

My report of 1903 has set forth many reasons for correlating the expansions of Lake Kara Kul with its glacial epochs. Avoiding a repetition of detailed explanations, the trend of events may be summarized as follows: During Pliocene time the Pamir was a region of high mountains which by early Quaternary time had been eroded to the core with a topography of worn-down, rather gentle slopes and wide valleys. Then took place that vast uplift which throughout most of Central Asia's mountains seems to have been the first event of Quaternary time, as its completion marks the advent of the glacial period. Streams cut down, deep-gashing the old topography; the Markan Su evidently developed its gorge back where Kara Kul is now. They had apparently graded and begun to widen their valleys, when everything on the high Pamir was interrupted by the glacial period. Elsewhere dissection has nearly obliterated the old topography, but on the northern Pamir it never got beyond the early stage of a system of gorges perhaps from 1,000 to 3,000 feet deep, with wide intervening areas left intact.

It is quite possible that, as Professor Davis suggests, the first epoch expansions of which we find such immense moraines were ushered in by a series of one, two, three, or more epochs of increasing magnitude, though all smaller than that great one by which they might have been obliterated. However complex may have been the transition to this maximum expansion, it seems unlikely that we shall ever know of them in this region, for even its moraines have lost all trace of their topography and are recognized only by their structure of mixed-up till with huge sub-angular boulders and occasional striated fragments.

During this great ice-epoch, which for our purposes may be named the first, the mountains around Kara Kul and the Trans-Alai, and I suppose all high areas of Pamir, were wholly mantled with ice comparable to small continental ice-caps of whose marginal moraines there still remain masses over 1,000 feet thick. When at length these widespread glaciers withered, deep gorges were left choked with "till" and the Northern Pamir thus isolated into basins and blocked around into a zone of held-up detritus. And though we may suppose that in succeeding glacial epochs some detritus may have escaped even from Kara Kul, the aridity of interglacial times, if at all comparable to the present, could not allow of transportation from there by water.

The Northern Pamir is thus characterized by a persistence of old topography. In its colossal isolation from moisture-bearing storms and with its glacier-made obstructions to stream erosion, it has stood in shape scarce altered through a period of geologic time; it has defied change while lands all around have suffered fast development of gorges, fast erosion of the old (first-cycle) topography which now remains elsewhere only on mountain tops and high spurs flanking them. Only the wind can succeed in getting much of anything out of the region. Otherwise, no debris can have been transported far since the first glacial epoch, excepting that shifted a few miles by glaciers and increasing the obstruction to subsequent erosion. Even part of the Alai valley and the first 20 miles of the Markan Su are no deeper than during the first ice-epoch. Thus one of the world's highest mountain regions was given long ago a shape so nearly dead to change that it