

and in the Tian Shan Mountains, where the greater number were seen, the ice rarely descends much below a height of 12,000 feet. Among the Alai Mountains the Khoja Ishken glacier comes down to an altitude of about 11,500 feet, while others stand higher; and even the largest of those on the north side of the Pamir, descending toward the great Alai basin, comes down only to an altitude of 10,500 feet.

In former times, however, these small glaciers were much expanded, so that the Altyn glacier, one of those on the north slope of the Pamir, stretched out 20 miles; those of Yak Tash on the Tian Shan plateau and of Khoja Ishken in the Alai Mountains both reached a length of 30 miles; and the Mudirum glacier on the Tian Shan plateau must have been nearly 50 miles long at the time of its greatest extent. All these Quaternary glaciers were small compared with those of similar mountains in Europe and America. The lowest of them in the steepest valleys was not able to descend to an elevation below 7,500 feet. The large ones on the Tian Shan plateau did not descend below 11,000 feet—that is, only 2,000 feet below the ice of to-day; and of those in ordinary valleys, where the ice was free to advance indefinitely down a steep, narrow trough, not one descends over 3,500 feet below the present glacier. No trace of a general ice-sheet was seen. The significance of this will be discussed later. At present it serves to show that the area of glaciation was very restricted and that its effect on the topography of the region is purely local.

The effects of glacial erosion will not be described here, since they differ in no essential respect from what has been described under similar conditions in other countries. Bold Alpine scenery is found among the arêtes and three-edged peaks of the southeastern Tian Shan, the cirques of the northern Pamir, and the main valleys with over-steepened walls and hanging side valleys in the Alai range. The green moraines not only provide the traveler with an easy road, but furnish fine pasture for the flocks of the nomadic Kirghiz, whose round felt tents one is almost sure to find in summer not far from every old moraine. The most peculiar feature of glacial erosion is the broad troughs cut in the smoothly sloping surface of the warped Tertiary peneplain where it has been uplifted in the Alai Mountains and still more in the Tian Shan plateau. The troughs resemble a series of grooves. They head in cirques in the crest of the ridge and widen and deepen as the branch grooves join the trunk trough during descent, until at the lower end they are typical glacial valleys with over-steepened sides. They may be considered as the elongated form which a cirque takes in an inclined plateau.

#### THE SUBDIVISION OF THE GLACIAL PERIOD IN ASIA.

In America and Europe geologists as a whole have come to the conclusion that the glacial period included several cold epochs separated by intervals as warm or warmer than the present. Hence, after finding that old moraines abounded in Central Turkestan, it was of the first importance to learn whether they indicated a similar subdivision of glacial time in Asia; for if there were several glacial epochs, not only might it become possible to correlate Quaternary events in Asia with those in the other northern continents, but a definite time-scale might be established which could probably be extended to the lowlands of Western Turkestan. An