inch, which I procured in India, are not as yet to be obtained in this country, and do not even—I believe Mr. Saunders will confirm me—exist in the India Office. The best maps you have in Savile Row misplace some of the main spurs and valleys of the Kangchinjanga group. The new map constructed by Mr. W. Roberts is a work of admirable accuracy up to the snow-line, and covers a district of extraordinary difficulty to the surveyor, owing to the dense jungle and the number of intersecting ridges and valleys.

NOTES ON THE HIMÁLAYA AND HIMÁLAYAN SURVEY.

By Emil Boss and Douglas W. Freshfield, Secretary R.G.S.

Something was wanting at the Geographical Society's meeting on the night of June 9. Officials moved about in an uneasy manner, and cast anxious glances round the benches. Mr. Graham himself, when he came to mention his Swiss companion, was seen to look inquiringly among his audience; but even to his eyes no Emil Boss was visible. Yet the Grindelwalder was present, securely ensconced in the corner in which native modesty and a chivalrous desire to leave to Mr. Graham the undivided honours of the evening had induced him to take refuge. On the following evening the Alpine Club were more fortunate.

Encouraged by the sight of many familiar faces, the Swiss mountaineer told—or rather was entrapped into telling impromptu—the tale of the conquest of the 24,000 feet of Kabru. His vigorous narrative, delivered in excellent English, naturally held enchained a sympathetic audience, who, as they listened to the personal details of each critical moment of the day, could almost fancy themselves sharers in the bold adventure. Thoroughly appreciated, too, were the weighty axioms of mountaineering which fell from this master of the craft. We may quote one, the neglect of which has cost too many valuable lives: 'Difficulties are no dangers; the only danger in the mountains is the unseen: what falls on you, or falls from under you; willingly to run in the way of this is foolhardiness.'

The details given were, for the most part, amplifications of Mr. Graham's account. The points brought forward were that the route followed in the ascent of Kabru was only made possible by an exceptionally favourable condition of the snow on the upper slopes, but that there was another route worth trying, and probably easier. Mount Everest was spoken of as a peak of highly formidable appearance, owing to the succession of steep snow- or ice-slopes, one above the other, to be surmounted. The ascent of Kangchinjanga by the northern ridge Boss thought difficult, but possible. He also thought that the first strong alpine party, fully provided, might hope to conquer Nanda Devi. Of the relative heights of Mount Everest and the peaks seen beyond it—that is, of the inferiority of the former—Boss spoke with great confidence. He would take surveyors to where they could measure these peaks, with no doubt as to the result.

But the most important, if not the most exciting, portion of Herr Boss's address was that in which he took up the discussion on the work of the Indian Survey, opened at the Geographical Society's meeting on the previous night. On this subject Boss's criticism was to some extent that of an expert; for he is a captain on the Staff of the Fifth Infantry Brigade of the Swiss army, and is therefore accustomed to use and study, and that with a view to corrections, the maps of a General Staff which, happy in having no wars, has, under General Dufour and his successors, made its fame as the producer of the finest cartographic work in the world.

To the general accuracy of the great trigonometrical survey of India Boss bore strong testimony. He spoke also in high terms of the new map of Sikkim, on the scale of two miles to the inch, no copy of which has yet reached any collection in this country. It will be found (when the tardiness of officialism allows it to be seen) as good as any map of such a district made by men not, in the Swiss sense, mountaineers could well be.

Far different, however, are the maps of Kumaon, *on the scale of one mile to the inch.* A large portion of one sheet, representing the glacier basin under Nanda Devi, the speaker would not allow was a map at all in any scientific sense; it was in all its details a work of imagination, with but slender relations to fact. Looking at the pale green splotches of Mr. Graham's copy, unlike, not only the particular glaciers they purported to represent, but any conceivable ice-stream following natural laws, he condemned them as 'nursery pictures.' Nor did his criticism stop here. On one of the most important tracks in the district, the Kuari Pass, he pointed out the omission of a deep bend in the road round a lateral glen whereby his party had been misled and forced to camp far from water.

Generally speaking, Boss said the main outlines of the country, its chief ridges and streams, were fairly laid down, but all the details of the hill structure were filled in both loosely and roughly. These criticisms he should be happy to justify on the spot in the company of any officer of the Indian Survey, and he trusted he might before long have an opportunity of doing so.

Boss admitted that it would be unreasonable to expect in a vast empire like India the accuracy attainable in maps of a small European State. What he alleged was that the Indian Government or its Staff—it was not for him to decide where the responsibility lay—did not make the best use it might of the services of the many excellent, zealous, and adventurous officers in its employ. The more energetic surveyors were often kept digging frontier ditches and demarcating tea-gardens—necessary work, no doubt, but not calling for first-rate men—while less competent men were sent to work in the Hills.

Mr. Graham's suggestion that mountain surveyors, like forest officials, should be sent where they might best learn their work, would sooner or later have to be attended to. Officers in training for the Himálaya might, he ventured to think, with advantage spend part of their time at Bern, where the Federal staff had created the highest standard of accuracy in mountain delineation. 'Icemanship' might at

the same time be picked up in the neighbouring Oberland at less expense than General Walker seemed to apprehend. He had himself often accompanied on the glaciers the parties engaged on the correction of the Federal maps.

There would, Boss felt certain, be no difficulty in procuring an official invitation from the Swiss Military Department to English officers or students to attend the field instruction given in his country. Their expenses would be very small, and so many of the instructors spoke English, that a knowledge of French and German, though useful, would not be indispensable. He could guarantee any English visitors the most friendly reception from all his comrades.

In conclusion, Boss expressed his hope that his conduct in evading observation on the previous evening would not be construed as any want of respect to the Royal Geographical Society, or of gratitude for the honour they had bestowed on him. Their appreciation had, he might say, made a change in his life. Hitherto he had tried to conceal where he had been; henceforth he should feel it his duty to make fuller notes and to communicate them. He hoped, as a first instalment, he might be able to furnish some notes of his travels on the skirts of Patagonia, in the southern Andes, in districts where few Europeans, and probably no mountaineers, had been before him.

At the close of Herr Boss's address—which he has himself revised and added to for these pages—Mr. D. Freshfield made some remarks which he has developed in the following note:—

In listening to these criticisms on the work of our Indian Staff, the first thing to be borne in mind is that of all the Government Surveys of the Alps, only one has stood fairly well the test of 'mountaineering' experience. We all know what the old Piedmontese, Lombard, and Austrian maps were, and even the Swiss 1:100,000 Survey has not escaped correction!

The Indian Staff—weighted with a field of enormous extent, and of a difficulty hardly imaginable by Europeans, checked besides by a Government which, like most Governments, prefers political to scientific objects, and subordinates quality to quantity—could have only by a miracle succeeded at once, where all other surveys have failed. To have produced, with assistants untrained in hillwork, maps of parts of the fastnesses of the Himálaya on the scale of an inch to the mile at the rate of 9 to 14 square miles per diem, speaks sufficiently for the energy—I had almost said for the audacity—of Indian surveyors. That the mountain sheets of such a Survey should be loosely filled in, that they should prove to be no more than rough, and very inexact, sketches of the gorges and the glacier-basins, is only what everyone with the least knowledge of cartography would have expected. The wonder is that, with the work in hand, such mountain maps should have been attempted at all, and whatever faults may be found with the way in which they have been carried out, the spirit that led to their being undertaken deserves our fullest appreciation. No one can turn over the annual reports which bear witness to the varied works constantly in progress in our Indian Survey Department, without feeling that it is a service to be proud of. But I think that few will lay them down with the con-

viction that, alone among our public services, its arrangements are above criticism.

As to the map of Kumaon, particularly called in question, I will give from these Reports some official facts. It is one of a series of topographical maps, constructed mainly, as regards details, by 'plane table sketching.' These maps are not considered by the Department as more than approximately correct, and are adopted 'for Native States or non-regulation British districts of a wild rugged character and small value, as regards revenue, where only a military map is required.'

The Surveyor-General himself thus describes the operations in Kumaon, and the rate at which they were conducted. I have italicised a sentence which shows that the heads of the Department had misgivings of their own on this point.

'During the year an area of 2,734 square miles has been topographically surveyed on the scale of one inch to the mile, and 353 square miles were triangulated in advance for future operations. *This is a larger outturn of work for the number of persons engaged than I am altogether prepared to welcome; for many difficulties and drawbacks were met with.* On the other hand, a considerable portion of the area topographically surveyed is at an altitude ranging from 10,000 to 25,000 ft. above the sea-level, where the operations were necessarily restricted to sketching the principal features of the country, without any attempt to obtain great accuracy or much minutiæ of detail, and the survey could be carried on with considerable rapidity. Lieutenant Hill examined a considerable portion of the work which has been done, and his report of the performances of the several surveyors is generally most satisfactory. Appended to his report is an interesting table showing the average rate of work per diem, in square miles, in different portions of the district under survey. He finds that in the higher ranges, where the operations partake of the nature of a reconnaissance, from 9 to 14 square miles were surveyed.' *

To this may be added the statement of one of the leaders of the party (Mr. Ryall) contained in the same Report for 1873–4.

'Of the four assistants, none, with the exception of Mr. L——, had had any training in hill-sketching. It devolved on me, therefore, to train these three.' One of them 'at first got somewhat confused on account of the intricate disposition of the many peaks about him.'

These four assistants were charged with all the details of the topography; and the quantity of their 'outturn' at the end of their first year's hillwork was considerable!

In the face of these admissions, it seems to me idle to protest that Mr. Graham's or Boss's criticisms are based on any misconception; or that everything a Staff could, under all the circumstances, be reasonably required to do, was in this case done to make the map as correct as might be. What it comes to is this. The traveller says, 'Your topography is bad.' The Department reply, 'We know that, but how could we help it?' I should be disposed to answer, 'In the first place

* *Report of Survey of India*, 1871–2. An almost complete set of these Reports is in the R. G. S.'s library.

by training your men beforehand; by not being in such a hurry; by giving in all reports quality more prominence, and quantity less; and perhaps in other ways.' It might have been well, where so much is guesswork, or, in official phrase, 'partakes of the nature of a reconnaissance,' to be content with supplying less detail. It would certainly have been better to distinguish in the method of reproduction, as is frequently done when a frontier occurs in European maps, what was positive from what was speculative.

And there is one point in which not only mountaineers, but physical geographers, may fairly press for an immediate reform. The method adopted in India (and I may say throughout Asia, for the Russian maps are no better in this respect) in delineating glaciers may pass in maps on the scale of the Indian Atlas but is surely deplorably unscientific in an inch to the mile survey. Some years ago I spent an hour in a vain endeavour to convince one of our own map-makers that glaciers do not, as a rule, lie on the tops of ridges and terminate on the brink of precipices, which cut them off from the valleys and the river-sources! The Indian Survey has run into the opposite error. In their large-scale maps the glaciers lie in the bottoms, and their relations to the snow-fields, and their place in mountain structure are travestied in a manner which, with reference to European maps, I can only call pre-Saussurian. I do not see, in the 'Manual for Surveyors,' issued by the Staff, any standard at all for scientific glacier-drawing. Surely such a standard should be introduced.

This fact, too, we may, without undue presumption, put before the Indian Staff. Without our special craft no Government in Europe has succeeded in mapping its mountains. All have gained something by the co-operation of mountaineers and Alpine Clubs, and a great deal by the introduction among their own officers of icecraft. There are, I believe, more original maps and map-corrections in the volumes of the foreign Alpine Clubs—not one of which is in the Geographical Society's Library—than in any other similar body of literature not primarily geographical. What Mr. Adams-Reilly, and Mr. Nichols, and Mr. Tuckett, amongst ourselves, Von Sonklar and Payer in Austria, M. Schrader in France, have done in mapping, ought to be better known. The Alpine Club map is, as regards the Italian Alps, an original work of very high value. Indian surveyors will, therefore, be ill-advised if they attempt to treat all alpine criticism as either futile or hostile.

Sir Richard Temple's warm invitation to tourists in general to 'try the Himálaya,' is not a little premature. But there will be before long more mountaineers 'fooling about'—I quote the elegant expression of an Anglo-Indian press-writer—Nanda Devi and Kangchinjanga; and the various district surveys of the mountains will be tested and valued according to their respective merits by men well versed in the use of maps. That such outside interest will not be found stimulating to the service, and very welcome to all the more intelligent of its members, I, for one, decline to believe.

The time is not yet ripe, however, for any re-construction of the Himálayan maps. That must be a slow and laborious after-work. Alpine men will be wise to look in another direction for any immediate

extension of their knowledge. In India, as in Europe, we hope to see individual travellers, by preference trained officers, encouraged to use their leisure and their ability in producing volunteer studies of separate districts or groups. The formation at Calcutta or Simla of an Himálayan Club, prepared to publish 'Narratives of Science and Adventure,' concerning the mountains, would be the most serviceable means to this end. Such a step was formally suggested to the Asiatic Society of Bengal by Messrs. Drew and Johnson in 1866. The Anglo-Indian does not lack energy, money, or opportunity. For sport he can find all these requisites. Even to the remote wilds of Changchenmo in the skirts of the Karakorum—according to Mr. Hayward—'at least half-a-dozen officers on long leave' penetrate yearly; and in Cashmere there is hardly a mountain valley where the traveller does not discover the camp of a fellow-countryman intent on sport, and more than half inclined to resent any intrusion on what, by hereditary instinct and the right of prior occupancy, he is desirous to treat as his preserve.

Meantime, it is perhaps too much to ask our Staff to recognise—what all the world knows—that in every step in map-making, whether as to beauty of execution or economy of workmanship, Bern is superior alike to London and Calcutta. No doubt there is admirable teaching to be had under their own control. But can they be surprised, when they send up surveyors who have never dealt with a hill to try their 'prentice hands' on the spurs of Nanda Devi, that a Swiss should doubt their power rather than their will to teach, and should think that some of our surveyors might with advantage go to his own schools. And I must repeat that for a 'snow-party,'—it is one of the official phrases—a surveyor ought to be taught ice-craft as well as hill-sketching, and that the man who has not learnt both is placed at a great and unnecessary disadvantage. I have nothing to alter in what I wrote for the 'Hints to Travellers,' of the Royal Geographical Society, two years ago on this subject.

'The highlands of Central Asia form one of the fields likely next to attract explorers. If their exploration is to be thorough, travellers must take with them some knowledge of glacial phenomena, and at any rate the rudiments of the mountain craft which has been brought to perfection by three generations of alpine peasants. Without these qualifications they will find themselves obliged to leave large, and, to the physical geographer and geologist, singularly interesting tracts of country ill-mapped and imperfectly explored.'

Again, the services of one or two alpine peasants, Swiss or Italian, as subordinate members of one of the Mountain Surveys, would not be ruinous, and such men would be invaluable on their own ground to the more enterprising members of the Survey. With such companions, Captain Harman might have been living now, and the peaks of the unknown heart of the Himálaya would possibly have been more or less measured! That enthusiastic officer deserved a better fate. It is sad to read how, while longing to survey new regions, he was tied down to measuring out tea-gardens. For this, however, it would be wrong to blame his immediate chiefs. There is a significant passage in the Report on the Indian Survey of 1879–80, showing how '*The*

Government of Bengal urged that local surveys were of far more importance than a general survey of Sikkim'!

Let us hope that Captain Harman's successors will have ampler opportunities; that they will teach Darjiling to take an interest in something beyond its Mall! We used to laugh in old days at the Italians of Courmayeur and Santa Catarina, who turned their backs on Mont Blanc and the Orteler, and knew nothing beyond their own bowl's throw. The Italians have learnt better things; yet a large English community live close to the noblest mountains in the world, and—turn their backs on them.

I have been at some pains in an attempt to elucidate the very confused and not altogether consistent statements contained in official documents and other publications as to the *heights* reached by the late Mr. W. H. Johnson between the years 1860 and 1865 while engaged under Colonel Montgomerie on the Cashmere Survey. For such success as I have attained, I am largely indebted to the kind help given to me by General Walker, lately the Head of the Indian Survey Department.

After considerable search I unearthed in the India Office a report of Lieutenant-Colonel Robinson, Officiating Superintendent G.T.S., dated Nov. 1, 1864, to which is appended a letter from Colonel Montgomerie, containing the following paragraph:—

'Starting from Changchenmo (Johnson) advanced first in a northerly direction, then returning in a south-west direction for some distance, he approached nearly the Shayok river, but finding that there was no path of any kind along that river, he marched right over the mountains till he struck the Yarkand road. During this march he visited several places of very much greater elevation than have ever been reached by any man. One of the points is upwards of 23,000 feet above the sea.'

This height is accepted by Lieutenant-Colonel Robinson in the body of his report.

Here at first I thought I had found the origin of the story told to Mr. Graham in India. But in this I was mistaken, as General Walker has clearly shown.

As to this feat of Mr. Johnson in 1864, no detailed information can be found in print. In the usual course his report should have been in the appendix to the report for 64–65 of the Survey. But no such document is so far discoverable. The only further published reference is to be found in the R.G.S.'s journal for 1875. Colonel Montgomerie in receiving on behalf of Mr. Johnson a reward from the Society made the following statements:—

'As a mountaineer Mr. Johnson was always conspicuous. No height, no amount of snow and ice were sufficient to deter him if an ascent was necessary; and the number of trigonometrical stations which he established at over 20,000 feet was quite extraordinary.

'Those who visit Ladâk—now a possible summer trip from London—would be able to see one of the masonry platforms from Leh, the capital, which was erected by Mr. Johnson's Survey Party on a peak

of the range opposite, and west of that town, at a height of 21,500 feet above the sea.

'The occasion of Mr. Johnson's ascending to 22,300 feet was owing to his inability to get at a valley in any other way except by crossing a ridge which reached this altitude. He actually forced his way over, and was obliged to spend the night at nearly 22,000 feet above the sea, darkness having come on before he got any lower.'

Here it will be noticed Colonel Montgomerie reduces the height from the 'over 23,000 feet' of the despatch to 22,300 feet. The discrepancy, so far as I know, has never been explained, nor has any information as to the nature of the measurement of this 'ridge' been given to the public.

But Mr. Drew, now of Eton College, Mr. Johnson's companion in Ladâk, tells me that, having frequently talked over his ascents with Mr. Johnson, the latter always referred to this as his *highest*, and as exceeding 22,000 feet, but did not profess to have taken any measurement which enabled him to estimate, otherwise than by comparison, the height of the ridge crossed.

I now come to the doings of Mr. Johnson in 1865. It was in this year on his adventurous journey to Khotan that he made his 'suppressed' ascent. While waiting for permission to enter Turkestan, he climbed three peaks of the Kuen Lun with the object of obtaining a view of and fixing the positions of the towns north of that range. The peaks he climbed were, according to his statement, which has not been questioned on this point, those distinguished and measured in the previous year, as E. 57—21,757 feet; E. 58—21,971 feet; and E. 61—23,890 feet! These are the figures of the Survey of Cashmere, 1868. The heights of two of the three peaks were determined by mutually verifying observations and are considered certainly accurate, but the height of the third peak was deduced from a single observation from a far distant station; it is, therefore, of very questionable accuracy, but it has been entered on the maps and will be found—as 23,890, not 23,728 feet—even in the last edition of the map of Turkestan.

Mr. Johnson, however, had never laid claim to have ascended to a point some 1,600 feet higher than had been reached by anyone else, and, as a matter of fact, he had met with no particular difficulty in ascending this peak; his attendants had carried up a full sized plane table with its braced tripod stand, both bulky articles, to the summit of the peak; the ascent from the camping ground, the survey work on the summit, and the descent had all been accomplished in a single day, as in the ascents of the two lower peaks, without any special effort. It was in the opinion of the Department obviously more probable that the single unverified determination of height might be erroneous than that Mr. Johnson should have unconsciously ascended to a height of nearly 24,000 feet; the determination was, therefore, treated as most probably inaccurate, and was omitted in compiling the synopsis of final data for publication.

The scientific reasons given above for rejecting the third determination are no doubt amply sufficient. I do not know that the heights determined in Cashmere have been proved elsewhere inaccurate, but in

other branches of surveying grave faults have been found in Mr. Johnson's work, and even if subsequent measurements should show that the height assigned to E 61 is correct, proof would still be needed that Johnson was right in his identification of the third peak he climbed with that summit. I fully admit, therefore, that the probabilities are strongly against Mr. Johnson having attained so nearly to the same height as Mr. Graham. But, while allowing this, it seems fair to add that what I may call the 'mountaineering' argument against Johnson's ascent is not at present conclusive. We do not know the height of his camping ground before and after the ascent. We must remember that in this region the snow line is above 19,000 feet, and that Johnson had established an extraordinary number of trigonometrical stations 'above 20,000 feet,' and slept at 'nearly 22,000' feet in the previous year. Again, as to his laying no stress on his exploit, it may be noted that he was a very reserved man and laid little stress on anything he did; that mountain ascents, as such, have never been treated by his department as matters of much interest; and that shortly after this journey, the adventurous character of which, though warmly recognised by his own superiors, called forth a reproof from the Political Department, Mr. Johnson left Her Majesty's Service for that of the Maharajah of Cashmere.

It is just possible, though certainly improbable, that he may have himself failed to appreciate the height he had gained on this occasion, as the results of the earlier Survey were worked out by other hands in India, and no copy, Mr. Drew thinks, of the Cashmere Maps had been in Mr. Johnson's hands when he held his conversations with him on the subject. Mr. Drew describes these Kuen-Lun peaks as comparatively easy of access, but does not remember any summit in the position of E 61, which appeared to surpass its neighbours by as much as 2,000 feet.

It must ever be a subject of regret that Mr. Johnson's wonderful mountaineering career should never have been thought worthy of more than the barest official record, and that his own suggestion of an Himálayan Club should have fallen to the ground for want of sympathy after a secretary had been appointed and a prospectus drawn up. It is in the field of his and Colonel Godwin Austen's labours that the question of rarity of the air, in so far as it concerns mountaineers, will probably be set at rest. If the conqueror of 'K 2' fails on Gaurisankar (I refuse in company with M. Réclus to call the mountain by any other name), he will not fail from the rarity of the air.

May I, in conclusion, express a hope that any Alpine Clubmen who may propose to attempt the Himálaya will before leaving England consult either myself or the librarian of the Royal Geographical Society. In the map-room and library at 1 Savile Row they will find all that has been made public about these regions, and can have put into their hands works which will direct them in their further inquiries.