

ponds, crossed by a cascading stream at about 10,500 feet, in a valley that had received the confluent glaciers from two troughs. The glacier from the larger trough must have been 2 miles long. In the next trough to the west, the glacier seems to have been smaller. No strong moraine was seen there. Further down the valleys there were smooth hills which we did not at the time take for moraines, but in the light of what was seen later, I am now disposed to regard them as weathered and rounded moraines of early origin. It was on the sides of these smooth hills that we saw the old irrigating canals, to be described in a later section. The glacial troughs, higher up the mountain, were of wide open, steep-sided, U-shaped form, eroded in the slanting granite highland already described.

When descending from the Kum-ashu pass in the Kok-tal range, we saw to the north a large moraine beneath a glaciated valley of the Chalai range (Jungaltau on Stieler's map, sheet 62), beyond the Tuluk-su (fig. 49). The glacier that made this moraine must have been 3 or 4 miles long, heading in three cirques beneath the sharp peaks and arêtes. On going up to the moraine the next morning, we saw a second and larger one, which Mr. Huntington examined, about 2 miles



Fig. 50.—Moraine in the Tuluk Valley, looking west.

to the west. In both cases the large moraines were of well-rounded forms, with few surface boulders and without distinct mounds or kettles, and the stream that issued from them had a well-opened valley with something of a graded and flood-planned floor. Moreover, the main valley seemed to have been significantly deepened by the Tuluk-su since the moraine was laid in it; and certainly some of the spurs on the south side of the main valley had lost their ends by the undercutting of the Tuluk, which the moraines had pushed against them, as shown in fig. 50; but the facets thus eroded on the spurs had roughly graded slopes, thus indicating that a considerable time had passed since the undercutting began. The other valley-side spurs showed no such facets, but tapered down to the valley floor. Within each of these large weathered moraines we found smaller moraines of much sharper and fresher form (fig. 51); their irregular mounds and ridges strewn with boulders, their kettles holding small ponds, and their streams cascading in narrow courses. The youngest moraine ended about in line with the north rock wall of the main valley. This seemed to be a moraine of recession from a larger group of more advanced morainic loops. The time interval of the retreat here indicated must have been short compared to the time that has elapsed since the larger moraine was formed.