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From Srinagar to the Sources of the Chogo Lungma Glacier: Discussion

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in Munich, as well as in that of the D. O. A. V. in Munich, including the work mentioned, fails to discover any mention whatever of the Chogo Lungma glacier or even of Arandu at its termination. Further, neither the Chogo Lungma nor Arandu is indicated on the elaborate maps which accompany the large work of the brothers Schlagintweit. Had Adolf Schlagintweit visited even the termination of so important a glacier as the Chogo Lungma, he certainly would not have failed to mention it in his writings and show it on his maps.

Before the reading of the paper, the PRESIDENT said: I have now great pleasure in introducing to the meeting our friend Dr. Hunter Workman, who will give us an interesting account of the exploration of some of the Himalayan glaciers.

After the reading of the paper, the PRESIDENT said: There are many things in Dr. Workman's interesting paper which might lead to discussion, and we have present with us this evening a most distinguished member of the old Indian Survey, whom I regret to say now seldom favours us with his presence, Colonel Godwin Austen, who is, I believe, the only surviving member of what I consider to be one of the most brilliant and accurate geographical pieces of work that ever was performed, namely, the Kashmir Survey. I hope Colonel Godwin Austen will now address us on the subject of Dr. Workman's paper.

Lieut.-Colonel GODWIN AUSTEN: It is almost superfluous for me to say how very much I have enjoyed looking at the beautiful series of photographs which Dr. Hunter Workman has shown us this evening. I have no doubt you have enjoyed looking at these photographs of Alpine scenery, to me it has even been a greater pleasure, because in the years 1860 and 1861 I was surveying these magnificent mountains. No one can imagine the magnificence of that scenery. I have had the privilege of reading Dr. Workman's paper. Early in his discourse he mentions the Indus valley and the wonderful effects of water-action and erosion on the hills on either side. That is perfectly true. The portion of the Indus valley, from the junction of the Dras river down to Skardo, is a wonderful gorge. You see there the action of former glaciation and beds of gravel and sand at an enormous height above the present level of the rivers; in fact, the glacial scenery you have been looking at this evening is only the remnant of the great glaciers that once filled those valleys. One of the pictures that you saw on the screen was the rock of Skardo that stands up in the middle of the valley. My work took me to visit the trigonometrical station at the top of that rock. There is an enormous transported block which has been left lying on the summit of that hill, and you have only to look round the sides of the valley of Skardo to see the enormous accumulation of gravel and sand that once filled the valley. The fact is that the history of the Indus valley has never been written. It goes back long into Tertiary times, and it has not only been excavated, but it has been filled up high with detritus, which has all been swept clean out of it again, and you only see now the remains of forces that were once in action. Perhaps one of the most interesting points is the end of the Arandu glacier. It is evident, from the photographs shown us this evening, and from Dr. Workman's description of it, that it has very much changed in the forty years since I was there. I have brought up with me a water-colour sketch of the end of the glacier, which I made in the year 1861. It shows quite a different outline from what it is at present. Again, the north bank of the glacier all the way up shows it has receded very much from the side of the mountain from what it was in 1861. At that time it abutted against the mountain-sides the whole way down, cutting off the drainage of the side valleys and formed a series of small lakes, all of which have disappeared since that time. The Arandu glacier, which we have heard about this evening, was first visited by Mr. G. T. Vigne in the

year 1835. He was the first Englishman who ever went into Baltistan, and he was the first to give an account of the large size and form seen from Arundo, but he never went up the glacier. He was followed by one or two others—I think Dr. Thompson was one—but they never went up the glacier any distance. The main trunk is pretty well known. I followed it up for about 22 to 25 miles, not in direct line. Frederick Drew, about three years after I was there, got, perhaps, a little further than I did, because he crossed to the centre. I did not go across the glacier, but made the attempt where the principal tributaries join; however, the glacier was terribly fissured, and I made such slow progress that I saw there was no hope of doing anything. I had a great deal of survey work to finish elsewhere, and I came back. It has remained for Dr. and Mrs. Workman's party to explore the recesses of this great glacier. It was very brave for Mrs. Bullock Workman to face all the discomforts of heat and cold and snow and exposure which work of that sort entails, and I am only glad to find there are travellers who will spend their time so admirably and so beneficially for us who live at home, and for all who are interested in great physical features—who spend their time on work of that sort, and come back with such beautiful photographs as we have seen to-night. I might say a great deal more about what you have seen this evening, but there is one thing I should like to mention. I think the word “la,” at the end of the name of the Rajah of Kashmir (Pratap Singh La) is not correct, and also in the case of the Amar Singh La, because the term “la,” which is in general use throughout the whole of Tibet, from Baltistan to Lhasa and Bhutan, means a pass that is used for traffic, the highest portion of a road over a water-parting, and therefore I think it better to call depressions which are not used for traffic “cols,” which is a more correct term than the word “la.” I will not say anything further, except to again express my pleasure at seeing the photographs which we have had put before us this evening.

Colonel WAHAB: Personally I feel that we Indian surveyors, whose work takes us to the higher Himalayas, ought to be able to do more than we have hitherto done to extend our knowledge of glacial phenomena in those regions. Since the days of the Kashmir survey, however, when triangulation was being extended over the north-western Himalaya, very few officers have had the necessary opportunities—for although surveys have been pushed up to the snows on the Sikkim, Kumaon, and Punjab borders in recent years, nothing beyond reconnaissance work on small scales has been attempted in the remoter regions; the occasional political missions, also, which have crossed the high ranges, have not given time for any adequate mapping on scales large enough to illustrate the glaciation of the country.

Detailed surveys of the higher Himalaya have, in fact, never been regarded as within the scope of the Indian survey, nor, while so much work of importance elsewhere remains undone, is it to be expected that they should. For this reason, while we as Indian surveyors regret that we cannot ourselves take up work of such interest, we welcome travellers like Dr. and Mrs. Bullock Workman, who are prepared to place their experience and resources at the disposal of science, and to undertake what a utilitarian Government naturally does not feel justified in attempting. What is required to illustrate glacial phenomena is an accurate examination of a definite area, such as that of the Chogo Lungma and its tributary glaciers, so graphically described in Dr. Workman's lecture, and a careful re-examination of the area after a few years, so as to determine from actual observation the movement and variation of the glacier. Refined measurements, such as those periodically made on the Rhône glacier, would probably be impracticable at such a distance from civilization; but in a region where glacial phenomena are on so vast a scale as in the Himalaya, rougher methods would no doubt give valuable results.

It is to be hoped that the interest aroused in Himalayan exploration by the journeys of Mr. Douglas Freshfield and Dr. and Mrs. Workman will induce others to follow in their footsteps, and thus add a higher and more scientific value to their journeys and those of their predecessors.

The PRESIDENT: Mr. Freshfield is unable to attend here, but he has written a letter containing some interesting remarks which I am afraid there is hardly time to read at this late hour of the evening, but which will be printed with the paper. So it now only remains for us to pass a very cordial vote of thanks to Dr. Workman for his most interesting paper, and for the entertaining and beautiful views which he has been so kind as to put on the screen for us.

Mr. DOUGLAS W. FRESHFIELD sends the following :—

I very much regret I have been prevented to-night from listening to Dr. Hunter Workman's paper. I have studied it with great interest and sincere admiration, not only of the pluck and perseverance of Dr. Workman as a mountaineer, but also of the powers of scientific observation and graphic description shown by him as an author.

There are several points I should like to have commented on, which I will briefly mention here—

(1) With regard to water-erosion and the pot-holes found high on the mountain sides. Is it possible that these were formed when the slopes were more extensively buried in glaciers by subglacial torrents? These, as we all know, are peculiarly active in the formation of pot-holes, a pot-hole being almost the necessary complement of the *moulin* (or shaft), through which the torrent falls from the surface to the bed of the glacier.

(2) The fact that of two glaciers of which the lower ends are closely adjacent, one should be advancing and the other in retreat, is, as I pointed out at Cambridge, not so surprising as it may appear at first sight. The interval between the date when an increase of material is poured into the reservoir of a glacier and that of the corresponding advance of its snout is regulated by a variety of conditions, of which the chief are the length of the ice-stream, its bulk, and the angle of its bed. To put it in the simplest form of words, short and steep glaciers answer to an increase in their food supply more quickly than long and comparatively level glaciers.

(3) The absence or rarity of great terminal moraines may, I think, best be accounted for by the action of floods in carrying away all but the heaviest blocks.

(4) In general features, the glacier described corresponds to those under Kangchenjunga; in both cases the lowest portion is, as described by Dr. Workman, a desert of torn and splintered rocks. The first surveyors imagined the lowest 5 miles of the Zemu glacier to be moraine, and called it so on their map.

With regard to one of the chief obstacles to Himalayan exploration, the effects of high altitudes on the human frame, I welcome in Dr. Workman's narrative the confirmation by a medical expert of my own experiences. Immunity from mountain sickness, I agree, is not to be obtained by training—by living above 10,000 feet for a period. I have rather found the reverse to be the case; mountain-sickness is very much like sea-sickness: good sailors and mountaineers are more often born than made; that is, the immunity is mainly constitutional.

Again, the discomforts all, or almost all, climbers suffer from are not progressive from 12,000 feet upwards. On the contrary, in many instances they diminish above 15,000 feet.

A few years ago it was argued by very competent Alpine climbers that it was *a priori* impossible for men to climb, at any rate do more than crawl, at 22,000 to 24,000 feet. That argument can no longer be maintained.

Avalanches are a danger which it is, I hold, the duty of every climber who has been in these regions to insist on. They are on a scale wholly different from those of the Alps, and Alpine experience is at first likely to be misleading. Mr. Mummery's fate supplies the most emphatic warning on this point.

A minor but very serious trouble is the inflammation of the lips, mentioned by Dr. Workman. It becomes torture to eat, and men cannot climb without eating. Perhaps Dr. Workman may be able to suggest a palliative. I found boracic ointment useful.

The greatest difficulties in the way of climbers in the Himalaya are weather and transport.

As to weather, I can only suggest that some year luck may reward patience, and a climbing party get the ten consecutive fine midsummer days needed for an assault on a great peak. They must wait on the spot to profit by them.

As to transport, I see little hope until the Indian Government co-operates with an attempt to climb K² or Kangchenjunga, as the Home Government has co-operated with Arctic expeditions; until it puts fifty militarily trained and disciplined mountaineers at an explorer's disposal. Without this help a money grant would be little use; with it a relatively small sum, £1000 or £2000, might accomplish that desirable end—the conquest of the highest mountain in the world. We have heard lately a great deal of the moral qualities called out by polar exploration. I venture to think they are also called out to a great extent in mountaineering at high altitudes. There is surely some reason in the rhyme of the poet—it is true he was a mad poet—Blake—

“ Great things are done when men and mountains meet ;
These are not done by jostling in the street.”

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and
LAURENCE PULLAR, F.R.S.E.

PART VII.—LOCHS OF THE SHIEL DISTRICT.

IN this paper it is proposed to deal with the results of the work of the Lake Survey among the lochs lying near the borders of Argyllshire and Inverness-shire, viz. (1) Lochs Shiel and Dilate, which drain by the river Shiel into Loch Moidart; (2) Loch Eilt, which flows by the river Ailort into Loch Ailort; and (3) Lochs Màma, na Creige Duibhe, and Dubh, which drain into Loch nan Uamh. The relative positions of these lochs are shown in the index map (Fig. 1). The principal loch is Loch Shiel, lying on the boundary-line between Argyll and Inverness, while Loch Dilate lies in Argyllshire, and the other lochs mentioned are situated in Inverness-shire. Mr. Garrett drew up some notes on Lochs Eilt, Dubh, Màma, and na Creige Duibhe before leaving for Borneo, and these have been embodied in this article.

* Plates, p. 352.