178. *Geomorphology of the Japanese High Mountains.*

(*First Report.*)

Glacial Topography in the Yari-Hotaka Range.

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The Yari-Hotaka range, situated at the southern extremity of the Northern Japanese Alps, runs from north to south and presents a splendid alpine landscape to the eye with its lofty and rugged peaks. Starting from the summit of Yariga-Take (3179 m), and following the ridge southward, we leave behind one by one, Ôbami-Dake, Nakano-Take, and Minami-Dake (all of them attain a height of about 3000 m), and finally arrive at Kita-Hotaka-Dake, the northern-most peak of the Hotaka Group.

It was previously known that a group of glacial cirques were developed only upon the eastern slope of this range. Glancing at the latest topographical maps based upon photographic surveying, we are strongly convinced of their existence: namely, three typical cirques at the head of Yoko-o-Dani and three small cirques at the source of Yari-Sawa. In order to re-examine these interesting topographies, the authors visited this region at the beginning of October, 1933, and carried out field studies for five days. This season of the year was carefully chosen because the amount of snow is at its minimum and permits us to observe moraines and roches moutonnées which are almost entirely hidden by the deep snow during the summer months. In fact, we experienced the first snow of the year at the height of nearly 3000 meters.

According to our investigations, the following facts were made clear:

Glacial cirques and troughs. These glacial topographies are not only found upon the eastern slope as was reported before, but also clearly recognized upon the western slope, as indicated by the existence of a somewhat elongated cirque, or, in other words, a glacial trough on a small scale at the uppermost part of Migi-mata, a mountain valley flowing in the southwest direction from Yariga-Take. Another example of glacial erosion upon the western slope was found near

Minami-Dake and Nakano-Take in the form of two small cirques. A small but distinct cirque was also found upon the eastern slope of the ridge separating Yari-Sawa from Yoko-o-Dani.

The upper part of Yari-Sawa has been supposed to be a small glacial trough because of its truncated spurs and its abnormally small gradient. Our studies have shown, however, that this mountain valley was once a young valley produced by normal erosion which was then partially modified by glaciers; consequently not only the lower part of its spurs was truncated, but also the head of this trough was cut into a "Trogschluss." Okayama found moreover many truncated spurs in the valley of Migi-mata.

Roches moutonnées. Just below the summit of Minami-Dake, the most typical example was found upon the "Karboden" of a cirque usually called Yoko-o-no-Ôbami; and in the valley of Migi-mata, Okayama recognized roches moutonnées in two localities.

Terminal moraines. The lowest terminal moraine in Yari-Sawa is situated at the end of Baba-Daira at the height of 1980 metres. On the other hand, the largest moraine was observed at about 2 kilometres upstream from Baba-Daira which was evidently deposited by the glacier coming from the cirque of Nakano-Take. This moraine is tongue-like in its ground form; it is more than 300 m long, about 150 m wide, and 100 m thick at its lowest extremity. Higher than this moraine, three terminal moraines were observed in Yari-Sawa, two were observed in the cirque of Nakano-Take, and three were observed in Yoko-o-no-Ôbami. It is a fact worthy of mentioning that four terminal moraines are always found so far as the glaciers from Yari-Sawa, Nakano-Take, and Yoko-o-no-Ôbami are concerned. This also applies to the valley of Migi-mata. In this valley, Okayama noticed three distinct terminal moraines and a conspicuous nick (Gefällsbruch). Supposing that this nick shows just the same form as was observed at Baba-Daira, we may be allowed to conclude that even in the valley of Migi-mata four terminal moraines mark the four retreats of the past glaciers.

In all other glacial cirques mentioned above, we observed terminal moraines with more or less distinctness. It can be naturally expected and we actually observed that striated and subangular boulders were abundant in all these terminal moraines.

The above observations permit us to conclude that the glaciers from Yari-Sawa, Nakano-Take, and Yoko-o-no-Ôbami were once united into one large glacier and extended as far as Baba-Daira at the epoch

of its greatest extension. This glacier, although the largest in this region, only modified the lower part of the valley of Yari-Sawa proper. As to the valley of Migi-mata, the former development of fairly large glacier and the modification of the lower part of the valley wall by glacial erosion are also evident.

Since the time of the greatest extension, these glaciers retreated in four stages and disappeared at last. This is shown by the following table, which gives us the approximate height of the terminal moraines of each glacier.

Stages	Moraines on the eastern slope			Moraines on the western slope
	Yoko-o-no Ôbami	Nakano-Také	Yari-Sawa	Migi-mata
IV	2800	2880	2850	2900
III	2700 (?)	2600	2650	2660*
II	2600 (?)	2275*	2540*	2500*
I		1980*		2420*

Yari-Sawa Trough

* covered by vegetation.

This new discovery of a terminal moraine at a remarkably low altitude (Baba-Daira, 1980 m) does not imply a considerably low snow-line in the Ice Age. In order to determine the altitude of the past snow-line, the present available data are by no means sufficient. So far as this problem is concerned, a great deal of attention must be paid to the facts that, at least in the middle part of Japan, the so-called glacial cirques are not so deeply carved as in the cases of Europe and America, and that the Jônen range, which is situated close to the east of Yari-Hotaka range and has many prominent peaks higher than 2800 m, shows no glacial features at all.

As to the abnormally low climatic snow-line during the Ice Age recently asserted by Ogawa,¹⁾ it will be sufficient to remark that high

1) Ogawa, T.: On the Pleistocene Glaciation of Central Japan. Proc. **8** (1932), 16-19. Ogawa, T.: On a Type of Glacial Topography in the Northern Foothills of Tateshinayama, Shinano Province. Proc. **9** (1933), 211-214.

up in the mountains we have not only striated boulders but many other evidences such as true moraines, glacial cirques, roches moutonnées and partially glaciated troughs, whereas from the lowlying plains only boulders with some striation of unknown origin and doubtful glacial depositional forms were reported.

Lastly a few words about the initial form of the Yari-Hotaka range may be made. Remnants of the old erosion surface completed during the foregoing cycle were found upon the ridge between Nakano-Take, and Minami-Dake. This surface is covered by a strata of about 10 m in thickness, composed entirely of soil and rock fragments, and upon which we noticed a kind of "Streifenboden." Existence of such a surface suggests to us the initial form of one of the most alpine mountain in Japan and gives us reason to except many glacial cirques upon such steep slopes as that of the Yari-Hotaka range.