Island, as it was believed that these positions were calculated to throw light on the relative variations of gravity at continental, coast, and ocean stations. It was found that gravity on the coast was greater than inland, and

[1] See "Memoir," p. 118. [2] See "Memoir," p. 135. [3] See "Memoir," p. 119.
[4] See "Memoir," p. 144. [5] See "Memoir," pp. 97 and 119.
[6] See "Memoir," p. 120.

at the ocean station greater than on the coast. Major Basevi intends to observe on the elevated table-land of Ladak and Tibet, then at Aden and in Egypt on his way home, and to close his pendulum work by a series at Greenwich. The President of the Royal Society has expressed an opinon that great judgment has been exercised in the choice of stations, and that the observations have been made with a scrupulous regard to accuracy. The observation that at inland stations gravity appears to be in defect of that observed at coast stations in similar latitudes, had already been made in comparing the results of pendulum observations in other parts of the earth. The cause of this is still uncertain, but, by including an oceanic station at Minicoy in the present series, a confirmation of the law has been obtained; for an increase of gravity was actually obtained on the island over that at the coast stations.[1] Major Basevi also took observations for the declination, intensity, and dip of the needle.

At the computing office,[2] Mr. Hennessey and Mr. Cole have redetermined the expansion of standard bar A. at Masuri, at a temperature of about 54°, and found it to be 4 per cent. less than had been determined at Calcutta in 1832, at a temperature between 76° and 212°. This involved a very careful and exact investigation, which entailed much labour on the accomplished computers. An accurate knowledge of the factor of expansion of the standard was the one thing wanting to permit of the final reductions of the base lines being taken in hand. Since the conclusion of Mr. Hennessey's operations the whole of these reductions have been completed, and the details of the operations have been printed. They form part of the volume of Colonel Walker's "Account of the Operations of the Great Trigonometrical Survey of India,"[3] which contains a complete and very interesting "Introductory Account of the early Operations of the Survey between the years 1800 and 1830," and "The Standards of Measure and the Base Lines." This great work will be completed in about twenty volumes.

Colonel Walker's Report for 1869–70 contains a new Index Chart of the Survey, showing all the principal triangulation, the secondary triangulation to fix the peaks of the Himalaya and Sulimani mountains, and the positions of the astronomical and pendulum stations.[4]

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[1] From Sir E. Sabine, February 1871.

[2] See "Memoir," p. 123. [3] See "Memoir," p. 125.

[4] See "Memoir," p. 109, where this Index Chart is given, reduced by photography.

The Report is also illustrated by an index chart of the Kattywar Survey, a plan of the Island of Minicoy, a general index to the Ranikhet Survey, and a map showing the route of the Mirza.[1]

III.—The Revenue Surveys of India, 1869–70.

The Revenue Surveys are divided into the Upper and Lower Circles, besides those for Madras and Bombay. The Upper Circle, under Colonel Vanrenen, included ten parties during the season of 1869–70, in the Central Provinces, Oudh, North-West Provinces, Punjab, and Sind. An area of 14,494 square miles was surveyed, at a cost of Rs. 5,11,025, or Rs. 35 per square mile. The Lower Circle, under Major Macdonald, consisted of parties in Nowgong, Luckimpore, Hooghly, Cooch Behar, Hazareebagh, Seebsaugor, and British Burmah. An area of 6,560 square miles was surveyed, at a cost of Rs. 3,32,735. The total work done, in the Upper and Lower Circles, during the season of 1869–70, was 21,054 square miles, at a cost of Rs. 8,43,761.

Among the surveys, that of the Peshawur District was commenced in 1863–64, and has now been resumed by Colonel Johnstone. Some work was done beyond the British frontier, the Kohat pass was explored, and errors were discovered in the old maps, notably one in the course of the Cabul river. Colonel Johnstone got on very well with the wild robber tribes, and he tells rather a good story of one of them who chanced to see his crest, the "flying spur." The Afreedee asked its meaning, and was told that, in former days, men in Scotland were as lawless as the Afreedees, and that, when the larder was empty, a dish was put before the chief, containing only a spur with a pair of feathers fastened to it, being a signal to him and his followers to boot and spur, and be off to raid the cattle over the border, and that the "flying spur" then became the badge worn by the clan. The hearts of the frontier Afreedees warmed to the Colonel, when they found he was the descendant of the British Afreedee.

In Bhawulpore, the maps are reported to be admirable specimens of drawing. In Sind the survey was completed with the district of Shahbunder. The work in Raepore was very severe, the country

[1] See "Memoir," p. 117.

being very pestilential, and not a single man of the party escaping fever. Mr. Hutcheson, an excellent surveyor, with acquirements of a high order, died at his post. Much useful work was done in Nemar, and the Superintending Engineer of the Indore State Railway, writes as follows,—"We found the plans of Nemar of "the very greatest assistance in our preliminary work of last "season. They saved us the necessity of making fresh surveys "of our own, and aided and expedited our progress very "materially."

Levelling has been carried out in connexion with the revenue surveys in the North-West Provinces, the Punjab, and Oude, and the level bench marks have invariably been connected with the more extended levelling operations of the Great Trigonometrical Survey. Thus the Revenue maps will be greatly enhanced in value by this additional information, which will be useful to irrigation officers. The Revenue Surveys are all carefully connected with the stations of the Great Trigonometrical Survey.

The work of the British Burmah Survey was just beginning to proceed smoothly, when a sudden order arrived to stop it; but it was subsequently arranged that the survey of Ramree Island should be completed; and the main circuit of Cheduba Island was also surveyed.[1] The survey of Cooch Behar was finished by Mr. O'Donel; and in Hazareebagh a very efficient and well trained party has been formed by Captain Sconce. The alterations in the physical formation of the country have been carefully noted. In Cooch Behar, especially, it was found that the rivers had changed their courses during the last twelve years; and, with the aid of the old maps, the original and more recent beds have been delineated on the maps of the present season.

Colonel Ternan's historical, geographical, and statistical Report on the Jaloun District of the North-West Provinces was printed at Allahabad in 1870.[2] It contains a sketch of the early history of the region round Calpee, including the campaign of Baber in 1528, the Pindaree war of 1817, and the operations of Sir Hugh Rose in 1857; an account of the administration of the district since 1832,

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[1] See page 11.

[2] "Report of the Jaloun District, Historical, Geographical, Statistical, 1869. By A. H. Ternan, Lieutenant-Colonel, B. S. C., Deputy Commissioner, Jaloun." (Allahabad, 1870.)

and details respecting its topography, meteorology, and agriculture. The Report is illustrated by a map on a large scale.

No general reports have been received of the progress of the Madras and Bombay Revenue Surveys, but it is expected that they will be transmitted to the Geographical Department of the India Office in future years.

IV.—The Topographical Surveys of India and Work in the Office of the Surveyor General, 1869–70.

During the season of 1869–70 seven parties of Topographical Surveyors were in the field;—

1. In Gwalior and Central India, under Lieutenant C. Strahan.
2. In the Central Provinces, under Mr. Girdlestone.
3. In the Vizagapatam Hills, under Colonel Saxton.
4. In Chota Nagpore, under Lieutenant Sale.
5. In Bundelcund, under Captain Riddell.
6. In the Khasia (Cossyah) and Garrow Hills, under Major Godwin Austin.
7. In Rajpootana, under Captain G. Strahan.

All these districts were previously either unmapped, or represented by very old and imperfect sketches. The Topographical Surveys are rapidly conducted through unremunerative and generally unhealthy and hilly regions, which are thinly populated, and where, therefore, elaborate Revenue Surveys are unnecessary. This is also the method adopted for mapping native states. India is too large and diversified to be dealt with on one system, and by one description and scale of survey only; and these Topographical Surveys furnish all details required for good military maps, or for engineering and some administrative purposes.

The total area topographically surveyed during the season of 1869–70 was 16,135 square miles, besides 13,218 of advanced skeleton triangulation, the cost being Rs. 3,54,407, of which Rs. 46,148 was for carriage and clearing jungles. The mapping furnishes material for several portions of the Atlas sheets, and great improvements have been made in the delineation of natural features by Lieutenant Sale and other officers, especially as regards the relative differences of height.

The Gwalior party was at work all round the Seronj base line, so that the survey was easily connected with stations on the series of the Great Trigonometrical Survey, though there was much jungle and high grass, and trees had grown up in the rays.[1] Mr. Girdlestone in the Central Provinces, was at work in the long strip of hilly country facing the southern flank of the Satpoora range. His party was broken up at the end of the season. It had been employed for 16 years in a difficult and malarious region, and had mapped 26,580 square miles. The Gond tribes, nestling among the wildest and loftiest parts of the Satpooras, were visited, and Mr. Scanlan, one of the party, drew up an interesting note on the Bharias, a Gond tribe. Colonel Saxton, in the Ganjam Agency, completed the examination of the Saora Hills among tribes which had never before allowed strangers to enter their country. He describes the hills as being cultivated to their summits (3,500 feet), by means of terraces supported by stone revetments; and he adds that these terraces are built by women who all smoke tobacco while at work. In Chota Nagpore Lieutenant Sale was surveying on the water sheds between the Johilla, a tributary of the Sone, and the Nerbudda. He describes a deceptive appearance in the landscape, as if the hills forming the watersheds died away and the two rivers joined, when really the Johilla turns abruptly to the north. This has given rise to a Hindu legend, that the Johilla was going in marriage procession to meet the Nerbudda, but that she became frightened, turned, and fled. The party in the Garrow Hills was in charge of Major Godwin Austen, who is now on leave in England. He was succeeded by Captain A. B. Melville, the news of whose melancholy death has just arrived in England. The Rajpootana party under Captain G. Strahan is reported to be in very efficient order. The country in which they are working, on the borders of the desert west of the Aravalli Hills, is comparatively easy, and Captain Strahan is laying out a series of secondary triangles on the meridian of 74°, emanating from the Kurrachee Longitudinal Series.

In the Surveyor General's Office at Calcutta the great event of the year has been the first issue of quarter sheets of the Indian Atlas engraved in India (No. 87, S.W. Lucknow, and No. 125,

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[1] See "Memoir," p. 72.

S.E. Sylhet). Colonel Thuillier reports, that the style of the work is all that could be desired, well bearing a comparison with the engraved sheets produced in England; and the correctness of his judgment on this point has been fully confirmed by high authorities. Mr. Coard, the Superintendent of this branch, has devoted a great portion of his time to the training of native apprentices in the art of engraving on copper, and they have made good progress. The work reflects great credit on Mr. Coard and his staff, whose labours have been cordially recognized by the Secretary of State for India in Council.

The lithographic branch of the office, under Captain Murray, is much in request. As many as 419 maps, plans, and diagrams, have been drawn, from which 101,610 impressions have been taken. Great progress has been made in training natives to draw on stone, which is preferable to transfer drawing, in the reproduction of the higher class of maps.

One of the most important improvements adopted by Colonel Thuillier has been the speedy issue of the results of the surveys in progress by the aid of photozincography and photolithography, and he has been very ably seconded in this branch by Lieutenant Waterhouse. As many as 60,116 copies of maps and plans have been photozincographed during the year, making a total of 161,726 lithographed and photographed. 18,006 copies have been issued to Government officials up to the end of December 1870.

V.—The Geological Survey of India, 1869–70.

The area which can be geologically examined very seriously depends upon the strength of the establishment, and there have been some very serious losses to deplore during the last season. Mr. C. Oldham,[1] the geologist who worked so ably in the Madras Presidency, and Mr. Ormsby, who had just completed the revision of a large portion of Bhaugulpore, both died from the effects of illness contracted in the field. Mr. King and Mr. Mallet were on leave until the end of 1870.

[1] See "Memoir," p. 161.

The country near Mopani, which is the site of the Nerbudda Coal and Iron Company's Works, was examined by Mr. H. B. Medlicott, who obtained the maps of the district from Colonel Gastrell in 1869. In 1870, Mr. Medlicott continued his investigations in the Jhansi and Saugor district, while Mr. Willson was at work in the country extending to the Jumna, near Calpee, and Mr. Hacket in the Jubbulpore country.

Mr. Ball was employed on the revision of the maps of the Rajmehal hills, which are now ready for publication and only waiting for the copper plates to arrive from England. Mr. Ball proceeded thence to the southern part of Chota Nagpore, to determine the boundary of the coal-bearing rocks. Mr. Mallet, on his return to India, proceeded to the south part of Mirzapore. He had, on his way out, reported on the geological structure of Aden, with a view to determining whether the principle of artesian wells could be applied there with any prospect of success.

In the Madras Presidency, Mr. Foote was engaged in geologically mapping the valley of the Upper Krishna, to determine, on one side, the outline of the great Deccan trap rocks, which have overflowed all the earlier formations, and, on the other, to fix the boundary of the immense area of fundamental gneissic rocks. Between these two formations a variety of other series crop out irregularly. Mr. King has now returned from leave, and will work in the direction of Koolburga, while Mr. Foote will proceed towards Belgaum, to join his lines with those of Mr. Wilkinson in the Concan.

Mr. Blanford, during the year 1869, was detached from Berar and Chanda, to examine the coal fields in Bilaspur (*see* "Records," May 1870), which he found to be thick and extensive, and he also examined a promising lead vein at Chicholi, near Raepore. He has since proceeded to Dumagudiem, on the Godavery, to report upon the best points for boring. This is the most southern locality in India in which coal is known to occur.

The coal-bearing rocks of East Berar and Chanda have engaged the attention of Mr. Hughes. The coal is in thick beds, nowhere more than 70 yards from the surface, throughout the Wun district in the Wurda valley, and Dr. Oldham reports that Mr. Hughes has shown much judgment and skill in fixing the localities for the borings. The existence of coal in the Chanda district was pointed out by James Prinsep, so long ago as in 1830 ("Gleanings in

Science," vol. ii., p. 386, and vol. iii., p. 381); but the Geological Survey, under Dr. Oldham, has now traced out the limits of the field, and made progress in a detailed examination of it. Mr. Fedden has been employed in mapping the area covered by trap rocks to the north and north-west of the coal field, to fix their boundaries in the vicinity of the coal measures. He has also examined the coal-bearing rocks in the area covered by the outlying portion of the great trappean flows near Wurrora, a locality where boring may also be undertaken.

The "Records" have proved most useful in giving early and timely notices of geological facts, which could not be given to the public for many months if it was necessary to wait for a complete report. Several Memoirs are nearly ready for publication, and in the preparation of the maps, especially of a detailed and beautiful geological map of Cutch, Dr. Oldham acknowledges the hearty and skilful assistance he has invariably received from Colonel Thuillier and all the members of his valued Department. The volume of the "Palæontologia Indica" for 1870 contains the first portion of the bivalve mollusca of the cretaceous rocks in the Madras Presidency. Meanwhile, the preparation of the final geological maps, to be issued on the basis of the sheets of the Atlas of India, has made much progress. Two quarter sheets, including the town of Madras, are nearly ready; and the copper-plates of several others have been despatched from England, that the necessary transfers for geological purposes may be prepared.

Mr. Tween, the Curator of the Geological Museum, is progressing with the detailed examination of the coals of India, in connexion with the experiments as to their actual "duty," which are being conducted by Colonel Hyde at the Mint Office. These combined assays and actual trials are expected to give a very much more trustworthy and accurate test of the relative values of the various coals of India than has hitherto been obtainable. The specific gravity of each coal is carefully determined, and the general assay or composition; and then a careful analysis of the ashes of the coal is made.

VI.—The Archæological Survey of India.

General Cunningham left England in the end of 1870, to preside over the archæological investigations in India; and next year we may look forward to the receipt of his first report. The instructions he has received from the Government are, first to prepare a summary of the labours of former inquirers, and of the results obtained, and then to draw up a general scheme of systematic inquiry for the guidance of his staff of assistants.

VII.—Meteorological Observations in India, 1870.

The Reports for 1870 have only been as yet received from Bombay and Madras, but Mr. Blanford, the Meteorological Reporter in Bengal, has prepared a valuable paper on the normal rainfall of that region, which was read before the Asiatic Society on May 27th, 1870.[1] Very few of the old records of rainfall can pretend to accuracy, and the series from 1852 to 1859 was handed over to Mr. H. Schlagintweit. Mr. Blanford uses, for the purposes of his paper, the records of 1842, 1852, 1860, 1869, and some miscellaneous observations. Professor Dove's tables give the rainfalls of 12 stations only in Bengal, and he classifies them in two groups, Dacca and the Ganges plain. The former group receives its rain from the south-west wind. But the western stations of the latter group are visited by heavy rain, only when, in consequence of high temperature in May and June, a large body of saturated air from the Bay of Bengal is drawn round from its primitive direction towards the plains of Upper India, which it reaches as a south-east or east-south-east wind. The rainfall is therefore later at these stations.

Mr. Blanford classifies his stations in ten groups, four in Eastern, three in Central Bengal, and three in Behar and Orissa. In the Assam or Eastern group, the heaviest falls are at Goalpara, near the lower end of the valley, and at Seebsaugor, at the upper extremity, where it exceeds 90 inches. Central Assam only averages 70 or 80 inches, the heaviest fall being in June and July.

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[1] "Journal of the Asiatic Society, Bengal," Vol. xxxix., p. 243.

This is caused by the intervention of the Khasia hills, which intercept the rains coming towards Central Assam, while they pass round the flanks at the lower and upper ends of the valley. At Cherrapoonji, in the Khasias, overlooking the plain of Sylhet, and 4,100 feet above the sea, the south-west winds are suddenly arrested by a mural escarpment up which they are driven, and they consequently discharge their vapours in torrents of rain unequalled by those recorded in any other part of the world. In one month (July 1861) 366 inches fell, but the fall is quite local. At Shillong, 30 miles to the north, and higher up, the average is only 96 inches.

In Behar, the western group, the fall is only 40 inches, and the rains commence a fortnight later than in the delta.

There is no satisfactory account of the cause of rain in the winter months, which is more regular in the upper part of the Ganges valley than in the Lower Proviuces. As the sun advances north in March and April, the temperature of the land rises rapidly. The focus of heat is transferred to the Punjab, and the air from the Bay of Bengal is drawn up the Gangetic plain, the fall decreasing with the distance from the sea. At Benares it is 34 inches, and at Agra only 25 inches. Mr. Blanford gives tables of mean monthly rainfalls at the end of his paper.

In Madras, new and accurate rain gauges have been supplied to 219 Revenue Stations. The Madras Meteorological Establishment has now been in existence for two years, and is in fair working order. Mr. Pogson has had new and convenient tables printed, for the reduction of observations, and all those for 1863 have been reduced. He publishes the meteorological results from the Madras Observatory Register every fortnight, together with the rainfall reports from the 219 Revenue Board Stations. Current monthly averages at the 13 Stations will be published from January 1870.

Mr. Chambers, the Superintendent of the Government Observatory at Colaba, has submitted a report describing in detail the existing arrangements for the record of meterological observations in the Bombay Presidency, and offering suggestions for their improvement and extension. He considers that, in any widely extended system of observation, it is advisable, in the first place, to select, with due regard to geographical features, a number of typical stations, each representing meteorologically a considerable tract of surrounding country. The necessity for a common plan of operations at all

stations arises from the fact that, if the observations are to be comparable with each other, they must be taken at the same hours of the day. Mr. Chambers recommends the appointment of officers, who may hold other appointments, for the inspection and control of the observations of each district; the establishment of an office at each Presidency town for the keeping and testing of instruments; the appointment of an officer to make the study and useful application of the collected observations his sole duty; and the employment of additional computers. He advocates the appointment of a single officer to receive the complete data from the whole of India, and to discuss them, and recommends a particular scheme. In the Bombay Presidency he proposes the extension of meteorological observations and the appointment of an officer with duties similar to those of the reporters in the Bengal Presidency.

On the above points Mr. Chambers is in general accord with the opinion of the Meteorological Committee of the Royal Society, as expressed in a report drawn up at the request of the Duke of Argyll, and dated April 11th, 1871. The Committee recommend that there should be five local central stations, and that the entire extent of the country should be apportioned between them. They also advise the appointment of a scientific director at the head of a principal meteorological office, to whom the superintendents of the five local stations would submit the data of observations taken under their supervision; and they draw attention to the importance of absolute uniformity as regards the instruments to be used and the methods of observing.

An article reviewing the present system of meteorological registration appeared in the Calcutta Review for April 1871. The reviewer pronounces our knowledge of meteorology in India to be actually but little in advance of its condition twenty years ago. He condemns the present system of having an independent reporter in each Government to carry out a scheme without reference to any general plan; and points out the necessity for concentrating the management in the hands of one qualified chief, in order to remove most of the causes of imperfection and failure. Such a director or superintendent would be for the whole of India, and would bring together and discuss results. The fact should be recognized that the expenditure of any considerable sum of the public money on meteorological registration is only to be justified by the expectation that it will yield a return in the shape of information of general

utility. The reviewer urges that meteorology should no longer be confounded with fiscal and sanitary questions, but pursued under the guidance of men acquainted with physical science and its methods. Revenue Boards and Sanitary Commissions will then obtain the information which they require for their own special objects, and which they have failed to obtain by their own efforts.

The reviewer finally points out the great importance of India as a region for meteorological observations. It is traversed, he says, by the thermal equator of the earth, and all the phenomena of direct solar action are here exhibited in their most favourable and striking forms; while India is also a field well adapted for the solution of problems, such as the cause of barometric tides.

VIII.—The Madras Observatory, 1869–70.

The reduction and preparation for the press of arrears in the Madras Observatory is considered by Mr. Pogson to be now a far more imperative duty than the accumulation of further records. In 1869, a code of instructions was drawn up by Colonel Walker, the Superintendent of the Great Trigonometrical Survey, to define future operations, expressly with a view to ensuring publication and to preventing further arrears from accumulating. Mr. Pogson looks upon this as the standard work of the Observatory, and fully concurs with Colonel Walker in the importance of rendering the results of observations available by prompt publication.

On January 12th, 1870, Mr. Pogson, at Madras, and M. G. Fleuriais, at Pondicherry, made a telegraphic determination of the difference of longitude between the two places,—1′ 3″·7 E.

IX.—Geographical Exploration.

The plan for exploring beyond the British frontier by means of Asiatics, which has been so ably conducted by Major Montgomerie in recent years,[1] has borne rich fruit lately in the important journey of the Mirza, in 1868-69, which is described by Major Montgomerie

[1] See "Memoirs," pp. 115 and 98.

in a Report forming an appendix to Colonel Walker's Report for 1869–70. The Mirza followed the route of Lieutenant Wood,[1] the discoverer of the Sirikul source of the Oxus, until he came to the two branches of that river, near Punja, the more northerly of which was taken by Wood. The Mirza took the southern branch, and reached the water-parting of the Pamir Steppe between Wakhan and Eastern Turkistan. Here he discovered the source of this southern branch of the Oxus in a small frozen lake called Pamir-kul, about 13,300 feet above the sea. The water-parting to the eastward is close to the lake, and the Mirza, after four long marches, found himself at Tashkurgan, the capital of Sirikul. Thence, after very trying marches, he advanced to Kashgar; and he returned to India by Yarkand and the Karakorum Pass. He carried a route survey from Cabul to Kashgar, the bearings being taken with a prismatic compass, and the distances measured by pacing. The party carried strings of beads, dropping one at every 100 paces, and having a large bead at every tenth, to represent 1,000 feet. Observations for latitude were taken at various important points, and the results of those as far as Punja, which can be compared with the observations of Wood and Griffiths,[2] generally agree within two or three minutes. This most important journey furnished Major Montgomerie with additional data for the discussion of several questions in the geography of Central Asia, such as the positions of Kashgar and Yarkand, and the direction of the Pamir water-parting. The new portion of the Mirza's route between Punja and Yarkand accounts approximately for the geography of about 18,000 square miles of hitherto totally unexplored country. The whole length of his route was 2,179 miles, and it is tested by 48 latitude observations at 14 places; about 340 miles being entirely new ground.

Mr. Shaw, who accompanied Mr. Forsyth on his journey to Yarkand in 1870, took three lunars, one a sun, and the two others star observations, by which he fixed the longitude of that place, his result agreeing within a few miles with previous determinations by route surveys. On his return he was detached to examine the country lying between the old and the new routes from Yarkand to Ladak, including the high table-lands at the head of the Karakash river and the valley of the Upper Shayok. This region resembles,

[1] See "Memoir," p. 19.

[2] See "Memoir," pp. 19 and 267.

on a vast scale, the edge of an embankment which has been much cut up by rain; the high plateau being edged on the south by a huge wall of limestone mountains. He examined the scene of the great débacle of 1841, when a lake was formed by the fall of glaciers, near the head of the Shayok, and traced the marks of the lake 200 feet above the ordinary level of the stream, extending for a dozen miles up the valley. Thus the calculations of General Cunningham regarding the size of the lake, founded on the records of the height attained lower down by its escaping waters, were signally verified.[1] Mr. Shaw also reports his opinion that, to the eastward of the Karakorum Pass, in 78° E., there is no continuous ridge dividing the waters of Southern and Central Asia; and he thinks that the idea of a Karakorum range east of 78° E., dividing the two water systems, should be abandoned.[2]

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[1] See "Memoir," p. 256.

[2] Mr. Saunders has communicated the following note, suggested by Mr. Shaw's interesting letter:—

"Mr. Shaw's idea that the Karakorum range does not extend east of the pass seems "to arise from taking too contracted a view of the grand phenomena exposed to the "traveller's notice; for the just correlation of such vast objects appears to require a "combination of conditions extending over an area sufficiently wide to embrace the "whole scope of them. It is also desirable to bring to such discussions some familiarity with the general treatment of similar subjects. Deductions relating to an "entire range of mountains should not be based upon a partial aspect of them.

"According to the view promulgated in the 'Sketch of the Mountains and River-"basins of India," p. 29, the Karakorum System as a whole has for its axis the water-"parting between the basins of the Indus and Lake Lob. It extends, therefore, "as far east as about 78° 50', where its termination may be marked by the snowy "peak distinguished as E 45 in the Trigonometrical Survey, or by the pass from the "head of the Karakash valley below that peak. Further westward is the snowy "peak, E 44, with an elevation of 20,673 feet above the sea; and other snowy peaks "have also been fixed by the Survey between E 44 and the Karakorum Pass, which "Mr. Shaw considers to be the termination of the Karakorum range.

"Between these culminating peaks, which are on the water-parting, and the Shayok "river, the ground at first has only a gentle slope, and forms very elevated plateaux "or 'depsang'; but these soon give way to precipitous declivities and ravines "descending into the gorge of the Shayok.

"There is nothing in these incidents that really contradicts the extension of the "Karakorum range as the name of the mountains eastward of the pass, and so far "as the basins of the Indus and Lake Lob continue in contact. When a geographer "views the subject as a whole, he must remember that he has to deal with the "continuous culminating summit of a vast mass, rising to heights upwards of 20,000 feet "above the sea, and forming the well defined water-parting between two remarkable "drainage systems. The summits may be formed by a single ridge, or the exterior "slopes of the mass may culminate in separate ridges with a plateau between,

During the season of 1860–70, Captain Carter was sent into the Peshawur district, to take observations of all the prominent peaks in sight. Of these he fixed 171 points beyond British territory, and determined the heights of 140.

Major Sladen's expedition, the main object of which was to ascertain the true causes of a recent cessation of an old established caravan trade between Burma and China, has been the means of assisting geographical inquiry by the exploration of an exceptionally interesting tract of country, hitherto closed to European adventure. The expedition left Mandalay in January 1868, proceeded by water to Bhamo on the Irrawaddy, and thence penetrated to the Chinese frontier. All that was vaguely known about the geography of the north-eastern frontier of Burma contiguous to China, before the time of Sladen's expedition, was that it seemed to be bounded by a succession of irregular mountain ranges, known in Burma as the Kakhyen hills, which separated it from certain indefinite Shan States abutting on the Chinese Empire.

The result of Major Sladen's work is, that the geography of the region between the eastern bank of the Irrawaddy and the Chinese province of Yunan is no longer matter of mere conjecture. Major Sladen describes the Kakhyen hills as the abrupt termination, at the south-western extremity, of several subsidiary parallel ranges, having a general inclination between east-north-east and west-south-west, which merge, at their northern and eastern end, into the greater Himalayan chain, which is continued through Yunan, from north to south, with prolongations into Burma, Siam, and the

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" perhaps almost a plain, or else broken into valleys, broad and shallow, or deep and " narrow, with corresponding spurs between them.

" If for a few miles the culminating summit is supported by slopes which spread " out with little declination for some distance, before they fall into the greater " declivity which constitutes the general slope of the mass, it is not necessary for a " cause, which when viewed with a cosmical eye is so trifling, to separate such a " section of the water-parting from the denomination which embraces the rest of it. " It may also be observed that a feature like that which is alluded to by Mr. Shaw, " and which forms the basis of his argument, becomes utterly lost on the reduced " scale which would bring the great objects of Himalaya-Tibetan nomenclature within " sight, at one view.

" On the grounds, then, of Physical Structure broadly considered, and of Geographical " Nomenclature regulated by a just generalization, I contend that the name " of the Karakorum Mountains is well adapted to the whole of the mass which, on " one side, drains into the Tarim and Lake Lob, and on the other, drains into the " Indus, by the Shayok, Nubra, and other affluents."

Malayan peninsula. The abrupt termination of the subsidiary ranges forms, in itself, a belt or zone of irregular lofty spurs, without any one general direction. It is this apparent irregularity which has hitherto caused the Kakhyen hills to be described as a transverse range, or succession of ranges, which it was necessary to cross in approaching the province of Yunan. In reality, this belt or zone, with an average width of from 40 to 60 miles, is only the termination of several parallel subsidiary ranges, which form the boundaries of well defined valleys, sometimes more than 100 miles long and three to five broad, and determine the course of three of the principal affluents of the Irrawaddy. The routes from Bhamo lead over the irregular portion of the subsidiary ranges which come down into Burma from the Yunan central range, and terminate abruptly within a dozen miles of the east bank of the Irrawaddy. As soon as this belt is crossed, the hills begin to assume a definite direction, and open out suddenly into well defined parallel ranges, enclosing valleys which comprise the northern Shan States. The whole distance from the Irrawaddy at Bhamo to Momein in China does not exceed 150 miles, crossing three ranges and three intermediate valleys. The valleys are from 2,500 to 4,000 feet above the level of the sea, while the parallel ranges do not exceed an elevation of 7,000 feet. The more striking features in the conformation of these valleys are their extreme length in one straight line of inclination, and the evidence afforded by terraces, at corresponding points of elevation on either side, of a lacustrine period during which the waters were gradually forcing an outlet through the several gorges which separated them from the line of greatest depression in the river basin of the Irrawaddy. Such is a general outline of the principal geographical features of the region traversed by Major Sladen's expedition. The accomplished commander and his officers collected much valuable information respecting the trade, the races, the natural history, and the geology of this hitherto unexplored country.*

Some useful geographical work has also been done in Arabia. In July 1870, Captain Miles and M. Werner Munzinger, C.B., undertook an expedition from Aden into the interior of Yemen. They

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* "Selections from the Records of the Government of India. Foreign Department, "No. LXXIX. Official Narrative of the Expedition to explore the Trade Routes to "China *viâ* Bhamo, under the guidance of Major E. B. Sladen." (Calcutta, 1870.)

landed at Bir Ali, carefully copied the inscriptions on the hill of Hisn Ghorab, and then commenced their journey inland to Hota, escorted by a party of Deaybee Arabs. They explored the ruins of Meifah, near Nakab al Hajar, which had already been examined and described by Wellsted. Captain Miles was astonished at the enormous size of the stones and the beauty and exactness of the masonry, in which no mortar had been used. The Wady Meifah* was once the principal channel of a rich and extensive commerce, and the various ruins testify to the former wealth and populousness of this part of Arabia. At Hota they parted with their Deaybee escort, and continued their journey to Habban, copying several Himyaritic inscriptions on the rocks by the way side. Near Habban, the country opens out into an extensive hilly plain containing many Bedouin houses, and on reaching that place they were courteously received by the Chief, Sultan Ahmed. Captain Miles intended to have pushed on to Nisab and Datheena, but he was obliged to relinquish this plan on account of the limited time at his disposal. The party returned to Aden by land. The country thus traversed, is occupied by four tribes, the Wahidees, Deaybees, Owlakees, and Fudthlees, of which Captain Miles gives a very interesting account; while the geological features of the region are described by M. Munzinger, C.B., who is so well known for his remarkable journey through the salt desert east of Abyssinia. M. Munzinger thinks that, the Government should possess a more thorough and complete knowledge of the country round Aden, and of the nations with which treaties have been made. The summer months at Aden are barely endurable, and he suggests that half the garrison should annually make a three months' promenade into the interior, with the object of benefiting the health of the troops, giving them exercise, and exploring the country. One year they might go to Taëz, another to the coffee hills of Yaffé, another to Nisab. The troops would enjoy it, the expense would be slight, much information would be obtained, and an excellent impression would be made on the simple but logical children of Ishmael.

An important Geographical Survey has been executed by Lieutenant St. John, R.E., in Persia. He has completed an elaborate map of the country between Teheran and Bushire, on a scale of eight miles to the inch, to illustrate the telegraph route; which is

* Mœpha Metropolis of Ptolemy.

reported to be infinitely superior, in every way, to any existing map of the same line of country. He found no very large errors on the ordinary maps, except in the position of Kashan, 150 miles south of Teheran, which is placed at least 10 miles too far south. Lieutenant St. John has also explored a previously undescribed route from Shiraz to Bushire, by way of Firozabad; and has, in conjunction with Lieutenant Stiffe, made a satisfactory telegraphic determination of the difference of longitude between Bushire and Kurrachee. He has also fixed, by telegraph, the differences of longitude between Bushire and Teheran, Koom, Kashan, and Shiraz.

The Indo-European Company have now completed their line, and signals from London pass, in fine weather, to any station on the line between Bushire and Teheran. Lieutenant St. John considers that there is an opportunity for getting a fair longitude for Teheran, by telegraph from Greenwich, and so on for India; as well as for ascertaining, by experiment, whether the time of transmission of a current over so long an extent of wire is sufficiently regular to make it worth while to undertake observations on a scale calculated to give really accurate results. If at one time it takes say three seconds for a signal from London to reach Teheran, and ten minutes afterwards it takes two or four, it would be hardly worth while to send out expensive instruments. But if, on the other hand, the results obtained with the present means are satisfactory, the scientific results would amply repay the cost of sending an experienced observer with a transit instrument to Bushire, to fix the differences of time accurately between London on the one hand and Kurrachee on the other. Colonel Walker's presence in England affords an admirable opportunity of trying some initiatory experiments in London, in conjunction with Lieutenant St. John at Teheran.

Colonel Yule's edition of Marco Polo[1] is a most valuable and exhaustive work, and will be indispensable to the student of the medieval geography of Central and Eastern Asia. It has been reviewed by Sir Roderick Murchison in his Anniversary Address to the Royal Geographical Society,[2] where the learned author's merits

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[1] "The Book of Ser Marco Polo, the Venetian, concerning the Kingdoms and "Marvels of the East. Newly translated and edited, with Notes, by Colonel Henry "Yule, C.B. In two volumes. With Maps and other Illustrations." (Murray. 1871.)

[2] Address, 22d May 1871, p. 21.

are cordially acknowledged, and where the main points of interest in the work are indicated. In the present abstract it will, therefore, be sufficient if I mention some of the more important geographical elucidations of Colonel Yule's commentary.

1. The singular name applied by Marco Polo to the Caspian Sea "Mer de Gheluchelan," which has sorely exercised previous commentators, is shown to be merely "Mer de Ghíl ou Ghilán," a well known Persian title of the Caspian, as misrendered by the ear of the traveller's amanuensis.

2. Much labour has been bestowed on the determination of the traveller's route from Kerman to the port of Hormuz, through a country of which our maps are most imperfect; and the site of the port itself, on the mainland of Persia, where it stood till transferred to a famous island of the adjacent sea, about the beginning of the fourteenth century, has been for the first time exactly ascertained and indicated, with the assistance of Colonel Pelly, who has himself visited the ruins.

3. Cobinan, in Persia, is shown to be, not "Khabis," as alleged by previous editors from the very slight similarity of name, but "Koh Benán," a district in the north of Kerman, which has, indeed, no place in our modern maps, representing, as they do, the region to be one of uninhabited desert; but which is mentioned by old Mohammedan geographers, and has been referred to by Mr. Consul Abbott, in a valuable Report on Interior Persia.[1]

4. The traveller's journey in Tibet is shown not to have extended further west than Bathang, and to have corresponded, in fact, very nearly with that so adventurously undertaken by Mr. T. T. Cooper. The journal of the latter traveller has afforded some striking illustrations of the account given by his medieval predecessor. New light is also thrown by Colonel Yule on Polo's obscure itinerary of the provinces on the south-west of China.

5. New considerations are brought to bear on Malay chronology as accepted by Marsden and Raffles, showing that the true date of the foundation of Malacca must be placed more than a century after that which those writers have adopted, and long after the time of Marco Polo.

6. The position of the various kingdoms of Sumatra described by Marco Polo has been discussed with much care, and it is shown that

[1] R. G. S. Journal, vol. xxv., p. 25.

they formed a continuous series, in the order of their description, along the shores of the northern half of the island, instead of being distributed nearly all round it, as previous commentators have supposed.

7. Cael (Kâyal), described by Marco Polo as one of the greatest Indian ports of his age, has long been recognized as situated on the Tinnevelly coast, but its *exact* position is indicated by Colonel Yule for the first time, by the assistance of the Rev. Dr. Caldwell, who is familiar with its extensive remains. The same note, on the same excellent authority, also points out the port which preceded Kâyal, namely "Korkhoi," undoubtedly the "Kolkhoi" of Ptolemy, which Lassen has misplaced.

8. The name "Mutfili," by which Polo describes the coast region of Telingana, and of which no admissible explanation has hitherto been given, is shown to be the usual Arab corruption of Motapalli, still existing as a small seaport of the Guntoor district, and which was probably the extreme northern limit of Polo's acquaintance with that coast of the Bay of Bengal.

9. The kingdom, on the coast of Malabar, described by the traveller under the name of "Ely," is traced through a succession of authorities, its name still surviving in that of Mount Dely (Monte d'Ely), north of Cannanore.

The above will serve as examples of the geographical questions treated in the notes, which, however, deal with a great variety of subjects of a different kind. All Eastern geographers will welcome the appearance of Colonel Yule's Marco Polo, which contains so rich a mine of sound learning and research.

In India, a very useful translation of Meyendorf's journey from Orenburg to Bokhara in 1820, by Captain Chapman, of the Artillery, an Officer who had already distinguished himself in Abyssinia, has been published by the Government, and will prove a valuable addition to the literature of Central Asian geography.[1]

The History of the Imâms and Seyyids of 'Omân,[2] which has

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[1] "A Journey from Orenburg to Bokhara in the year 1820. Edited by Baron von Meyendorf. Translated by Captain E. F. Chapman, R.H.A." (Calcutta, 1870.)

[2] "History of the Imâms and Seyyids of 'Omân, by Salîl-ibn-Razîk, from A.D. 661 to 1856, translated from the original Arabic, and edited, with Notes, Appendices, and an Introduction, containing the history down to 1870, by George Percy Badger, F.R.G.S., late Chaplain in the Presidency of Bombay, with a Map." (Hakluyt Society, 1871.)

just been completed, is a great addition to our knowledge of comparative geography. It is translated from the Arabic, and edited with notes and an elaborate introduction by the Rev. George P. Badger, and forms one of the volumes of the Hakluyt Society. This work contains a vast amount of authentic and novel information respecting the original settlements of the Arab tribes in Omân and along the southern shores of the Persian Gulf, together with their subsequent annals down to the present time, interspersed with numerous incidental notices of the geography and territorial divisions of the country. Availing himself of these notices, the editor has been enabled to identify a number of localities, the names of which have been changed in modern times, to make several important additions to Wellsted's Map of 'Omân,—the only delineation of the province, drawn up from personal observation, which we possess,—and to correct Wellsted's very imperfect nomenclature throughout. He has done the same for the littoral of the Persian Gulf and the parts adjacent, and he has given, in his revised map of that region, which illustrates the work, a correct English transliteration of the native names. Some improvement, in that respect, over the Chart of the Persian Gulf constructed by Captain Brucks,[1] was made in the Chart of Captains Constable and Stiffe, published by the Admiralty in 1860.[2] But Mr. Badger remarks that "a great "many of the names remain uncorrected, which, if pronounced as "transliterated into English, would not be recognized by the "Arabs." He also mentions, with regret, that the Admiralty Chart omits the names in the Arabic character, which are printed, together with the English, on Brucks's earlier chart. As far as is possible, however, Mr. Badger's map remedies this omission, and will undoubtedly be found of great use by all European navigators in those seas. With that view, as well as on account of the various historical, political, and geographical details contained in the work, it seems very desirable that the Commanders of all Her Majesty's ships serving on the Persian Gulf Station should be supplied with copies. I would also venture to suggest that Mr. Badger's revised nomenclature should be adopted in any future edition of the Admiralty Chart of the Persian Gulf.

[1] See "Memoir," p. 10.

[2] See "Memoir," p. 33.

X.—Geographical Department of the India Office, 1870.

The work completed in the Geographical Department of the India Office during the year 1870 has been already described in Section XVII. of the "Memoir on the Indian Surveys." The sheets of the Hyderabad Survey and of Captain Selby's Mesopotamian maps are still in hand. Four index maps for the "Memoir on the Indian Surveys," a large diagram for the Committee of the House of Commons, and a map showing the lines of railway in India, have also been prepared. A supplement to the Catalogue of Maps issued by order of the Secretary of State is nearly ready, and the complete catalogue of the collection of maps and geographical documents in the India Office is progressing. Parcels of maps, received from the Surveyor General, have been presented to the Royal Asiatic Society, the Royal Geographical Society, the British Museum, the Quartermaster-General's Office, and the Topographical Depôt of the War Office.