A NOTE ON THE TOPOGRAPHY OF THE NUN KUN MASSIF IN LADAKH

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AFTER the early reconnaissances of the Nun Kun in the sixties, little attention was devoted to the region for many years; only the lower valleys around the base of the massif were visited by sportsmen. In 1898, however, Majors C. G. Bruce and Lucas climbed the lower slopes of the Ganri glacier, and the former crossed the Sentik La on to the Barmal glacier, and followed it down to the Bhot Khol (Major Bruce in the *Alpine Journal*, 1899). In 1902 Dr. A. Neve and the Rev. C. E. Barton ascended nearly the whole length of the Shafat glacier lying to the east of the massif, and during the same year they crossed the basin of the Barmal glacier from Tongul, *viâ* the Sentik La, descending south-westwards into the valley of the Bara Zaj Nai ('Thirty Years in Kashmir,' p. 179, by Dr. A. Neve). In 1904 Dr. Neve again crossed this glacier (*Ibid.*, p. 189).

In 1903 Dr. Sillem, a Dutch mountaineer, explored this region, and reached and photographed the high snow plateau crowning the massif. In 1906 Dr. and Mrs. Bullock Workman visited the district, claimed to have discovered Dr. Sillem's plateau, and made a complete tour of the mountain knot. Unfortunately their work was not based on the few trigonometrical points fixed in the region; their results led to much controversy, and some of them were not accepted. Since those days a certain amount of evidence has been collected on the points of difference raised by them.

The peaks referred to by various travellers are here summarized in tabular form with the accepted values of latitude, longitude, and height, deduced from the triangulation of 1859–60:

New number.	*Name or old number.*	*Latitude.*	*Longitude.*		*Height.*
		° ′ ″	° ′ ″		Feet.
Pk.1/52 C	Nun, Nana, or Ser	33 58 55·8	76 01 31·1	...	23,410
Pk.7/52 B	Kun, Kana, or Mer	34 00 47·6	76 03 22·4	...	23,250
Pk.6/52 B	Pinnacle Peak	34 01 22·0	76 04 50·1	...	22,810
Pk.12/43 O	Snowy Peak "D 41"	33 58 44	75 58 03	...	—
Pk.11/43 O	Snowy Peak "D 42"	33 59 07	75 55 41	...	—
Pk.39/43 N	Snowy Peak "No. 10"	34 00 22·2	75 50 30	...	19,830

It will be remembered that in her published account ('Peaks and Glaciers of Nun Kun,' p. 85), Mrs. Bullock Workman claimed to have ascended to 23,300 feet, to the summit of a peak which she named Pinnacle Peak, and which she persistently referred to as "the second highest peak" of the group. Her heights and this statement were at variance with previously triangulated values, and a review of her results (published in the *Pioneer* of 14 Feb. 1910), pointed out the view of the

Survey of India, namely, that Pinnacle Peak was the third highest, and Kun (or Mer) was the second highest peak of the district.

This was answered by Mrs. Bullock Workman in the *Pioneer* of 6 May 1910; she claimed that her hypsometric height obtained at the summit of Pinnacle Peak and compared with simultaneous observations at Dras, was more accurate than the Survey height.

The question of the height of Pinnacle Peak relative to others of the neighbourhood was decided by the retriangulation of the peaks in 1911, though in 1910 Dr. A. Neve again visited the region and took some observations with a clinometer lent him by the Survey for that purpose. These observations of Dr. Neve were worked out at Dehra Dun, and indicated that Kun was approximately 480 feet higher than Pinnacle Peak.

The original triangulated values made Kun approximately 440 feet higher than Pinnacle Peak, which was therefore believed to be the third highest peak in altitude.

The re-triangulation of the peaks in 1911 from different stations and from a different series than the original one gave the following completely independent values for the three peaks:

	° ′ ″	° ′ ″				Feet.
Nun	33 58 47·5	76 02 05·6	...	...	...	23,506
Kun	34 00 52·6	76 02 56·2	...	...	...	23,114
Pinnacle	34 01 22·2	76 04 49·8	...	...	...	22,741

The triangles from which these results were obtained were ill-conditioned, especially for the longitudes of the peaks, and the new observations for position were now computed in conjunction with the old. Almost perfect triangles of observation were obtained, and the resulting co-ordinates of the three peaks became:

	° ′ ″	° ′ ′				Feet.
Nun	33 58 56·3	76 01 30·6	...	...	...	23,357
Kun	34 00 47·8	76 03 22·6	...	...	...	23,220
Pinnacle	34 01 22·2	76 04 50·1	...	...	...	22,742

Here we see that Kun is 478 feet higher than Pinnacle Peak. In fact, in every case, Pinnacle Peak is several hundred feet lower than Kun. These last values agree very well with those hitherto accepted, and although they may be nearer the truth than the older ones, the objections to making changes in accepted values of heights, when fresh evidence produces unimportant variations, are so serious that the original values have been retained in all Survey of India publications. The old height of Pinnacle Peak (22,810 feet) was deduced with a coefficient of refraction 0·05, while that used with the modern observations is 0·07. By using the latter coefficient (0·07) for the early observations, the height (22,810 feet) becomes 22,738, and closely agrees with the new height, the weighted mean becoming 22,741 feet, using 0·07 for all observations. Similarly the old heights of Nun and Kun are in excess of those obtained above,

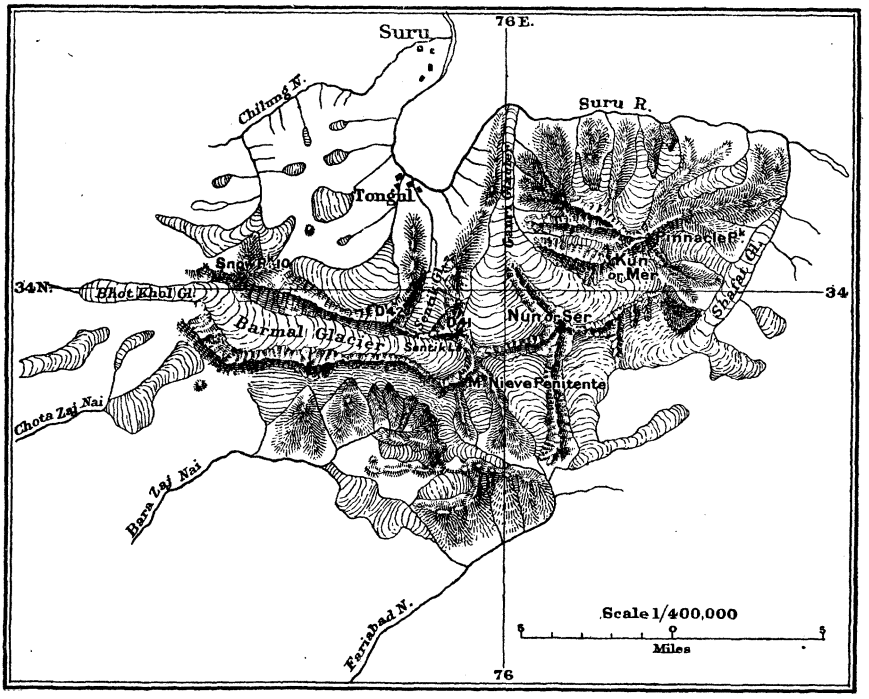
owing to the coefficient 0·05 being used instead of 0·07, and the old observations give heights closely in accordance with the later ones, if 0·07 is used. The point at issue is, however, the relative values of the three peaks, and is unaffected by any adopted coefficient of refraction.

Another point brought out in the review of Mrs. Bullock Workman's book was one originally noted by Major C. G. Bruce after his expedition in 1898, and raised by Dr. A. Neve after his journey in 1902. The old Survey map showed the Barmal glacier rising in a mountainous cirque south of Snowy Peak No. 10 (34° 00′ 22″, 75° 50′ 30″), flowing eastwards, bending north-eastwards immediately west of Peak D 42 (33° 59′ 07″, 75° 55′ 41″), and finally draining into the great bend of the Suru river near Tongul. Dr. Neve pointed out that the glacier rose in a rocky cirque south of D 41 (33° 58′ 44″, 75° 58′ 03″), flowed westwards, south of and past D 42, and, at a point almost due south of Snowy Peak No. 10, it changed direction north-westwards and joined the Bhot Khol glacier. He established the connection of Peaks No. 10, D 42, and D 41 by a rocky wall, asserted that the Barmal glacier was the Upper Bhot Khol, and, perhaps rather loosely, referred to the whole extent of ice as the "Great Western glacier of Nun Kun." No new edition of the Survey map was published, but Dr. Neve's amendment was admitted by the Survey to be probably correct, and it was supported by Major Bruce's account in the *Alpine Journal.*

The Workmans during their visit in 1906 made some notable ascents on the western outliers of the massif, but they did not follow the Barmal glacier down to its tongue, as had been done by Major Bruce. Yet in their published account they accused Dr. Neve of "erasing" the rocky wall south-west of Snowy Peak No. 10, "correctly charted by the Survey," in order to show the Bhot Khol–Barmal connection; and they maintained that Dr. Neve's "assertions were not in accordance with fact," and that the Barmal glacier drained into the Bara Zaj Nai; their map was drawn accordingly.

The Survey of India review, mentioned above, referred to the undeserved reprimand of Dr. Neve, pointing out that at any rate the travellers agreed as to the main course of the glacier, though they differed as to the actual hill-stream into which it drained. Dr. Neve, however, was determined to prove or disprove the correctness of his topography, and in 1910 again visited the district. In a letter from Dras, dated 25 September 1910, he wrote: "We ascended the Barmal glacier from the Bhot Khol and took photos and observations from a point due south of No. 10 . . . I then made a complete circuit round No. 10 *viâ* Bhot Khol, Suru, and then up the Tongul–Sentik route; camped at 17,500 feet on the Barmal glacier, and climbed D 41 in spite of the fresh snow. It was cloudless to the west, north, and north-east, and I got a circle of compass bearings. . . . At the bend of the Barmal glacier south of and west of Peak No. 10, I have three photos showing the continuation of the range on the south and

south-west side (Bara Zaj Nai)." This is the range erased by the Workmans. In his book, 'Thirty Years in Kashmir,' Dr. Neve gives a detailed account of this journey. He mentions that during his early expeditions to these parts he was not aware of Major Bruce's journey of 1898, an account of which had been published in the *Alpine Journal* of 1899. But the conclusions of their two expeditions were identical. In 'Twenty Years in the Himalaya,' Major Bruce gives his account of the Barmal glacier to the Bhot Khol, and on p. 99 he says: "In front of us lay the only question of the tramp: *a large and broken icefall* (see photo)." Opposite p. 100 is the photo referred to. This is almost identical with the



Sketch-map of the Nun Kun Massif

photo in the Workmans' book on p. 148; here, however, this icefall is singularly described as a "glacier-covered mountain wall separating it (*i.e.* the Bhot Khol) from the Barmal which lies on the south of the wall. This is the wall erased by Dr. Neve from the Survey map to indicate the junction of the Barmal and the Bhot Khol."

Major Bruce descended this icefall. Dr. Neve both ascended and descended it. The Workmans only saw it in the distance. Dr. Neve has not only proved that the Barmal is the Upper Bhot Khol glacier, but his photographs also show that there is no drainage outlet from the Barmal into the Bara Zaj Nai, which was the contention of the Workmans.

Dr. Neve also maintained that his assertion that the Barmal glacier

came "all the way from Nun Kun" was justified, since it rises in the cirque formed by D 41, the Barmal Ridge, and Mount Nieve Penitente, the western boundary and buttresses of the Nun Kun massif.

In addition to this, Dr. Neve, from the summit of D 41, found Nun almost due east of D 41, as originally shown on the Survey map (lat. of D 41, 33° 58′ 44″; lat. of Nun, 33° 58′ 56″). The Workmans had stated that D 41 was a mile too far south on the Survey map, and had therefore displaced this fixed point to another position west-north-west of Nun.

It is difficult to place much reliance on maps that have been based on the shifting of triangulated points: probably the only advance in topographical knowledge gained from this expedition of the Workmans was the indication of a route up the "North-west Nala" from the Fariabad Nala to the Barmal glacier; and even here the enclosing of a glacier in an amphitheatre of mountains with no outlet for drainage tends to shake confidence in the topographical details of the map.

To sum up: the alterations which should be made on the map of this district published by the Workmans are as follows:

(1) Pinnacle Peak should be 22,810 feet and not 23,300 feet high.

(2) D 41 and probably the whole glacial basin of the Upper Barmal should be placed a mile further south, as indicated by Dr. Neve.

(3) The connection of the Barmal glacier with the Bara Zaj Nai should be erased (proved by Dr. Neve's photographs), and an icefall connecting the Barmal and Bhot Khol glaciers in place of the mountain ridge should be shown at the bend of the Barmal glacier south and south-west of Snowy Peak No. 10 (proved by Major Bruce and Dr. Neve independently).

(4) The drainage of the glacier south-east of Mount Nieve Penitente should be connected with the "North-west Nala."

From a mountaineer's point of view, the fact emerges that the height reached by Mrs. Bullock Workman was not so great as 23,000 feet.

CLIMATIC CONDITIONS ON THE IMPERIAL AIR ROUTES

Prepared by the Meteorological Office (Air Ministry), and communicated by the Controller-General of Civil Aviation

THE diagrams here reproduced show by gradations of tint the meteorological conditions month by month along the Imperial Air Routes —the white space representing a month with less than 30 per cent. of days of rain, fog, gales, or thunderstorms, and the light and dark tints months with 30 per cent. to 60 per cent. and over 60 per cent. respectively of such days. The diagrams are only approximate, and bad-weather factors represented by equal tints at different places or for different months are not necessarily the same. Thus the same tint may represent rainfall in one case and fog in another. The diagrams, however, by showing at a glance the