

time. One can ride all day over the old ones, but no horse dares set foot on the loose blocks of the recent fourth-epoch moraines. The very fresh beaches from 60 feet down to the present lake level might be coupled with this last advance.

All the Kara Kul glaciers of to-day lie in part on moraine, over which they have advanced from some more contracted stage, and they all terminate with a vertical or overhanging ice-cliff, from which large cakes of ice break off from time to time. I am inclined to think that their overhanging termini indicate that they are at present advancing. Most of them are mere valley tapplings or tongue-shaped flows from high ice-fields, smooth-mantling the old worn-down granite mountains. Nowhere has nature been more graceful than in the making of these ice-fields, with high domes and troughs, and winding flows, all glare and clean and coalescing into the meandering striæ and cross-ribbing of more rapid motion where they are drained by valley glaciers. In this region there is no true snow-field, such as in the Alps. At no time did I find more than the 1 or 2 inches of snow of some recent fall, and under that was glare ice. Climbing on the domes is for the most part from step to step, while, with gun and camera, one balances and chops. When considering the power of solar rays felt directly through an arid atmosphere of 16,000 to 20,000 feet elevation, we understand why snow changes so rapidly that in a few days after storms all is transformed to a crust of ice that coalesces with the underlying dome. Another remarkable feature of these mantles is the utter lack of surface débris over their clean, white expanse. This must be attributed to the gentle slopes of their underlying topography, none of which can rise above to shed débris. We shall have more to say about that topography. Their expansions during the older epochs were, as stated, somewhat similar to that of a continental ice-sheet and resulted in widespread accumulations of moraine now characterizing the slopes of all high mountains around the basin.

Obviously no reconstruction of past events in the Northern Pamir can be undertaken without data from without its zone of held-up detritus; for, to decipher its orogeny, we must study its surroundings of erosive activity, where terraces of rejuvenated valleys fall under distinct erosion cycles belonging to periodic uplifts, and, where these valleys debouch, look for marginal deformations of the flanking piedmont zones. Everywhere beyond the borders of the Pamir's relatively dead topography deep gorges and canyons, torrential valley systems, and sharp land forms are met with. Already the Markan Su has cut through the last tributary moraines that blocked its course, and below them changes into a corrading stream. The Pamir's old preglacial topography is only 500 feet above the stream at the junction of its headwaters of Kizil Kul, but diverges rapidly with the stream to several thousand feet above only 60 miles eastward, where only the flat backs of mountains and massive spurs of soft red strata flanking the Trans-Alai remain of the ancient continuities of gentle slopes and inflected surface.

This is in general the state of valley systems developed into border ranges of the Pamirs. My studies of several of these valleys (Kizil Su west, Kizil-Art Darya, Markan Su, Kizil Su east, Taldic Darya, and Zerafshan) follow under the headings Alai Valley, Karategin and Hissar, Zerafshan, Tarim Basin, and Fergana Basin.