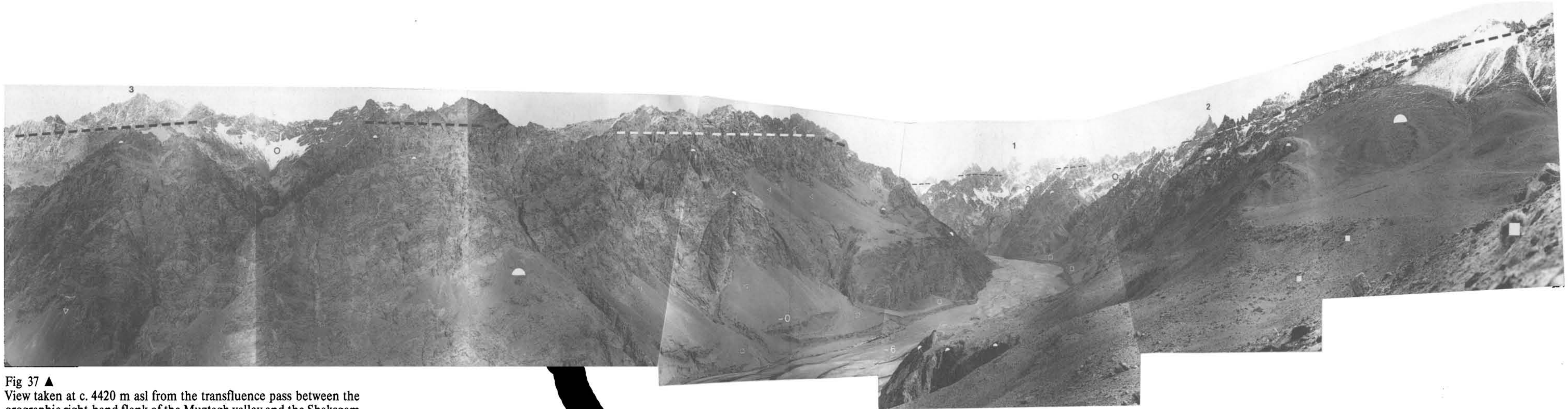


Fig 37 ▲
View taken at c. 4420 m asl from the transfluence pass between the orographic right-hand flank of the Muztagh valley and the Shaksgam valley (Fig 138, No. 12), showing a panorama ranging from N (No. 3 = dolomite satellite peak of the 5792 m mountain in the Aghil mountains) via E (No. 1 = 6190 m peak in the northern Muztagh Karakorum) via ESE (No. 2 = another more than 6000 m-high satellite peak NW of the 6210 m peak, no[redacted]K 2-Skyang Kangri Group) to SE (right-hand edge of the photo) up to the SE flank of the transfluence pass. The Shaksgam valley is the major longitu[redacted]ey between the two systems of the Karakorum and Aghil, draining the glaciers of the Karakorum N-slope. At most 1 km wide, its drift floor bottom (an in[redacted]cave drift floor, -6) runs at 3900–3960 m asl. The Shaksgam valley is a classic glacial trough with a wide base filled with loose rock and steeply ris[redacted]soidally abraded and polished flanks (▲◥). As a result of their steepness these flanks are subject to frequent crumbling, which produces scree and rough[redacted]ck up to the ice scour limits (----). On the calcite flanks of the transfluence pass glacial abrasion and polishing has been preserved up to more than[redacted]m[redacted]right). In the Late Ice Age, when the level of the Shaksgam ice stream network had melted down below the ELA - which was then at about 4400 m a[redacted]e la[redacted]aine ledges with erratic blocks of dolomite and gneiss were deposited (■) on this transfluence pass. Viewpoint: 36°07'N/76°26'E. Photo: M[redacted]e 19.[redacted]

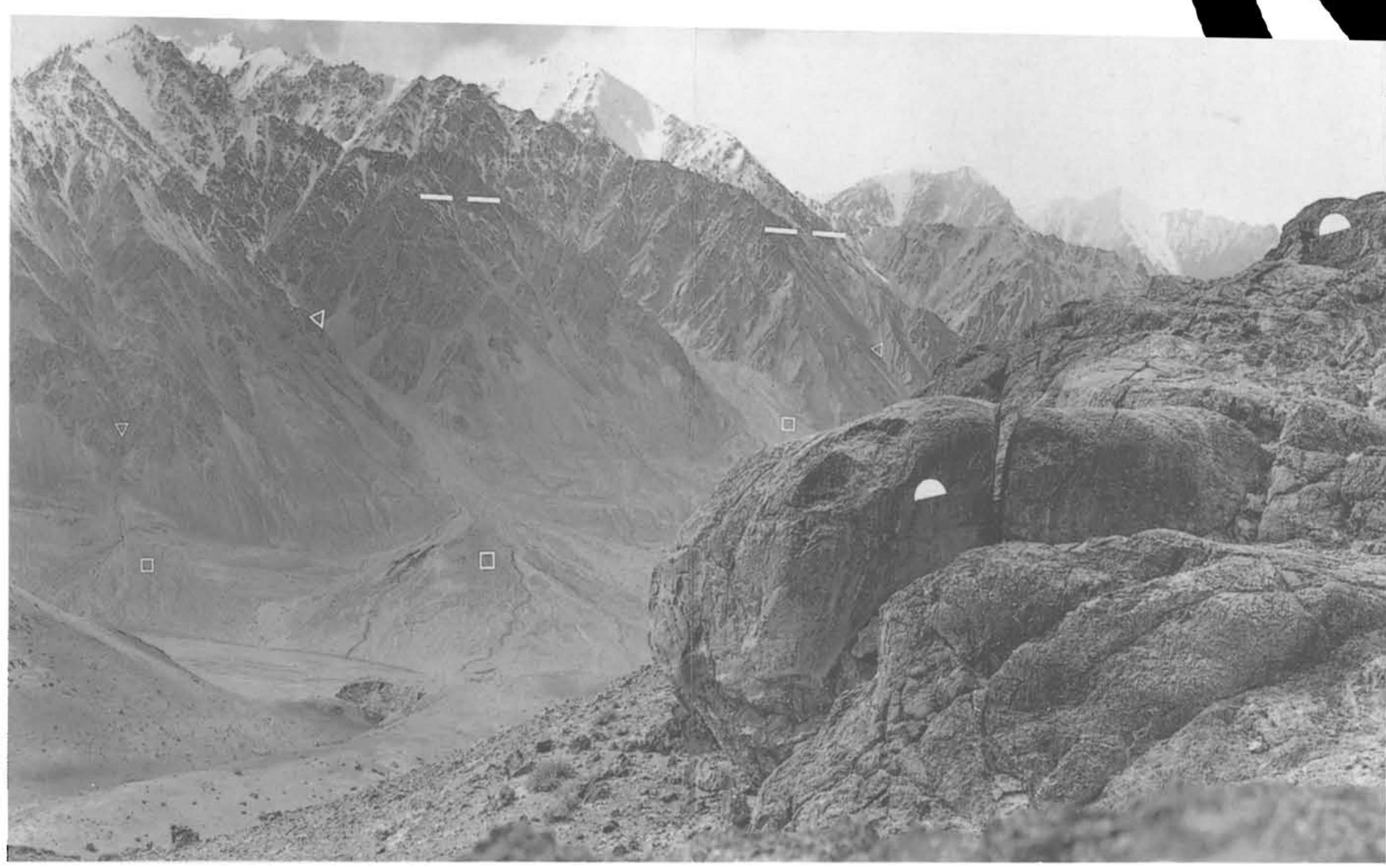


Fig 38 ▲
Glaciated knobs (▲) on the transfluence pass between the Muztagh valley and the Shaksgam valley, which have been formed in solid calcite rock at 4520 m asl (Fig 138, No. 12). The fine relief roundings on these basic polish forms (quite apart from traces of frost weathering and corrosion on the rock surface) are evidence that the polishing process of the ice took place when the pressure melting point had been reached. This points to a very substantial hanging glacier thickness of the transfluence. Following deglaciation talus fans and cones (□) have been deposited on the 3900 m-high floor of the Muztagh valley. Viewpoint: 36°05'N/76°29'E, facing W. Photo: M. Kuhle 19.10.86.

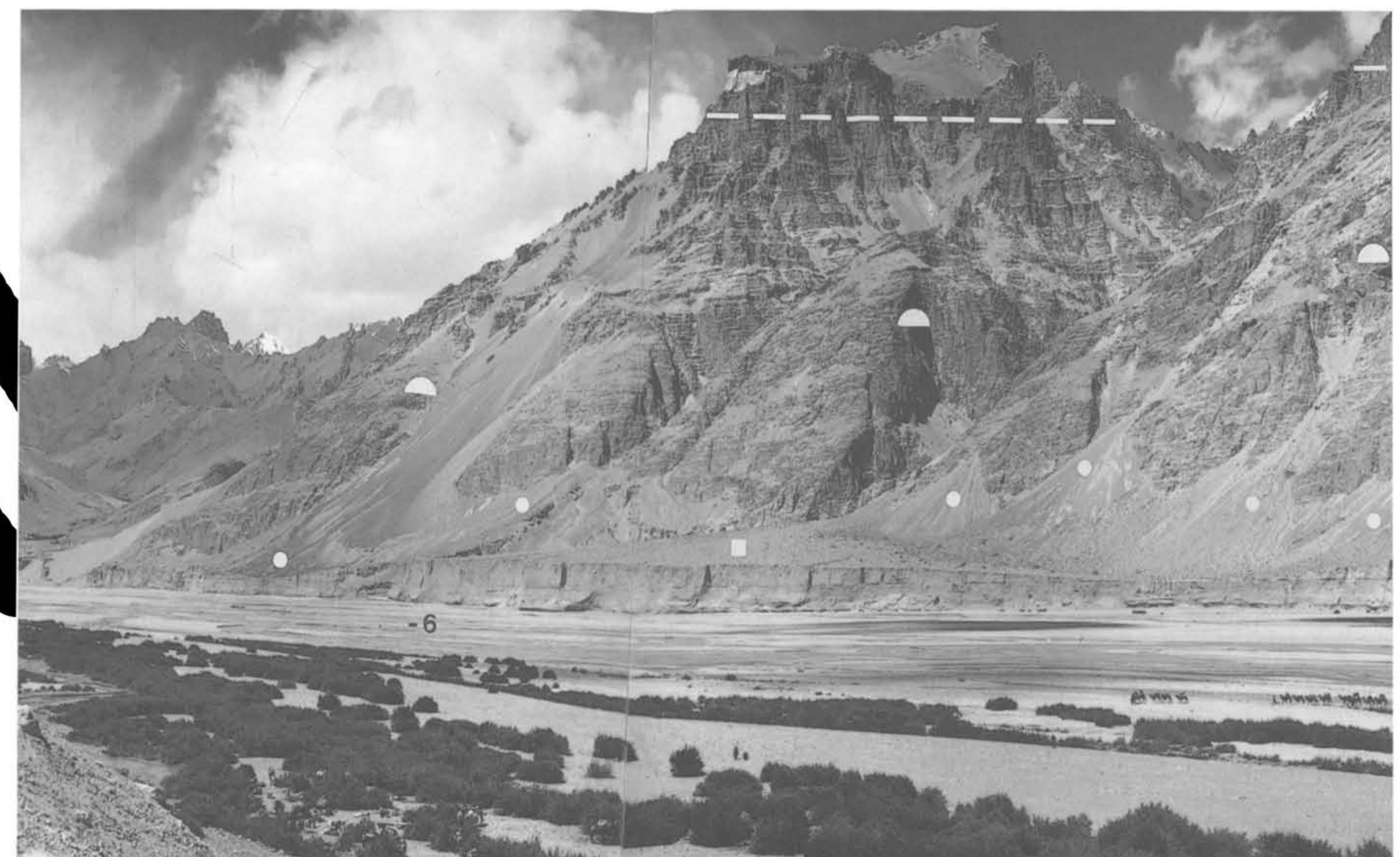


Fig 39 ▲
Taken at 4120 m asl; view from the oro[redacted]ft-hand flank of the Shaksgam valley towards the NW to the opposite valley flank; being part of the Aghil mountains it is constructed fr[redacted]ontal dolomite strata (Fig 138, No. 23). It is a trough flank which is characterized by glacial band abrasion and polishing (▲); the ice[redacted]mits (----) extend to c. 1200 m beyond the edge of the trough. Talus cones and fans (● ■) were built up within a few thousand y[redacted]fter glaciation, and simultaneously undercut by the bed of washed drift (-6). Viewpoint: 36°08'50"N/76°36'E. Photo: M. Kuhle 30. 8. 86.

Fig 40 ▲
Glacier striae (↓↑)at 3700 m asl on the orographic right-hand flank of the Aghil or western Surukwat valley (Fig 138, No. 46) are evidence of the prehistoric existence of a Surukwat glacier, a tributary glacier of the Yarkand ice stream network. The striae occur in quarzites with ferro-manganese incrustations, and render high polish pressure significant (ski sticks on the right). Viewpoint: 36°20'N/76°36'E. Photo: M. Kuhle 28.8.86.

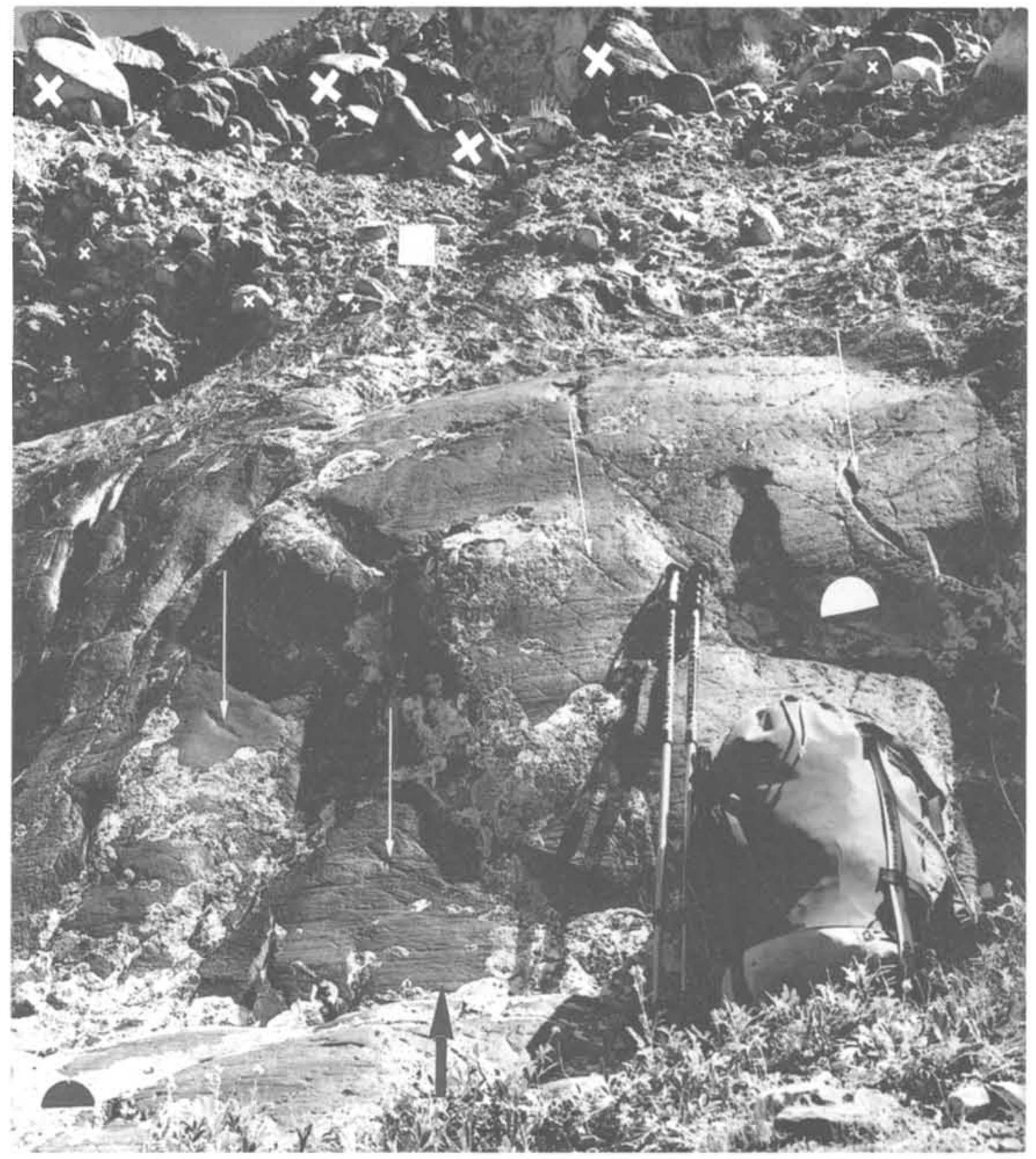
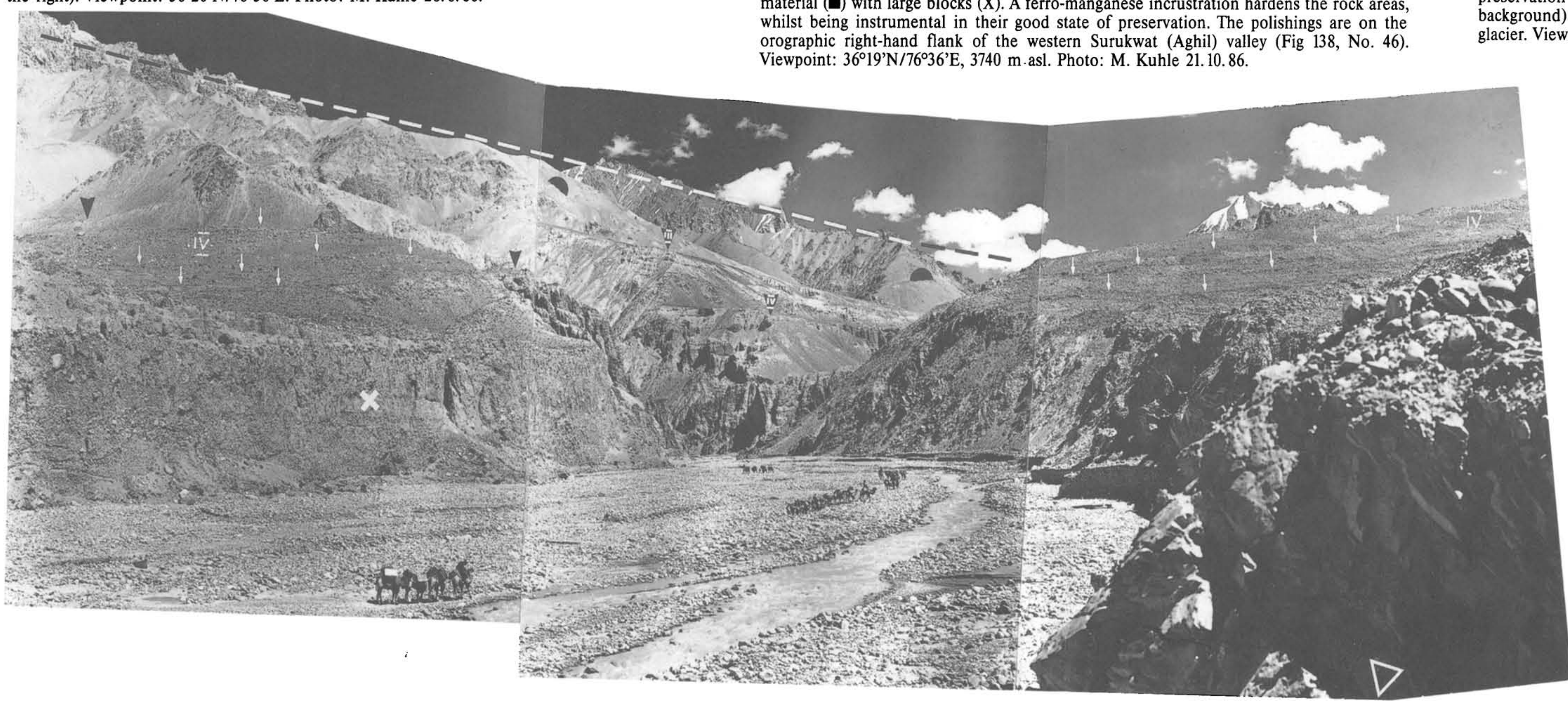


Fig 41 ▲
Rock polish (▲) with glacier striae (↑); splintering and break-outs from glacial flank polishings in quarzite rock. The polish was – and in places still is – covered by ground moraine material (■) with large blocks (X). A ferro-manganese incrustration hardens the rock areas, whilst being instrumental in their good state of preservation. The polishings are on the orographic right-hand flank of the western Surukwat (Aghil) valley (Fig 138, No. 46). Viewpoint: 36°19'N/76°36'E, 3740 m asl. Photo: M. Kuhle 21.10.86.

Fig 42 ▲
Glaciated knobs (↙) with preserved polish (◆▲) in the area of the confluence of the Surukwat valley and the Yarkand valley at 3580 m asl, c. 100 m above the present drift floor (Fig 138, No. 33). They occur on outcropping edges of the strata of easily splintering, and therefore rapidly weathering, vertical pelitic metamorphites (phyllites). Their good state of preservation suggests a final Main Ice Age genesis. The ice scour limit (- - - - in the background) at about 4400 m asl marks the surface position of a more than 1000 m-thick glacier. Viewpoint: 36°23'N/76°41'E, facing W. Photo: M. Kuhle 27.8.86.



◄ Fig 43
View from a rock foundation above the drift floor of the Muztagh valley at c. 3940 m asl, facing E into the mouth of the K 2 valley. There are the Late Glacial lateral moraines of the K 2 tributary glacier (III and IV in the centre of the photo) and the Muztagh main glacier (IV, far right and far left), the confluence area of which had been here. (↓↓↓) mark the exaration drills or furrows in the ground moraine (basal till), which has an additional exposure further down (X). The ice scour limit (- - - -) indicates the highest reconstructed glacier level. Viewpoint: 36°04'N/76°25'20"E (Fig 138 left of No. 2). Photo: M. Kuhle 2.9.86.

Fig 44 ▲
View of the Sarpo-Laggo glacier from an altitude of 4380 m asl, facing SSW up to the 6544 m peak (No. 1) and on to facette-like, down-worn glacigenic truncated spurs and cuspate areas (◗◖) (Fig 138, No. 7). The Ice Age filling of the transgression glacier covered the relief up to and beyond such ridge peaks (- - - -). The Sarpo-Laggo glacier is in the process of retreating. Its dendritically-branching tributaries (→), each with two side moraines coalescing with others to form numerous median moraines in the glacier tongue, have brought down so much scree that end moraines (■) have been deposited The form of their embayment, however, is largely due to their core of dead ice. They were formed when the ice retreated - ie not accumulated, but classic dumped end moraines. Viewpoint: 36°00'N/76°22'E (Fig 138, No. 4). Photo: M. Kuhle 17.10.86.

Fig 45 ▲
View at 4040 m asl, from the floor of the Sarpo Laggo valley (upper Muztagh valley, Fig 138, No. 4) on to the right valley flank and its glaciated hanging valley in an ESE direction. Its mass balance being in equilibrium (neither advancing nor retreating), the glacier flows off from the S-flank of the 6040 m-high peak. A confluence step has formed, which leads down towards the main valley; the gleaming bright rock polishings (left and right above ∇) show that it had been included in the prehistoric glacial flank polishing. The moraine material which the hanging glacier had brought down was transported across the confluence step by torrents, and deposited once again as mudflow (∇). Viewpoint: 36°00'35"N/76°22'20"E. Photo: M. Kuhle 17.10.86.

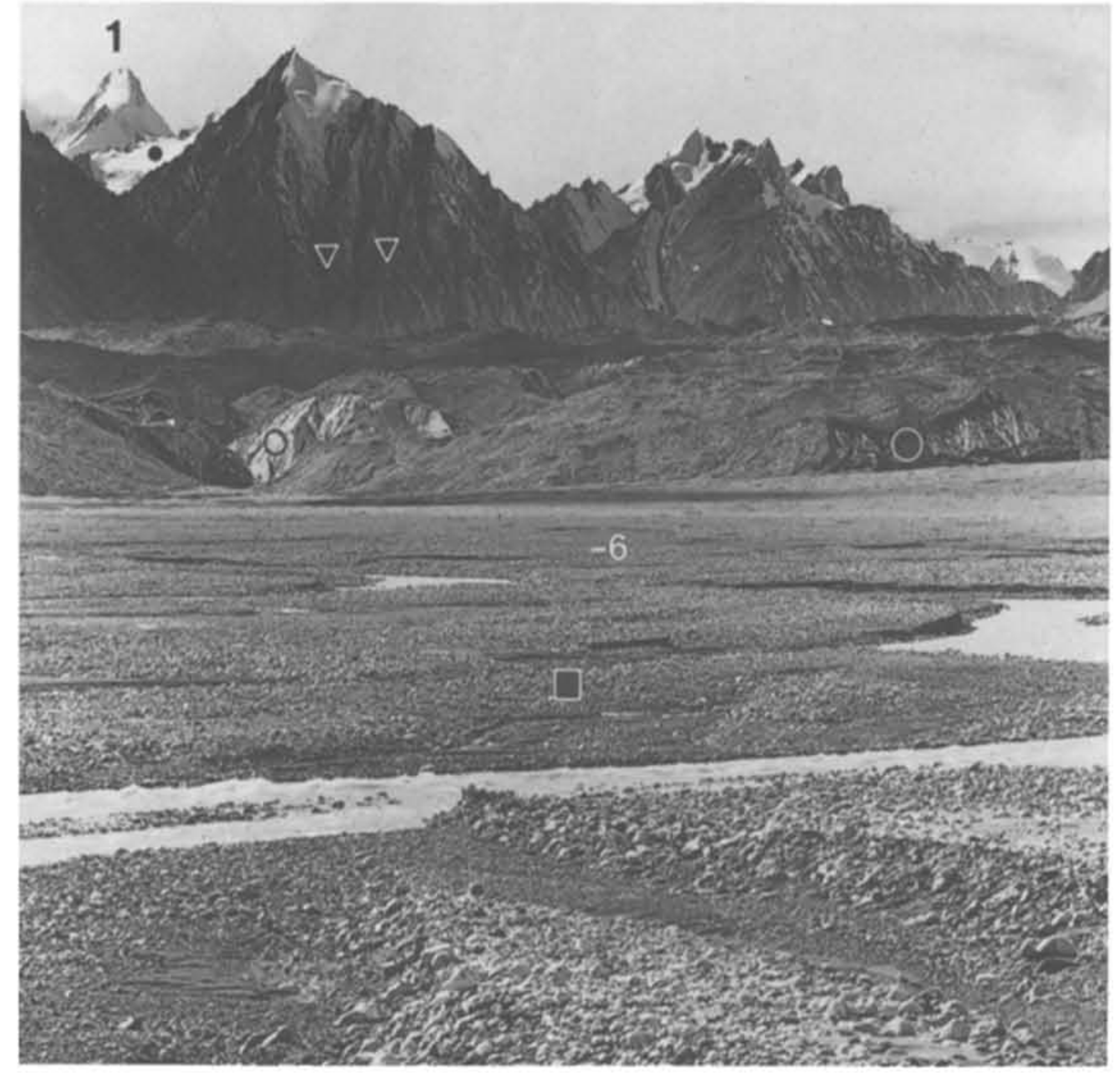


Fig 48 ▲
View from the 3 m-high remnant of an ice cave drift floor at 4000 m asl to the front of the Skamri glacier tongue (○○) with the ice cave (○ on the left). In the foreground the anastomosing meltwater channels are building up the present ice cave drift floor (□ -6). The glacier tongue has not piled up a frontal moraine. On the contrary, it advanced across the almost horizontal drift area without much friction. The glacier tongue is now retreating (cf. Fig 47). No. 1 = 5953 m peak near the 5475 m-high pass, which leads to the Nobande Sobande glacier in the W; ● also marks the feeding area of the Skamri glacier. At this season the meltwater output is already reduced to 1/3 to 1/4 of the summer run-off, and is concentrated in the main branches. Location: 36°03'N/76°22'E (Fig 138, left of No. 9). Photo: M. Kuhle 14.10.86.

Fig 46 ▼
Taken from the orographic right-hand flanks of the Sarpo Laggo valley at c. 4380 m asl (Fig 138 right, below No. 9), Fig 46 shows a panoramic view ranging from SSW, up the Sarpo Laggo glacier via No. 2 (6493 m or 6505 m peak, Chiring Group) to the SW, via roughly W to the 7265 m-high Crown (No. 1, highest peak of the mountain group N of the Skamri glacier) to NW via the Sarpo Laggo and Skamri valley confluence, which join here to form the Muztagh valley (-6). Flank abrasion and polishings, truncated spurs and cuspate areas (◖◗) are evidence of the almost all-embracing glacigenic wealth of Main and Late Ice Glacial forms in this valley [(- - - -) level of the ice stream network]. Talus cones (∇) show Holocene to present-day periglacial frost weathering and fluvially induced transformation. The lateral moraine ledges of Stages IV to V provide information for the understanding of non-synchronic oscillations of the Sarpo Laggo and the Skamri glacier tongue: walls ⬡ and walls V belong to the Skamri glacier, the tongue end of which made a hammerhead-like advance into the Sarpo Laggo valley. This also serves as evidence for the simultaneous retreat of the Sarpo Laggo glacier, since it had vacated the Sarpo Laggo valley in question. Viewpoint: 36°01'N/76°28'E. Photo: M. Kuhle 15.10.86.

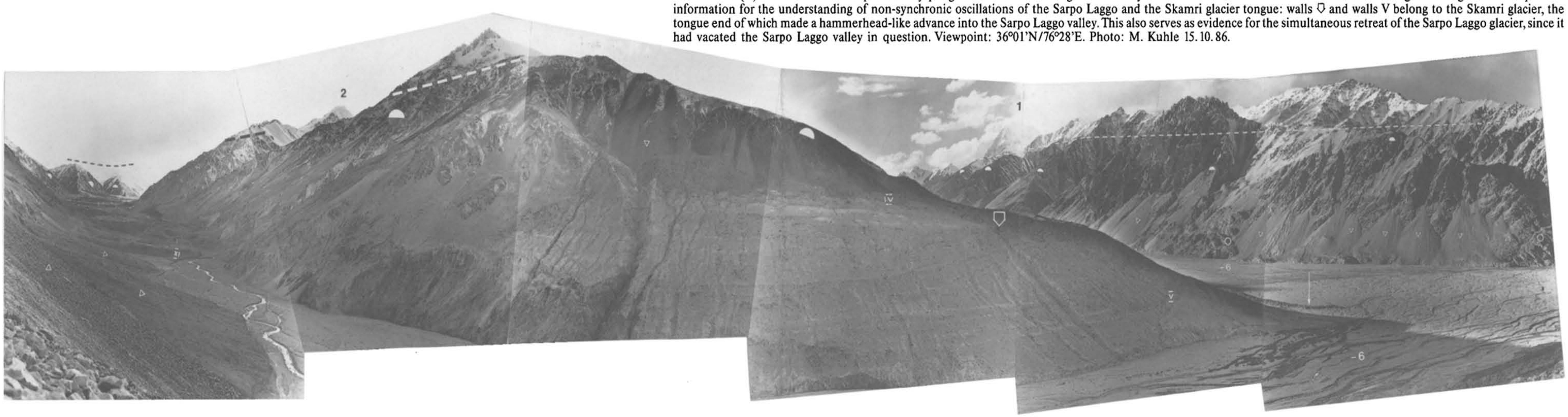



Fig 47 ▲
View from the body of the Late Glacial lateral moraine on the orographic-right valley flank (120 m below level IV) (location see Fig 36, right side of IV; Fig 138, No. 5) facing WNW across the Skamri glacier; No. 1 = Crown 7265 m; No. 4 = slightly more than 6000 m-high northern satellite peak of the 6900 m-high mountain of the Chiring Group. The tongue of the Skamri glacier is retreating - evidence for this may be seen in the body of ice which is melting down under a thick surface moraine, and disintegrating into a Toma landscape, as well as in the ice cave's (⇩) retreat into the glacier tongue. A comparison with the white ice tongue end of the Skamri glacier in summer 1976 (Fig 49 ●) is proof of the correctness of this analysis. The comparison also shows that the three most forceful thrusts of the tributary streams which presented themselves in white ice 10 years ago (■□●) are now completely covered by surface moraine, though their outline has been more or less preserved. The orographic left-hand (opposite) valley flank shows the characteristic three phases of glacial slope formation from the Main Glacial period to the Inter-Glacial period. Phase 1: Main Ice Age flank polish up to the ice scour limit (- - - -), so that cuspate slopes formed between the hanging side valleys (◓); Phase 2: the lowering of the ice stream level was followed by the formation of talus cones (▽); Phase 3: historic valley glaciers, including the present Skamri glacier, undercut these talus cones at the foot of the valley slope through glacial lateral erosion (↑↑). Location: 36°02'10"N/76°20'40"E, 4330 m asl. Photo: M. Kuhle 14. 10. 86.

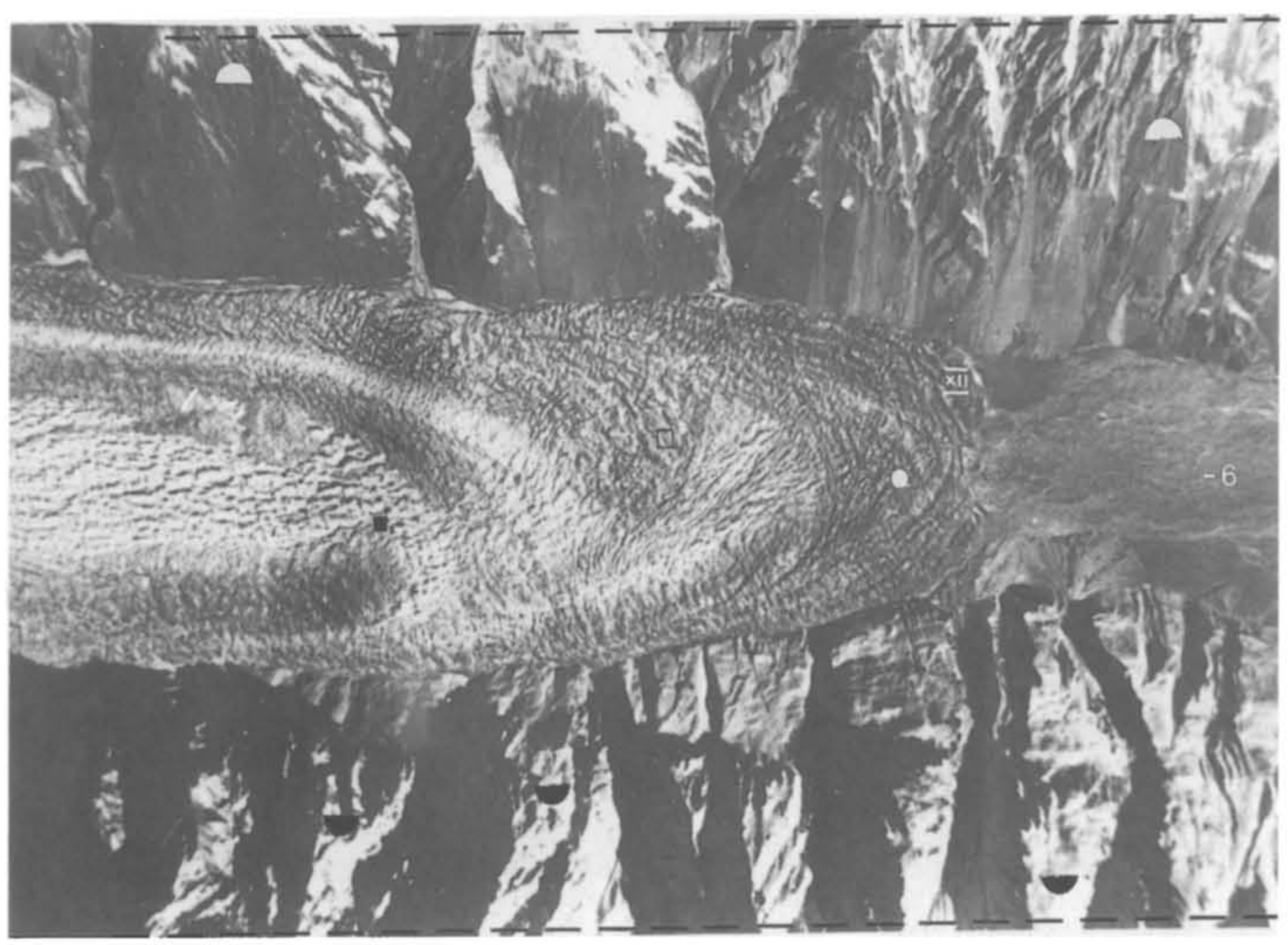


Fig 49 ►
Vertical exposure of the Skamri glacier tongue, at that time still largely consisting of white ice, and advancing (cf. Figs 47 and 48). The surface of the tongue, as part of the area of the most intensive ablation, was structured by firn ice pyramids. Formed by variously condensed moraine cover and the remaining white ice in between, "streaks" are evidence that the ice bodies of the tributary glacier streams (■□●) remain separate from one another till the glacier ends. Depending on their size, they merely reach more or less far down to the tip of the glacier tongue. The largest tributary stream with the most substantial feeding area forms the glacier end (●). (◓◒) mark the prehistoric flank abrasions and polishings and cuspate glacial slopes (cf. Fig 47 also); - - - - marks the highest established ice scour limits. Position at the time of the exposure: 36°02'40"N/76°18'E. Chinese air photo 1976.

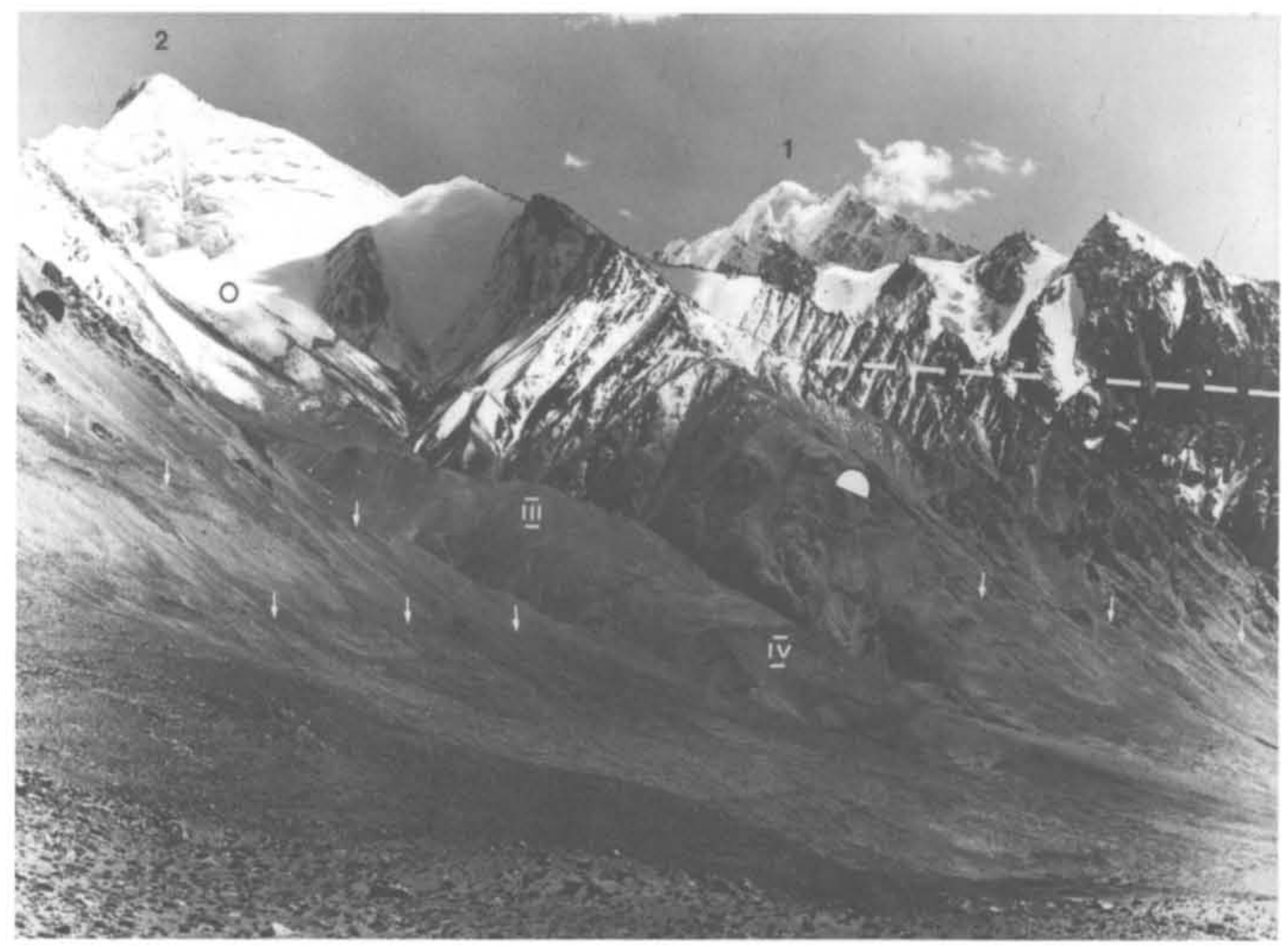


Fig 50 ▲
View from the orographic right-hand flank of the Muztagh valley at 3970 m asl (Fig 138 No. 10) facing S towards the Chongtar Group and into the right flank of the Muztagh valley. No. 1 = 6540 m peak: a mountain in the extended N-ridge of the 7315 (or 7370) m-high Chongtar main peak; No. 2 = 6040 (or 6050) m-high peak. The glacier development in the Muztagh valley since the Main Ice Age can be reconstructed on the valley flank: (- - - -) marks the Main Ice Age glacier level, (◥) the glacial polishings of the flank abrasion and III together with IV the Late Glacial lateral moraines, which built up when the glacier surface receded below the snow line and the valley glacier cross-profile was reduced. (↓↓) mark ground moraine (basal till) ledges and adjacent exaration furrows. Location: 36°03'15"N/76°25'35"E. Photo: M. Kuhle 2. 9. 86.

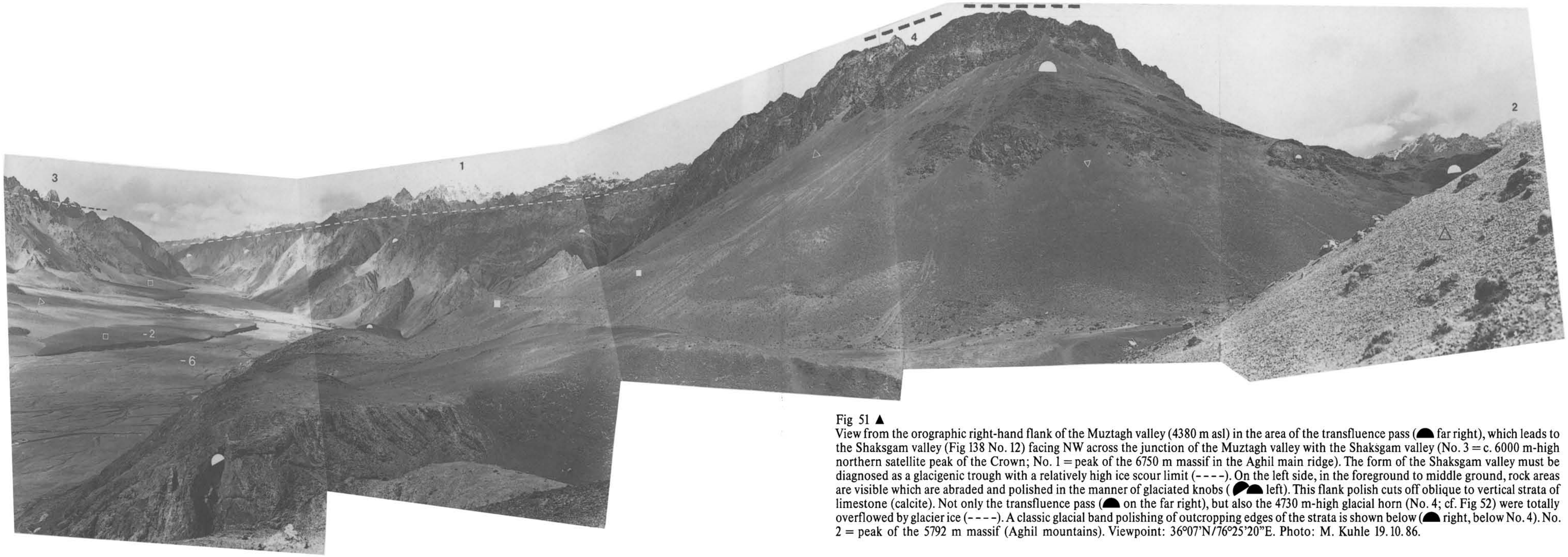
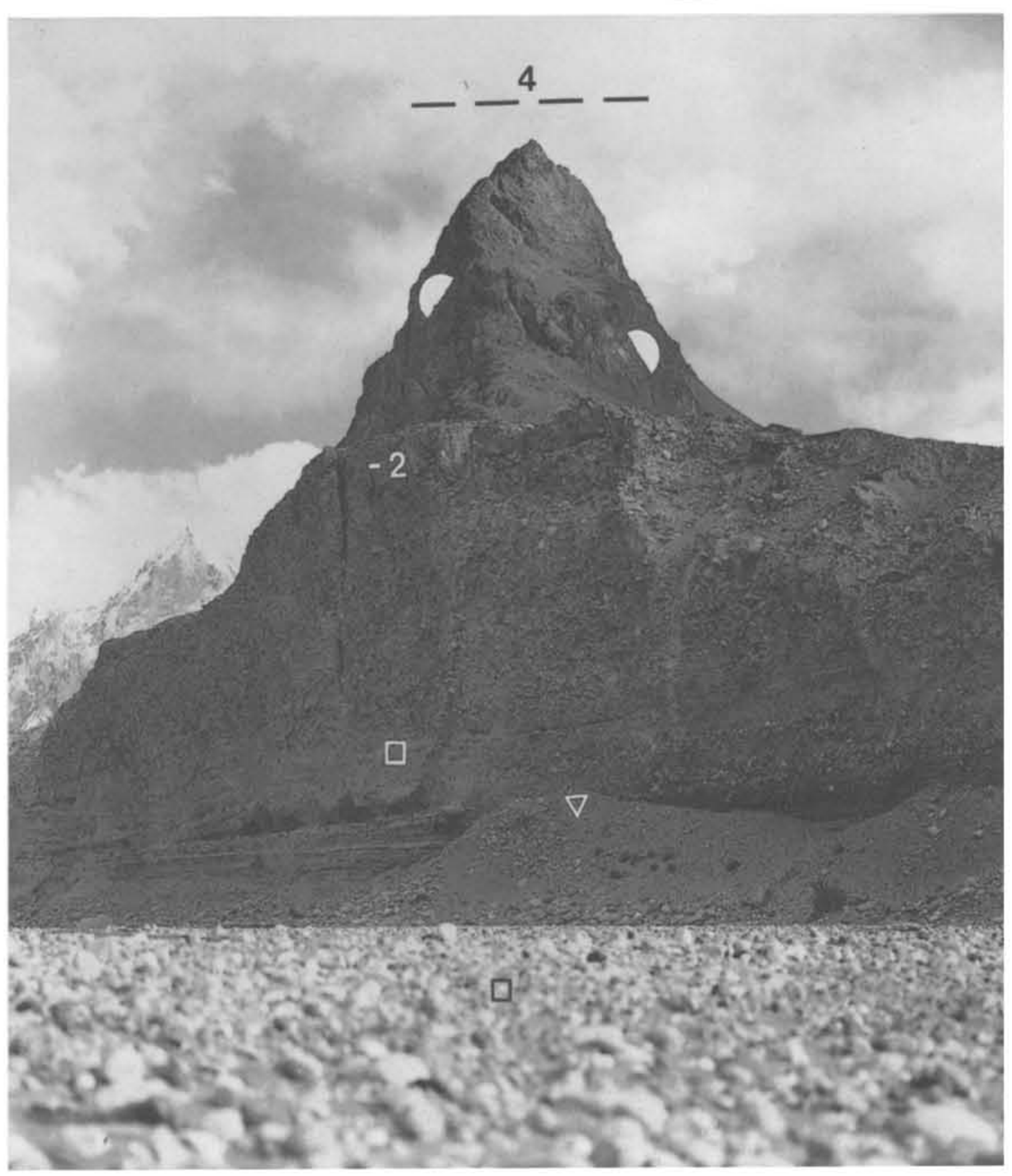


Fig 51 ▲
View from the orographic right-hand flank of the Muztagh valley (4380 m asl) in the area of the transfluence pass (⯊ far right), which leads to the Shaksgam valley (Fig 138 No. 12) facing NW across the junction of the Muztagh valley with the Shaksgam valley (No. 3 = c. 6000 m-high northern satellite peak of the Crown; No. 1 = peak of the 6750 m massif in the Aghil main ridge). The form of the Shaksgam valley must be diagnosed as a glacigenic trough with a relatively high ice scour limit (- - - -). On the left side, in the foreground to middle ground, rock areas are visible which are abraded and polished in the manner of glaciated knobs (⯊ left). This flank polish cuts off oblique to vertical strata of limestone (calcite). Not only the transfluence pass (⯊ on the far right), but also the 4730 m-high glacial horn (No. 4; cf. Fig 52) were totally overflowed by glacier ice (- - - -). A classic glacial band polishing of outcropping edges of the strata is shown below (⯊ right, below No. 4). No. 2 = peak of the 5792 m massif (Aghil mountains). Viewpoint: 36°07'N/76°25'20"E. Photo: M. Kuhle 19. 10. 86.



◀ Fig 52
View of the 4730 m-high glacial horn (No. 4) made of limestone in the exit of the Muztagh valley from the drift floor of the Shaksgam valley (□ bottom) at 3900 m asl. In front the historic drift floor terrace No. -2 (Middle Dhaulagiri Stage 'VII). Viewpoint: 36°08'15"N/ 76°25'E (Fig 138 No. 13). Photo: M. Kuhle 31. 8. 86.

Fig 52 a ▲
Glaciated knob (⯊) in the middle of the Shaksgam valley. Situated in the confluence area of the Muztagh valley, it consists of calcitic limestones and has been shaped from a pre-glacial rock-bar mountain (Fig 138 No. 11). The rocks have undergone perfect glacial rounding. They are covered by a thin scattering of ground moraine. Glacifluvial drift and moraine ledges (■) have been deposited on the edges. The most recent drift floor surface (valley sander □), which forms the valley floor of the Shaksgam valley, is situated at 3900 m asl. It sediments the base of the glaciated knob. Viewpoint: 36°09'N/76°23'40"E. Photo: M. Kuhle 31. 8. 86.

◄ Fig 53
Downhill view of a representative glacigenic trough valley on the Kuenlun N-slope, seen from 4400 m asl (Fig 138 No. 15). It leads WNW, down to "Kudi Valley" as the main valley, which is reached at 3900 m asl (below - - - -, in the background). The valley is set out in granites. The valley bottom is filled with Late to Neo-Glacial moraines (III, IV, V ■). Cuspate areas and truncated rock spurs (◤◢) are preserved up to the ice scour limit (- - - -). Viewpoint: 36°33'N/77°15'E. Photo: M. Kuhle 28.10.86.

Fig 54 ▲
View from 5000 m asl from above the 4950 m-high "Mazar pass" (Fig 138 No. 16) towards WNW across a source basin of the "Mazar valley", which leads down to the Yarkand in the south (foreground to middle ground). No. 1 = 5796 m peak, a continuation of the glaciated Kuenlun main ridge – from the 6328 m massif following the strike of the mountain system towards the W. Beyond the source basin an orographic left-hand side valley of the "Kudi Valley" sets in on the right and, running down on the left, passes below Peak No. 1. At 3050 m asl it joins the main valley S of the Kudi settlement (Fig 138 No 40). Its source area had been filled with glacier ice up to (- - - -). On the valley slopes the post-glacial periglacial scree shows solifluidal block-band patterning (∇ background). Viewpoint: 36°35'10"N/76°00'E. Photo: M. Kuhle 27.10.86.

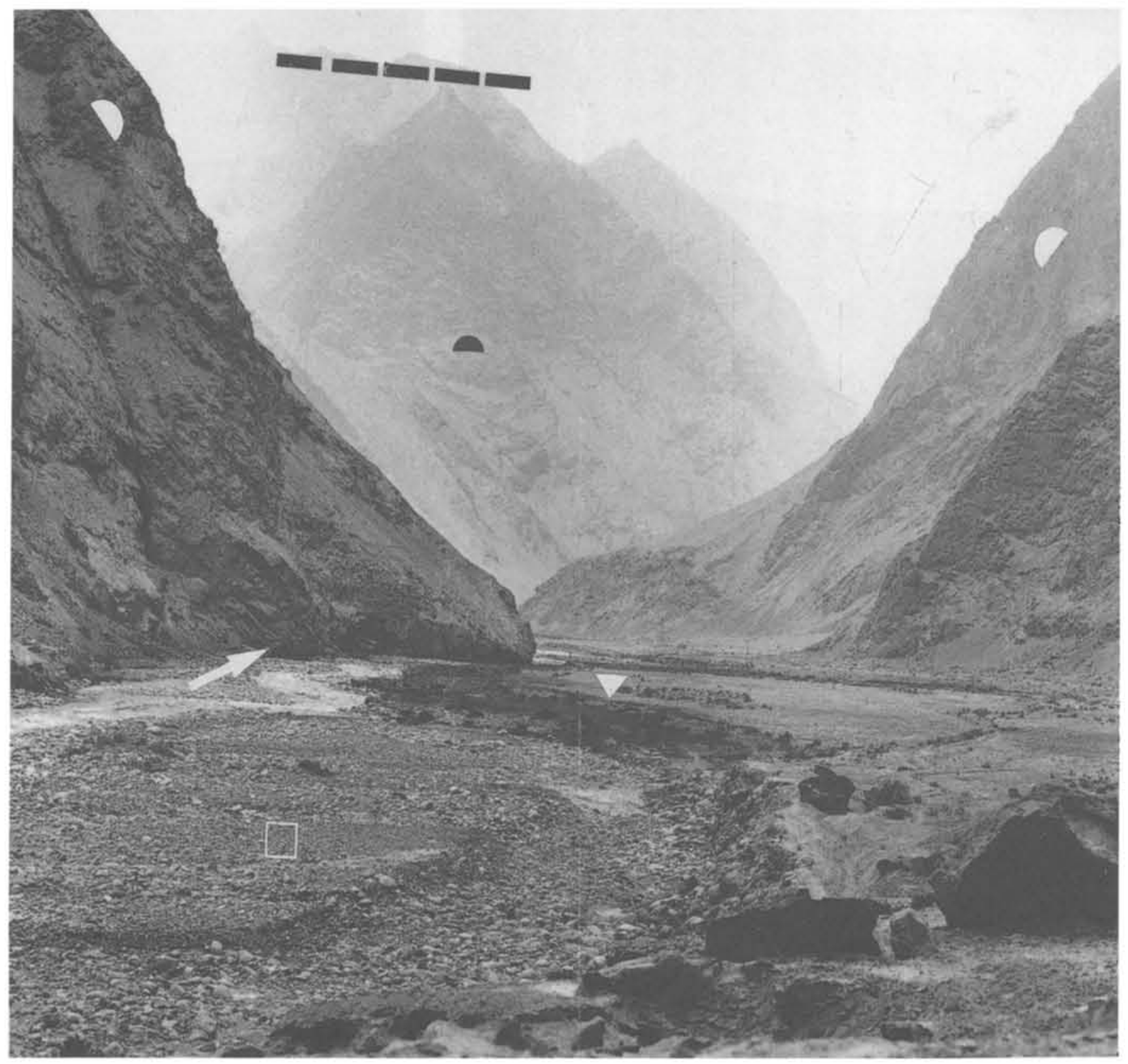
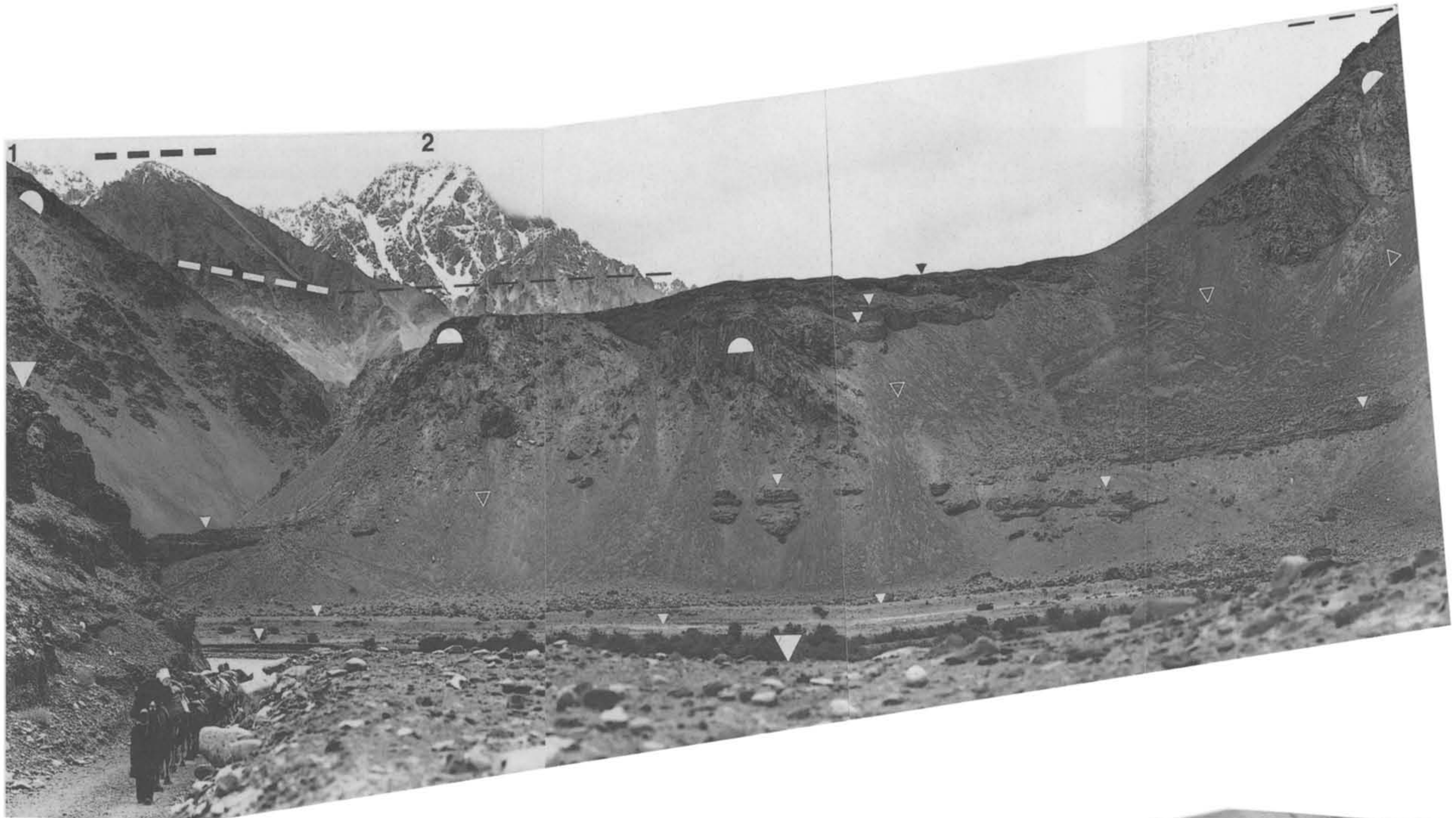


Fig 58 ▲
View from the bottom of the Kudi valley at c. 3100 m asl facing down-valley towards NW (Fig 138, right of No. 40). The features of a trough-shaped gorge are clearly visible; its relatively broad concave form (below ◥◤) has been planed down by flank abrasion and polishing from a substantial ice stream (- - - -). As a result of lateral erosion the post-glacial fluvial process led to undercutting (↗) of the glacigenic valley flanks in granite rock. Viewpoint: 36°46'20"N/77°01'15"E. Photo: M. Kuhle 19.8.86.

Fig 59 ▲
View of the orographic left-hand side valley of the Kudi valley from the confluence area (Fig 138 No. 40) somewhat S of the Kudi settlement at 3050 m asl facing upwards in a SSW direction. The valley leads straight down from the Kuen Lun main ridge (cf. Fig 54); thanks to its relatively steep gradient, it has the form of a narrow gorge. Ice Age glaciation (- - - - ice level) has given the valley the slightly concave appearance of a "trough-shaped gorge". Unequivocal flank abrasions and polishings (◥◤) in the local bedrock granites are only preserved in a few places. Viewpoint: 36°49'30"N/76°59'E. Photo: M. Kuhle 19.8.86.



◄ Fig 60
View from the bottom of the Yarkand valley at 3740 m asl, looking up-valley towards the ENE (Fig 138 above No. 51). No. 1 = peak on the S ridge of the 6532 m-high massif; No. 2 = another satellite of the 6532 m-high massif further S. Two ice stream levels must be differentiated (- - - - below = Late Glacial; - - - - top = Main Glacial period). Jutting out horizontally into the valley from right to left (◓◓ in the centre), the rock ridge represents the remnant of an older trough valley floor. Subglacial meltwaters of the prehistoric Yarkand glacier stream have cut a V-profile into it (second ▼ from the left). On the far left (▼ far left) a drift terrace is exposed (below the camel caravan of the expedition - to provide a comparison). The remaining (▼) mark further drift floor terraces (sander terraces). Viewpoint: 36°18'20"N/76°49'30"E. Photo: M. Kuhle 26. 8. 86.

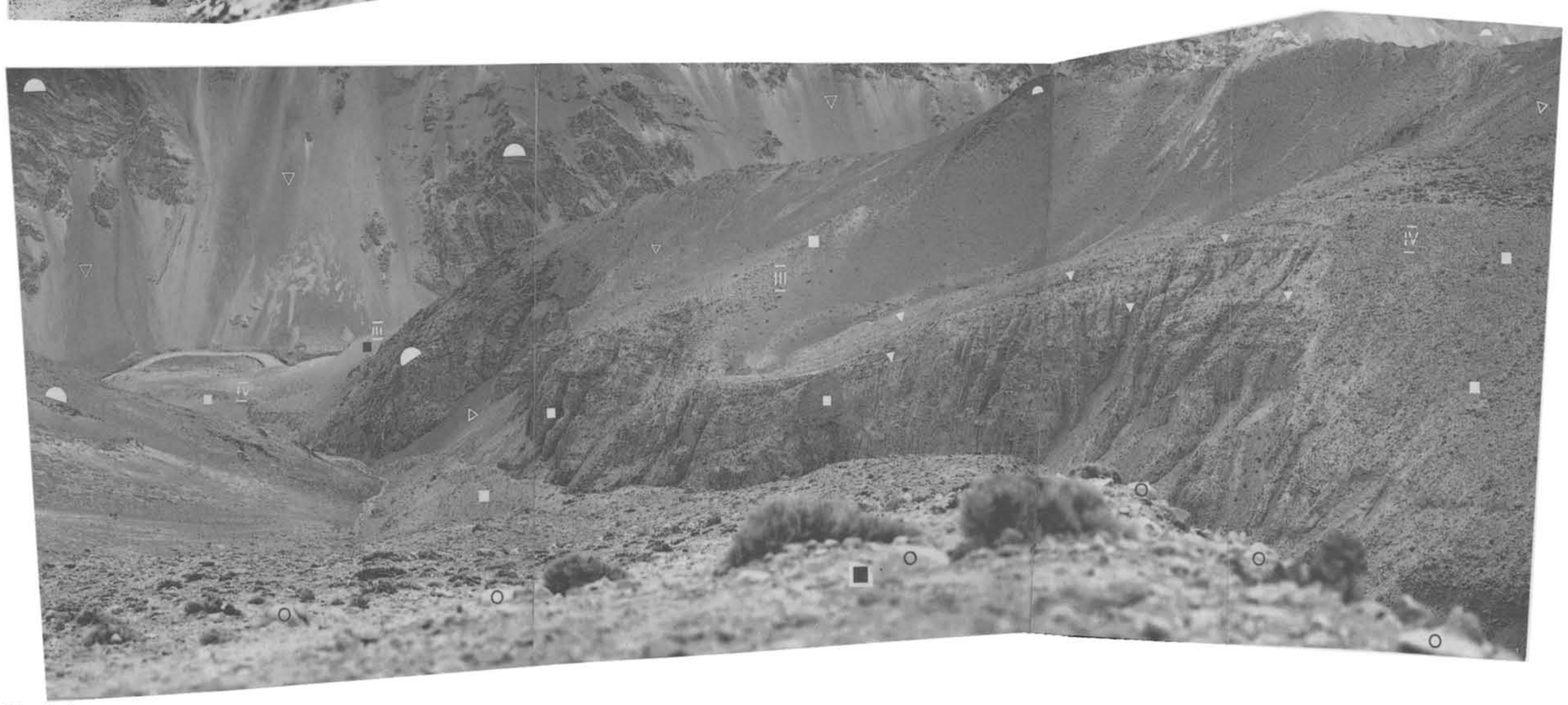


Fig 62 ▲
View from the orographic left-hand flank down the right-hand Yarkand side valley which drains the 6532 m-high massif (Fig 61; Fig 138 No. 18) facing S. At 4340 m asl the location of the exposure is in the area of the root of the left-hand Late Glacial lateral moraine of Stage IV (■■ foreground with moraine blocks ○). On the opposite side, the corresponding right-hand moraine terrace (IV right) is well exposed (■■, centre). Its internal construction shows banking and stratification (▼▼). This stage was the last one for the tributary glacier to reach the main valley (see end moraines ■ IV, far left; Fig 63). The main glacier had already melted down at this time. The higher moraines of Stage III provide credence for a last Late Glacial confluence with the main glacier. They terminate in an orographic right-hand main valley lateral moraine of the same age (■III, far left). Viewpoint: 36°26'N/76°53'50"E. Photo: M. Kuhle 25. 8. 86.

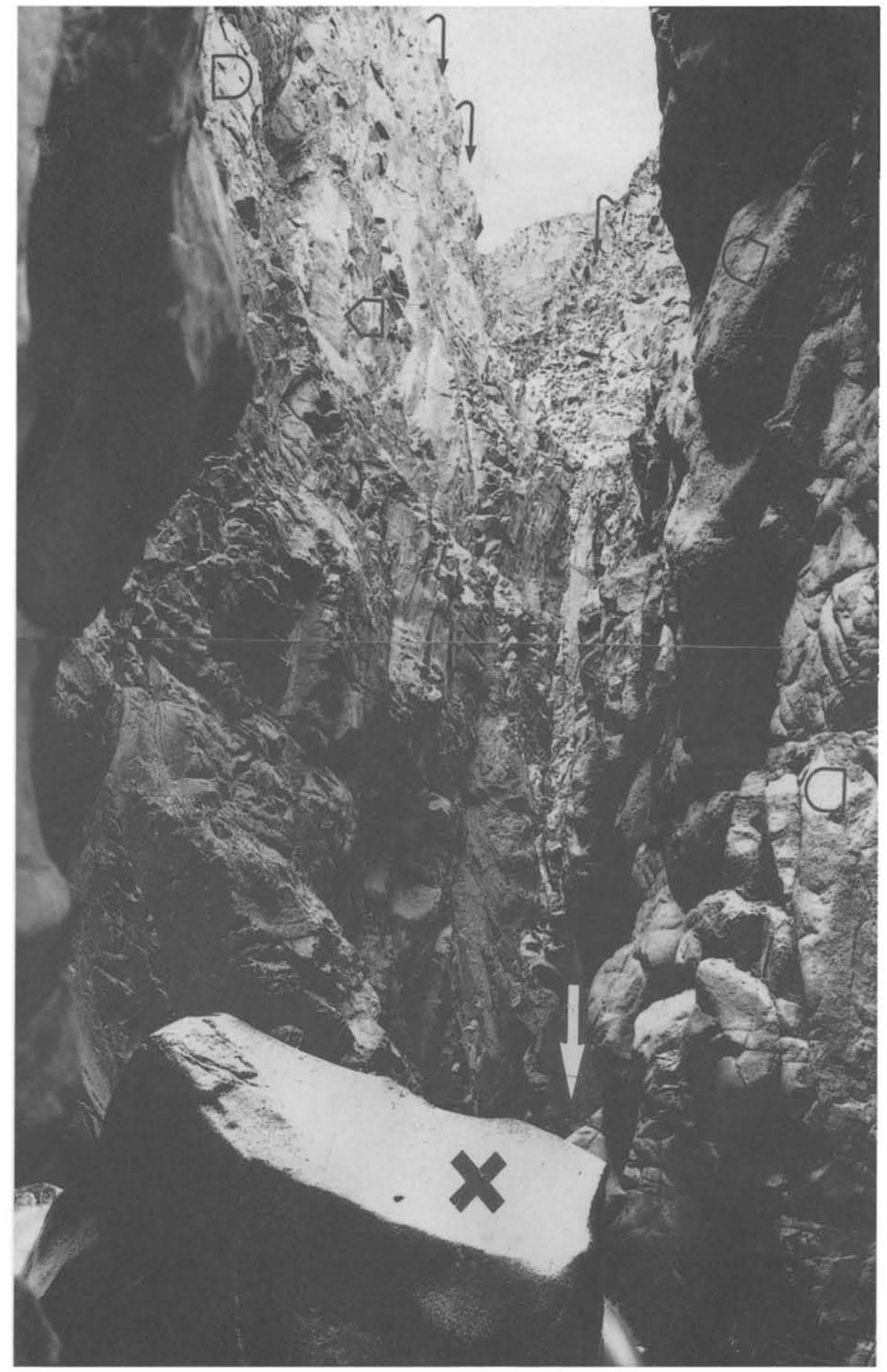


Fig 61 ▲
In the trough ground of an orographic right-hand side valley of the Yarkand, which had been heavily glaciated during the Ice Age, a sub-glacially cut gorge has been set out (Fig 138, left of No. 18). This is an up-valley view of the gorge at 4100 m asl, facing NNW. It is set out in hard granite, and drains the 6532 m-high massif (Kuenlun) to the S. X marks a gorge block above the talweg (↓). Heavy rain causes moraine blocks (basal till) to plunge from the upper edge of the gorge (⤵). Viewpoint: 36°26'N/76°53'45"E. Photo: M. Kuhle 25. 8. 86.

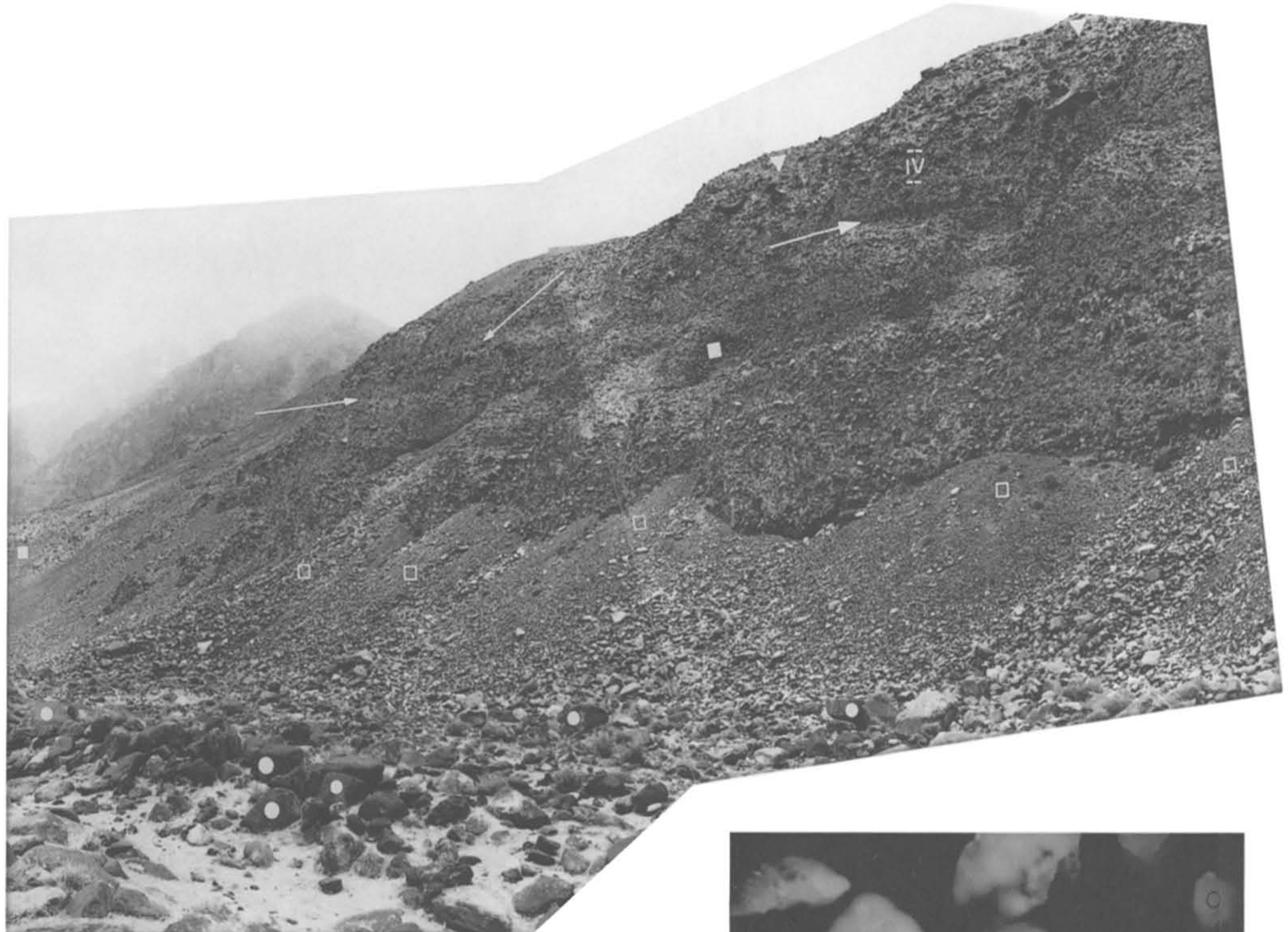


Fig 65 ▲
View from the floor of the "6008 m-high massif SSE-valley" at 3850 m asl, looking down towards the confluence with the Yarkand valley (↓) (Fig 138, between Nos. 19 and 38). This section of the territory, which shows the continuation of Figure 64 further down the valley, provides evidence for the existence of glacigenic V-shaped valleys. Though crumbling and weathering have roughened-up the valley flanks since deglaciation, as talus cones and talus slopes (◁▷) show, flank abrasion and polishing has been preserved in the granites in some places (◥◤). Flank polish and abrasion very high up the Yarkand valley provide information (▲) about the Main Ice Age thickness of the ice (- - - -). Viewpoint: 36°27'N/76°57'30"E. Photo: M. Kuhle 24. 8. 86.

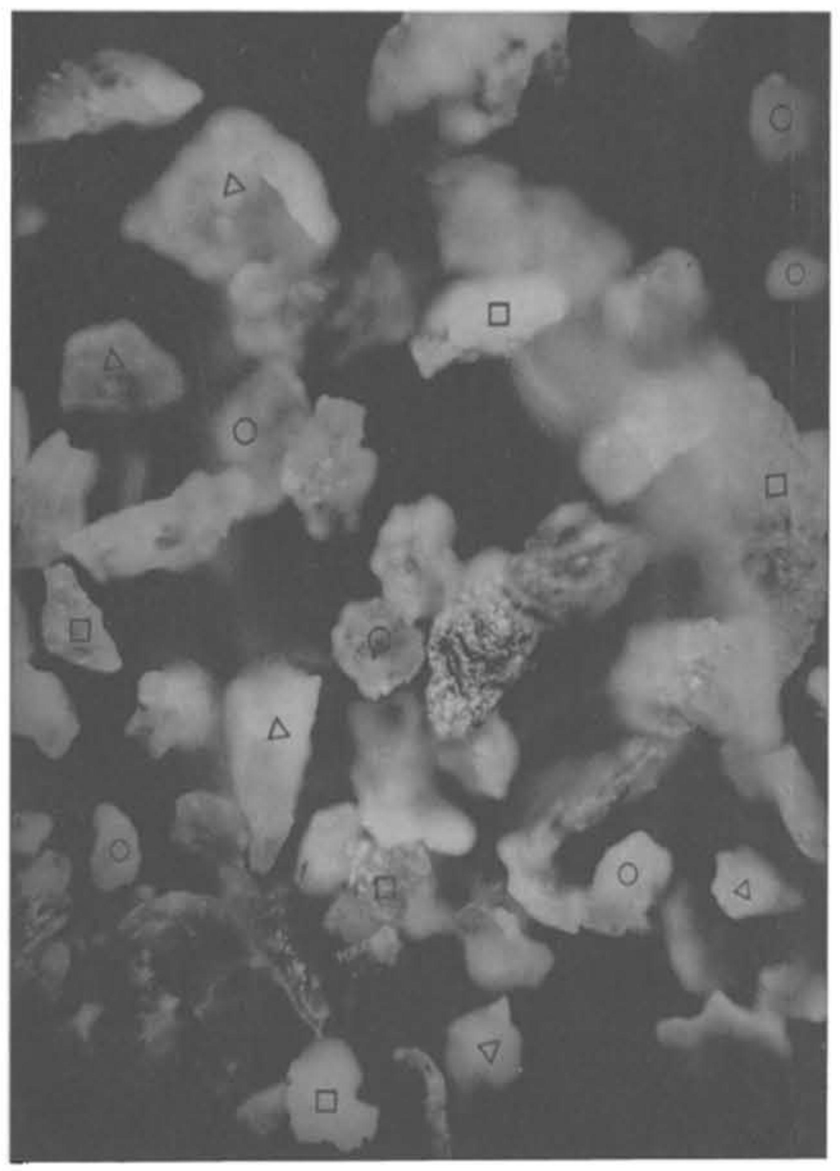


Fig 68 ▲
Microscopic photograph of representative grains > 200 μ of the 24. 8. 86/5 sample for morphoscopy (cf. Fig 56 and Fig 66 No. 7). This is a fluvial, or glacifluvial sediment of frost debris and moraines from metamorphite and granite parent rock, which has been transported < 10 km.
□○△ mark the three discernible grain surfaces (see running text). Viewpoint: 3770 m asl; 36°26'40"N/76°57'50"E; Fig 138, No. 38).

◀ Fig 63
Exposure of the right-hand end moraine (■ IV) in the exit of the orographic right-hand side valley of the Yarkand (Fig 138 below No. 18) at 3800 m asl. The diamictite material is relatively coarse-grained, a fact that is explained by the short distance it was transported by the at most 20 km-long tributary glacier. Intermittent bands of drift (→) are evidence of the considerable contribution the meltwaters made in this sedimentation process in the vicinity of the late Late Glacial glacier face. (□) mark talus cones from this dumped moraine material, (●) large erratic granite blocks which show dark brown crusts of iron manganese as a result of considerable insolation and potentially high evapotranspiration. Viewpoint: 36°25'N/76°54'20"E (Fig 62 IV, on the far left) Photo: M. Kuhle 25. 8. 86.

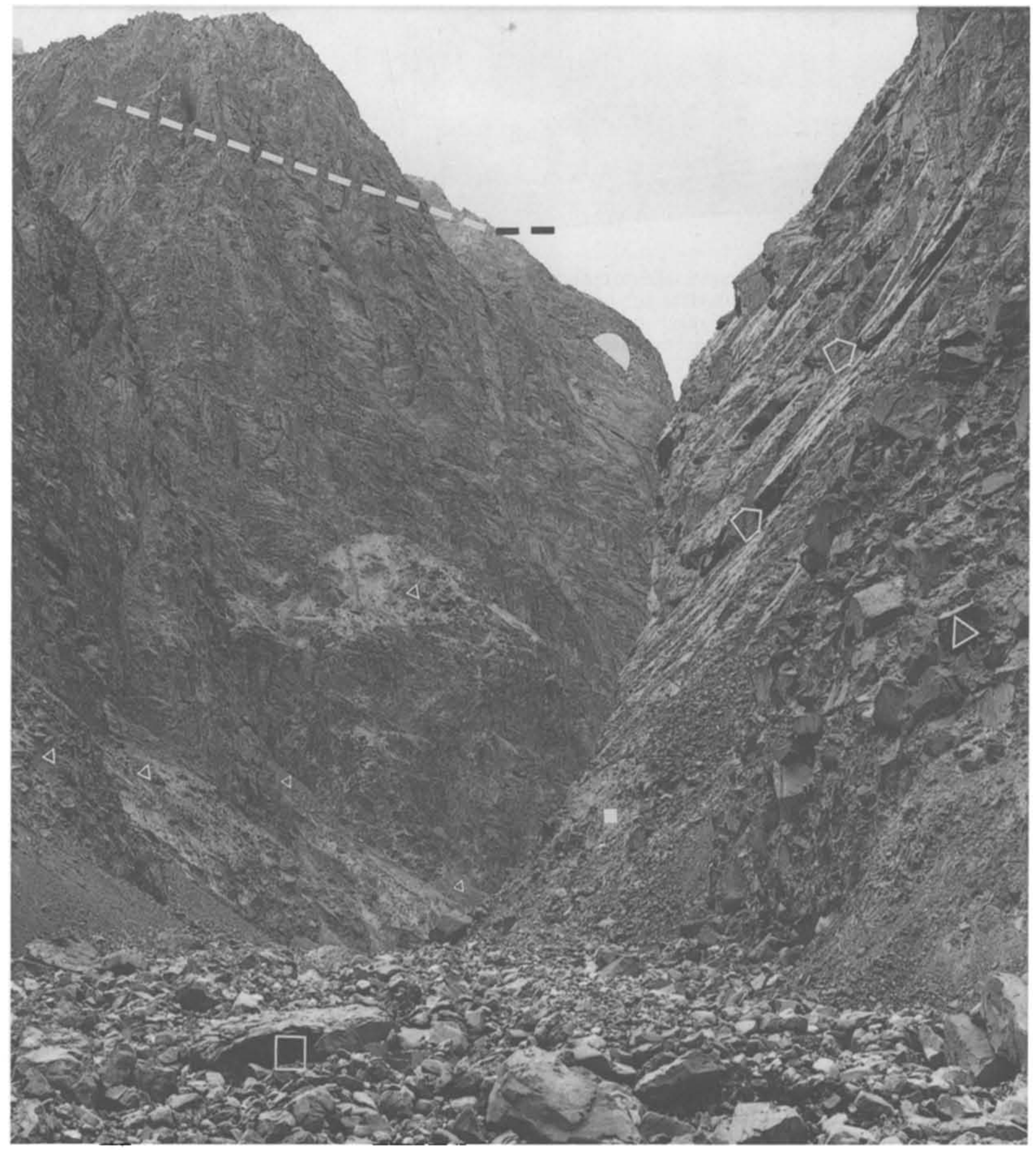


Fig 64 ▲
View from the drift floor at 3920 ml asl down a gorge to which flank polishing (◥) had given the form of a trough (Fig 138, right of No. 19). This orographic right-hand tributary valley of the Yarkand valley drains the 6008 m-high massif (Kuenlun) to the SSE. It is set down in granite, which tends to crumble widely (⬠) when affected by glacigenic undercutting and fluvial lateral erosion. (- - - -) marks a probable early Late Glacial ice scour limit. Viewpoint: 36°28'N/76°56'50"E. Photo: M. Kuhle 24. 8. 86.

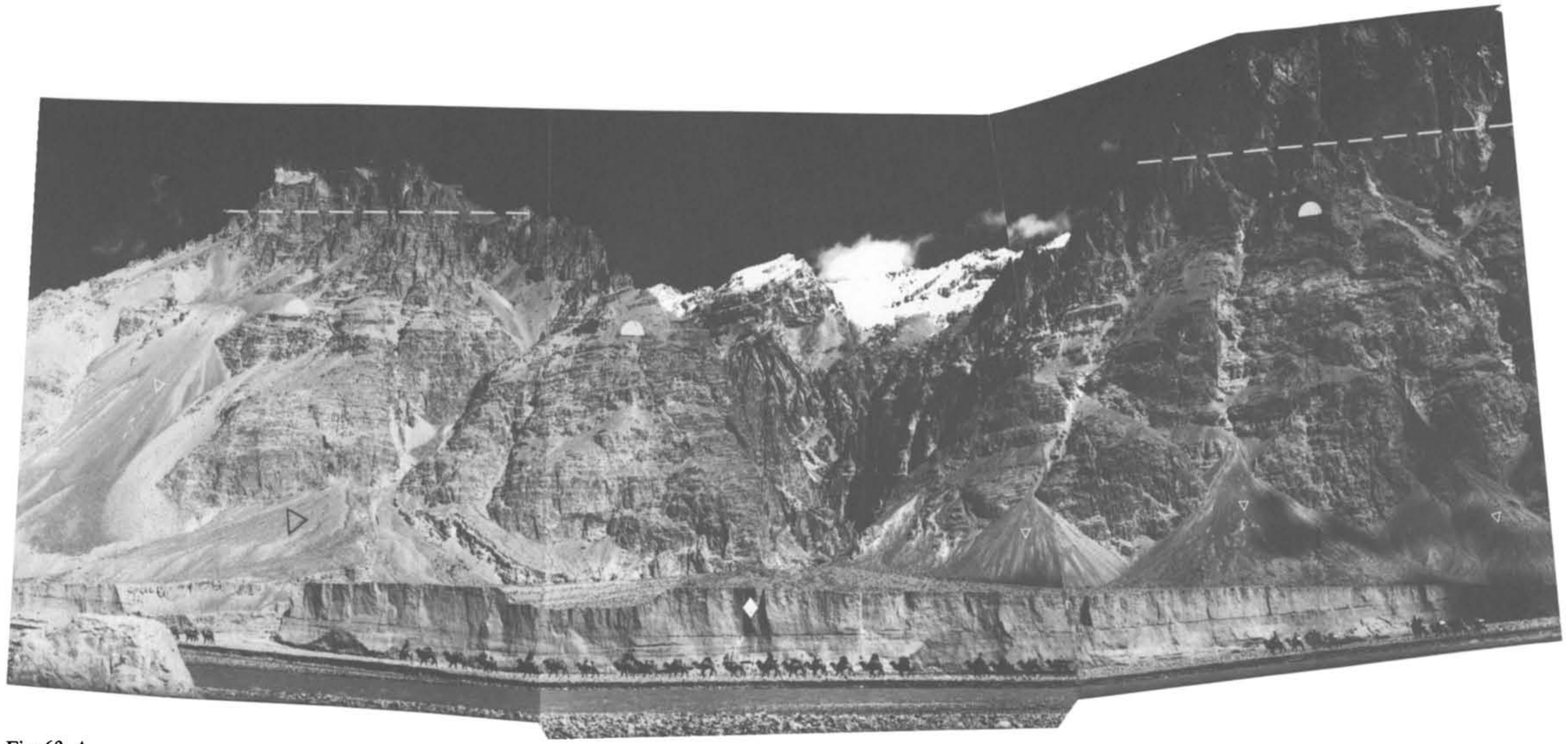


Fig 69 ▲
View from 4080 m asl across the Shaksgam valley to the orographic right-hand trough flank of the major longitudinal valley in the N (Fig 138, right of No. 21). The ice scour limit (- - - -) runs at 5000 m asl, and must be held to be from the early (old) Late Glacial period. It provides evidence of glacier thickness of more than 1000 m at that time; added to this is the thickness of loose material which has accumulated in the valley bottom (the caravan of camels is walking on this drift floor). The glacial band abrasion and polishing of the outcropping edges of the strata (◓) occur on the dolomites of the Aghil ridge. Their excellent state of preservation, in spite of arid continental conditions of free-thaw cycles, which have at any rate already built up more than 200 m-thick alluvial fans (♦), talus cones (▽) and mudflow cones (▷), is striking, given the considerable degree of dissolution and gullying of flanks immediately above the present glacier levels in the Karakorum. This tends to suggest a more recent age for these flank abrasions and polishings (◓), or a much higher glacier level during the main Ice Age. Viewpoint: 36°07'N/ 76°36'E. Photo: M. Kuhle 30. 8. 86.

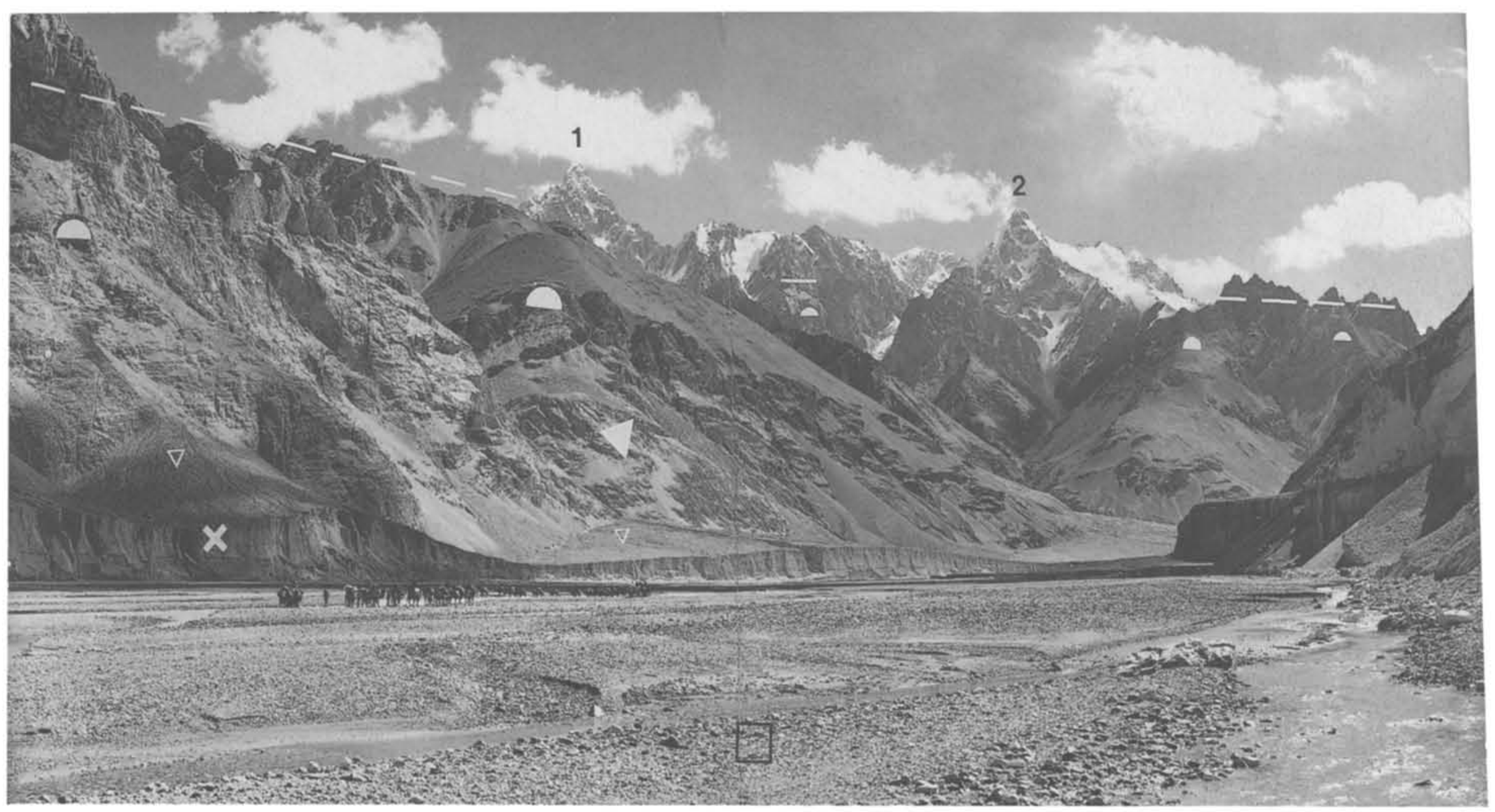


Fig 71 ▲
View from the drift floor (□) of the Shaksgam valley at 4060 m asl (Fig 138 No. 23) in an ENE direction towards the orographic right-hand valley flank and the higher peaks of the Aghil mountains. No. 1 = 6500 m-high peak; No. 2 = 6500 m-high peak (both unnamed). (◓◓) marks the glacial band abrasion and polishing of the outcropping edges of the strata. (- - - -) marks the early Late Glacial polish level of the Shaksgam ice stream network at about 5000 m asl. The ice scour limit between Nos. 1 and 2 (- - above ◓) indicates a main Ice Age level at 5600 m asl. On the glacially abraded and polished trough flank Late Glacial ground moraine (basal till) positions are preserved up to several hundred metres high (◁). Over large areas they have been dissected into earth pyramids. Fig 122 shows the moraine material in detail. Hundreds of metres thick, the talus cones, alluvial fans and mudflow fans (▽▽) were built up in post-Late Glacial times. Every year when the Shaksgam river is in flood they are distally undercut (X). Viewpoint: 36°08'N/76°35'E. Photo: M. Kuhle 1. 9. 86.

Fig 70 ▲
View from 4200 m asl towards SSE up the Shaksgam valley to the high peaks of the more easterly Karakorum main ridge, which are part of the catchment area of this valley (Fig 138, between Nos 23 and 24). No. 6 = Apsarasas (7245 m); No. 5 = Teram Kangri (7462 m); No. 8 = Urdok (c. 7300 m); No. 3 = Sia Kangri (7422 m). In the foreground a current mudflow fan, which is being undercut by the present valley drift floor with the Shaksgam river (-6). -1 and -2 are the historic ice cave drift floor terraces of the older (VI) and middle Dhaulagiri Stage ('VII). (◓◓) mark the glacial flank abrasions and polishings of the main Ice Age ice stream network, which extend to more than 5500 m asl; (- - - -) marks its level. Viewpoint: 36°07'N/76°38'E. Photo: M. Kuhle 20. 10. 86.

Fig 72 ▲
View from the drift floor of the Shaksgam valley (-6) at 4000 m asl (Fig 138 left of No. 21), facing NW towards the orographic right-hand flank of this trough valley. In respect of the state of their preservation, the quality of the (◓◓) glacigenic flank abrasion and polish decreases upwards towards the ice scour limit (- - - -). The cutting of the gorge in the wall (↓) and the piling up of the talus cone (▽ left) below its exit took place post-Late Glacial. Viewpoint: 36°06'25"N/ 76°33'E. Photo: M. Kuhle 1.9.86

◀ Fig 73
View from the drift floor of the Shaksgam valley (□) at 3980 m asl (Fig 138 between Nos. 21 and 20), facing NW down this large longitudinal valley towards the 4730 m peak (No. 4). Peak No. 4 is the glacial horn in Figures 51 and 52 from different perspectives. This peak divides the transfluence pass from the adjacent Muztagh valley towards the NW (Fig 138 No. 13); during the Main Ice Age it was totally covered by the Skaksgam ice stream network (- - - - left). The well preserved glacial flank abrasions and polishings (◖◗) belong to the Late Ice Age; talus fans and cones (□ left) belong to the post-Glacial (Holocene). Viewpoint: 36°06'30"N/76°29'E. Photo: M. Kuhle 1.9.86

Fig 75 ▼
Fluvial groove (◀) on the orographic left-hand rock-wall of the Shaksgam valley; on this scarp it is reached by the annual early-summer meltwater, and deepened further (Fig 138 between Nos 12 and 20; cf. Fig 76). (□) marks the body of drift material on the valley floor, regularly moved by the Shaksgam river. There are only a few meltwater arms at this season. Above a currently undercut rock mass (■) juts out, forming the approximately horizontal base for that rock groove (◀). In the background clearly visible rock abrasions and polishings reach up to great heights (◖). Viewpoint: 36°05'25"N/76°28'20"E, 3965 m asl. Photo: M. Kuhle 1.9.86.

Fig 76 ▼
Shows the upstream continuation of the scarp mentioned in Fig 75 with its rock groove (⇘) and the protruding rock base below (■). For the comparison of size there is a 182 cm-tall person (on the right of the right ⇘). (□) marks the actual Shaksgam drift valley; (◖◗) the orographic left-hand flank abrasion and polish; (- - - -) the Ice Age level of the glacier. Viewpoint: 36°06'25"N/76°28'21"E (Fig 138 between Nos. 12 and 20). Photo: M. Kuhle 1.9.86.

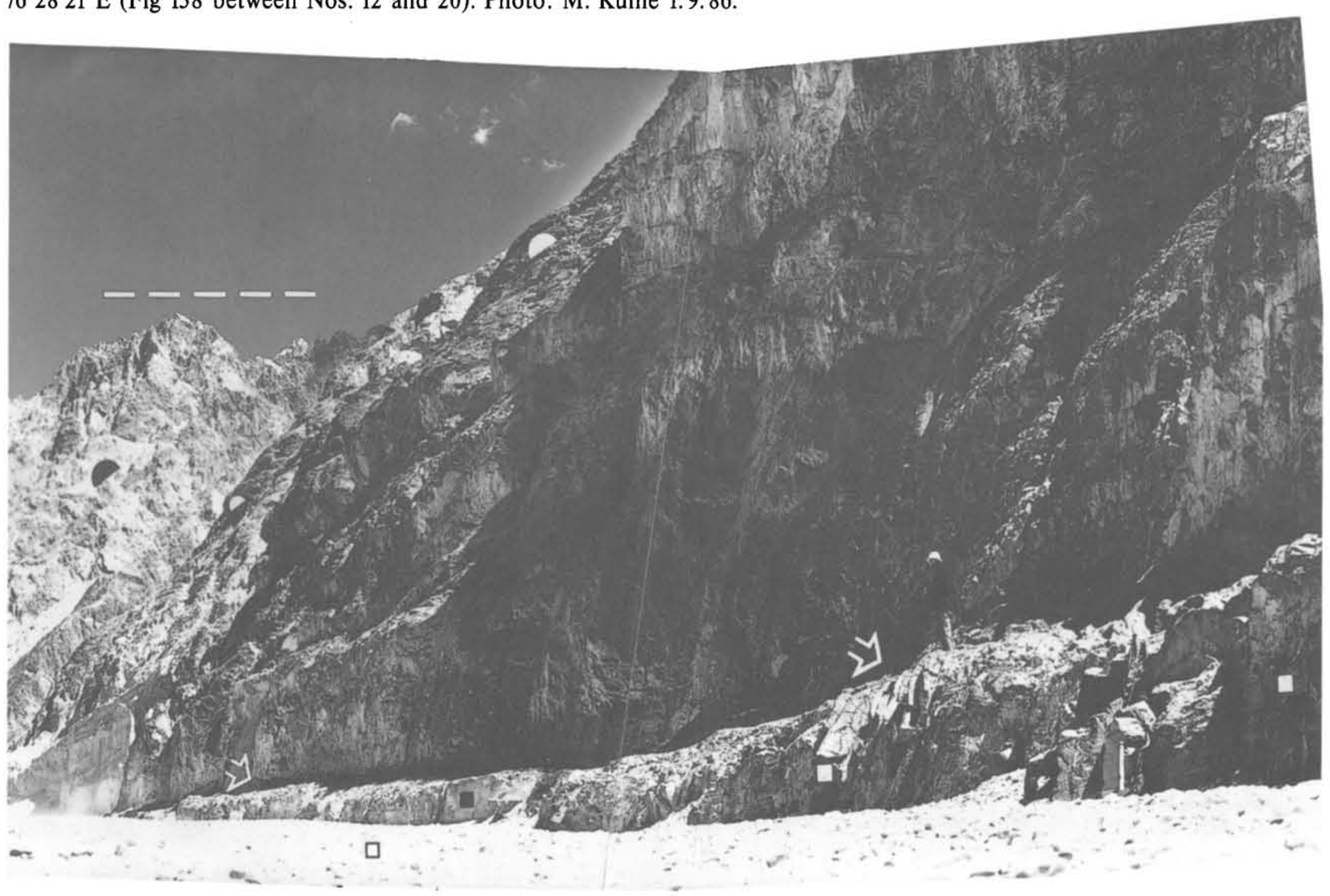
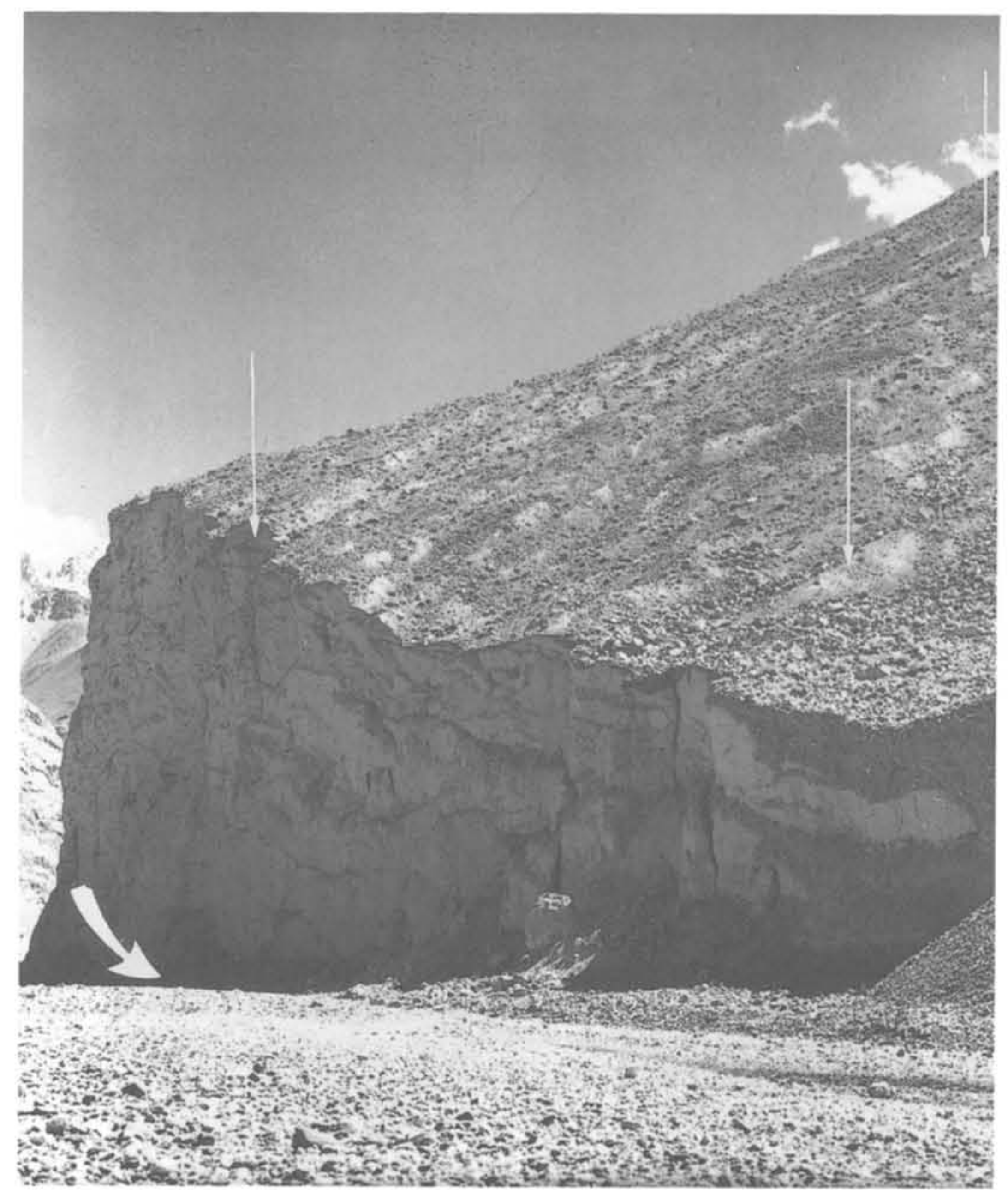


Fig 77 ▼
Mudflow cone at the foot of the orographic left-hand flank of the Shaksgam valley at 4060 m asl, facing up-valley towards the ENE (Fig 138, left of No. 23). ↓↓ mark the separate mudflow tracks which build up the cone; their lenticular cross-profiles (cf. Fig 78 X) also appear in the exposure. The mudflow cone is still in the process of construction. The very high exposure is kept steep by simultaneous, almost annual, undercutting (↘) from the Shaksgam river. Viewpoint: 36°08'N/76°35'E. Photo: M. Kuhle 1.9.86



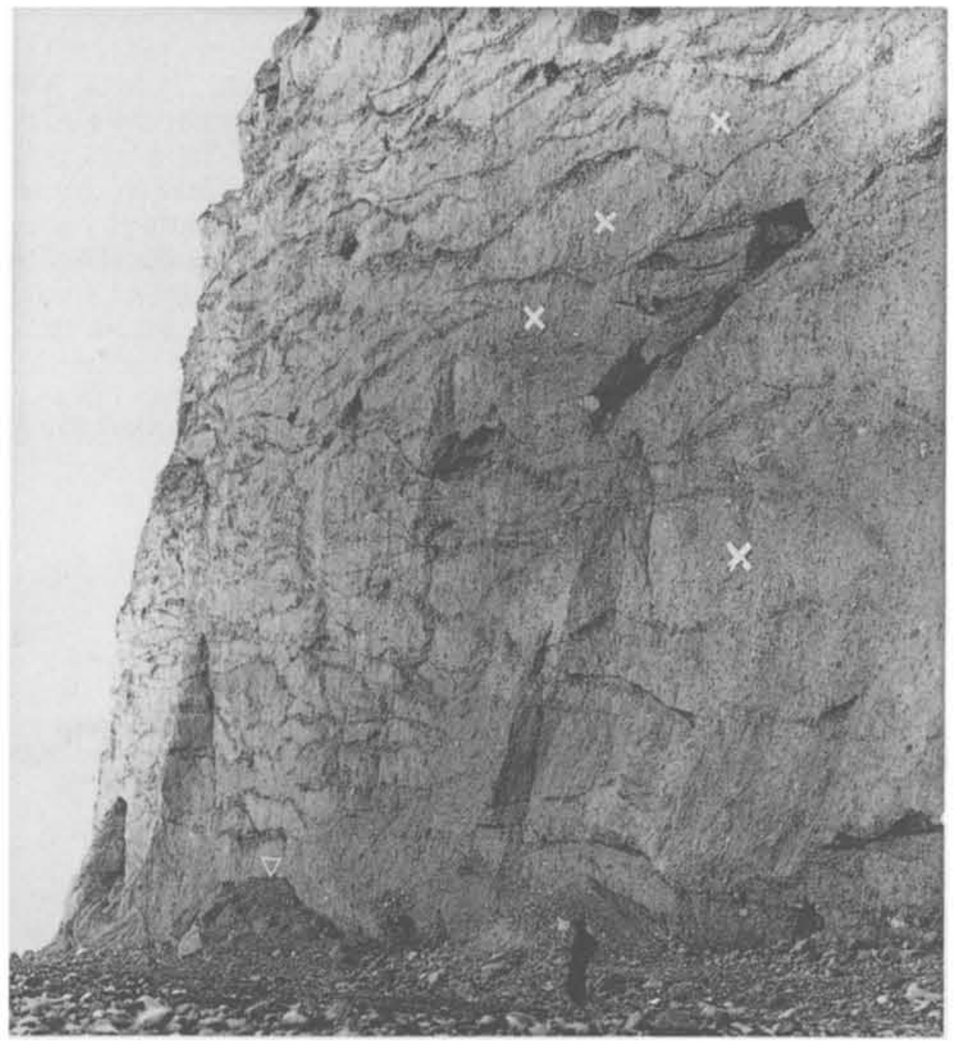


Fig 78 ▲
Detail from the 65 m-high exposure wall of the mudflow cone (cf. Fig 77) on the orographic left-hand in the Shaksgam valley (Fig 138 left of No. 23) at 4060 m asl. Although this is a matter of perfectly chaotic, ie diamictite material of very different grain sizes with big blocks "floating" apart from one another in a matrix of fine material, a glacial-genesis of the sediment on the basis of the lenticular mudflow cross-profiles (X), ie macroscopically, must be excluded. These separate mudflow events and their sediments, which form the cone, are divided from one another by strata of rough scree and drift where the finer material has been washed out. This is evidence of the ever-present effect of the meltwaters from snow. Viewpoint: 36°08'N/76°35'E. Photo: M. Kuhle 1.9.86.

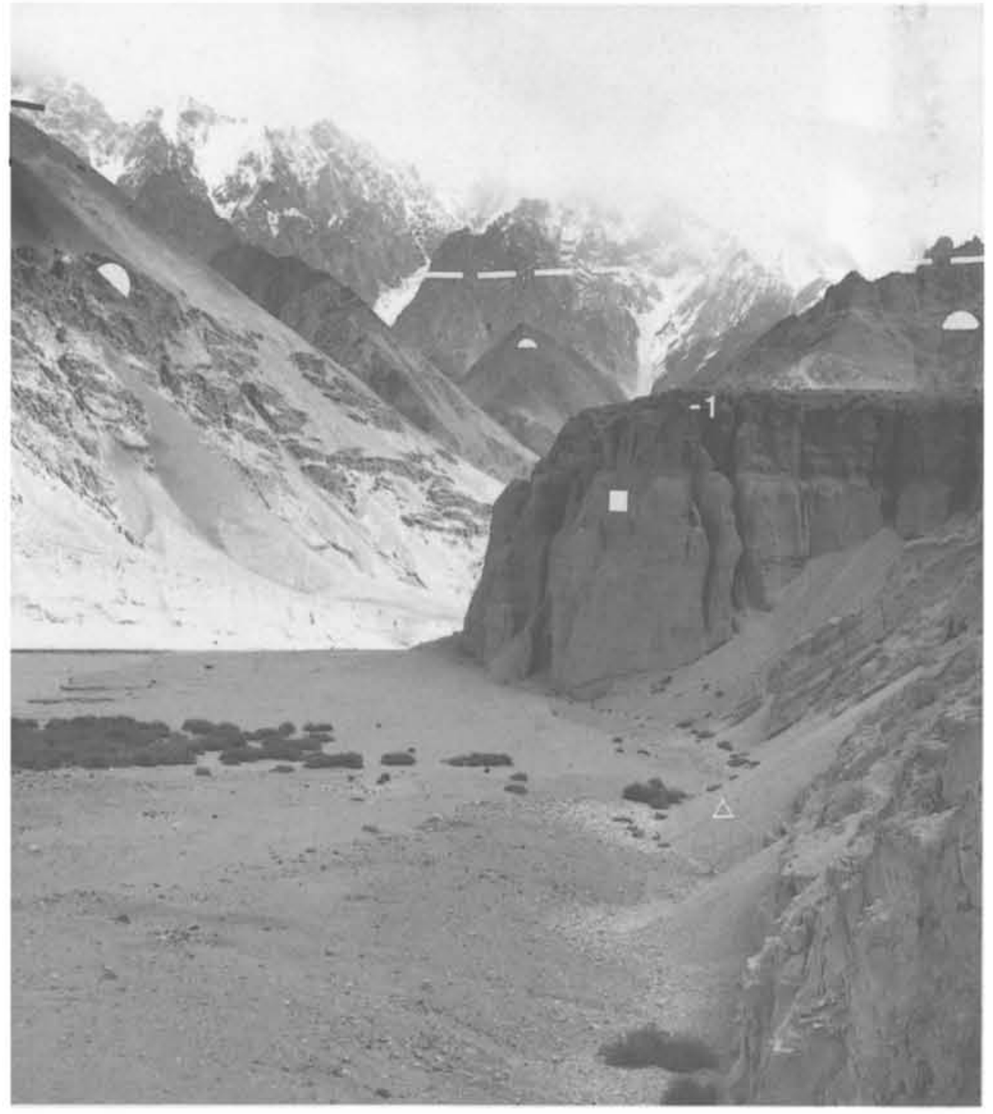
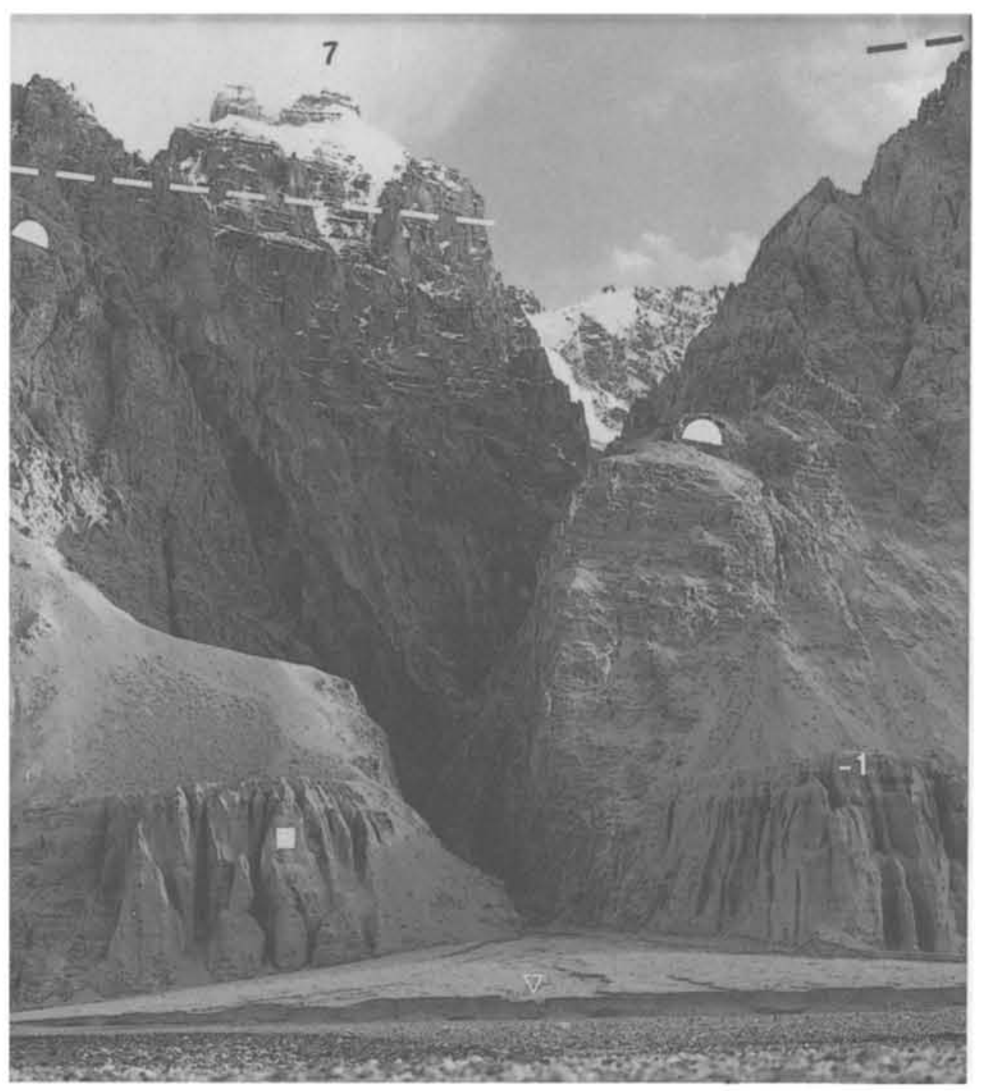
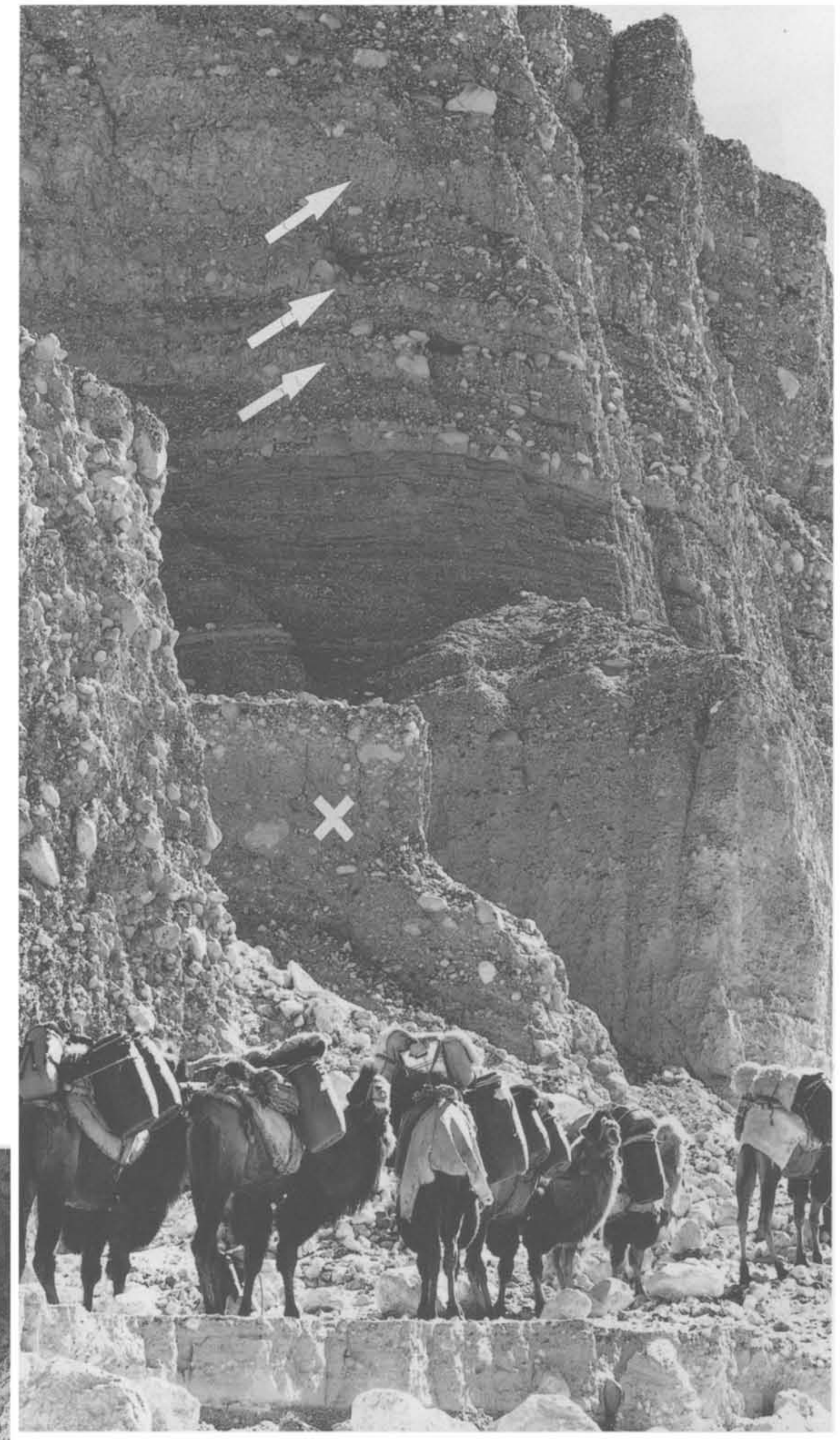


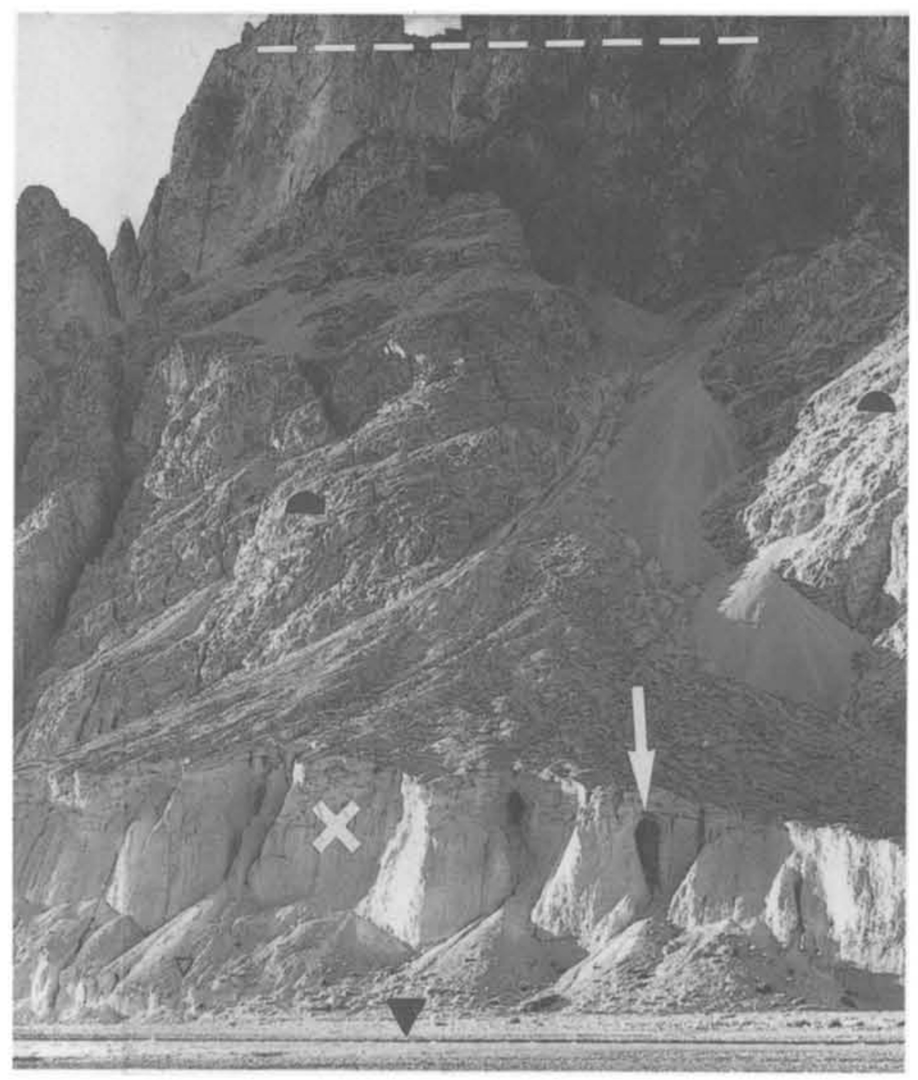
Fig 79 ▲
View from the left-hand flank of the Shaksgam valley (Fig 138 No. 23) at 4100 m asl, facing ENE valley upwards towards the remnant of a drift fan terrace (■ -1). This alluvial fan was deposited on the main valley floor as ice cave drift floor during the Neo-Glacial to historic glacier Stage VI (older Dhaulagiri Stage). It has meanwhile been distally undercut and eroded by the lateral erosion of the Shaksgam river. Figure 80 shows the still glaciated tributary valley, which forms the catchment area of this "indirect sander cone". (▷) marks this year's freshly deposited talus cones, which will be removed by the next floodwater. In the background, joined by the orographic right-hand tributary valley, are the c. 6500 m-high peaks of the Aghil ridge, together with the Ice Age flank abrasion and polish (◥▲) and ice scour limits (- - - -) on their slopes. Viewpoint: 36°07'35"N/76°36'30"E. Photo: M. Kuhle 31.8.86.



◄ Fig 80
View from the present drift floor of the Shaksgam valley at 4080 m asl looking SSW into a gorge-like, orographic left-hand tributary valley (Fig 138 No. 23), the head of which continues to be glaciated. During the older Dhaulagiri Stage VI an "indirect talus sander" (■ -1) was tipped on the floor of the main valley from here, and during the 2050–2400 years of this Neo-Glacial stage, which have passed since, largely removed again by the lateral erosion of the Shaksgam river, so that steep terraces have formed (cf. Fig 79). The present sander cone (▽) penetrates these terraces. As the present drift floor, it belongs to the present glacier (background). No. 7 = N-satellite of the 6210 m peak; its top is c. 2000 m above the Shaksgam valley floor. (▲) marks flank abrasions and polishings, and (- - - -) points to the Ice Age upper limit of these glacial band abrasions and polishings. In spite of so substantial an ice thickness (- - - -), this glacigenic side valley beneath peak No. 7 is shaped like a gorge, or at most a "gorge-like" trough. This is the result of both the steepness of its talweg as well as the Late Ice Age subglacial meltwater erosion. Viewpoint: 36°07'40"N/76°36'32"E. Photo: M. Kuhle 31.8.86.

Fig 81 ►
Outcrop of a mudflow fan in the Shaksgam-valley at 4080 m asl (Fig 138 between Nr. 23 and 22). It is built up of resedimented till, containing granite and limestone blocks (dolomite: Do 90%, Ca 10% and calcite: Ca 90%, Do 10%). The glacial diamicton (↗) was transported 4–6 km by mudflows (s. Fig 84 ▽). The grain-size distribution remained the same, however, in contrast to tills (primary till is exposed on the base of the mudflow layers X) the mudflow fan shows distinct bedding. Each mudflow event established a new layer (↗). Location (s. Fig 84 ♦): 36°06'30"N/76°38'45"E. Photo: M. Kuhle 20.10.86





◄ Fig 82
View from the present drift floor of the Shaksgam valley at 4070 m asl, facing NW (Fig 138 right of No. 21) on to the right-hand trough flank with its glacial banded abrasion and polish (▲) in dolomite rock. (- - - -) marks the Late Glacial ice scour limit at 5000 m asl, c. 1000 m above the Shaksgam river (▼). The mudflow cone at the foot of the wall (X) has been built up within a few thousand years since the deglaciation of the Shaksgam valley. The driving force behind its formation is the annual meltwaters from snow in this S-facing mountain flank of the Aghil mountains, which rises to about 5500 m asl. Some of these meltwaters already seep into the surroundings near the cone and formed a wealth of subterranean karst forms with a cave system in the soluble loose rock (calcite and dolomite). Two of these karst caves have been exposed by the lateral erosion of the Shaksgam river (↓ and left of it). Viewpoint: 36°08'30"N/76°36'E. Photo: M. Kuhle 31.8.86.

Fig 83 ▼
View from the mudflow cone surface (♦) of the orographic right-hand side of the Shaksgam valley at 4250 m asl: panorama ranging from S via peak No. 7 (c. 6100 m-high satellite of the 6210 m massif, Karakorum) towards the W down the Shaksgam valley, into its orographic right-hand flank up to the exit of the "southern Aghil pass valley" towards the NW (No. 6 = c. 5300 m-high spur peak on the right-hand flank of the "southern Aghil pass valley") across the Shaksgam trough (Fig 138, right-hand above No. 23). During the Main Ice age the maximum glacier level must have been at least 5500 m asl (cf. main text), though there is no evidence of it in this middle chamber of the Shaksgam valley. The highest ice scour limits marked here (- - - -) run between c. 5000 and 5350 m asl. Formed in calcite and dolomite rock, the flank abrasion and polish (◗▲◖) gets better the further down it occurs. In parts, remnants of ground moraine (■ right) have been preserved on the valley flanks, which can be recognised by their gullies from afar. Viewpoint: 36°08'30"N/76°38'10"E; on the far right the camel caravan ascending the "southern Aghil pass valley". Photo: M. Kuhle 20.10.86.

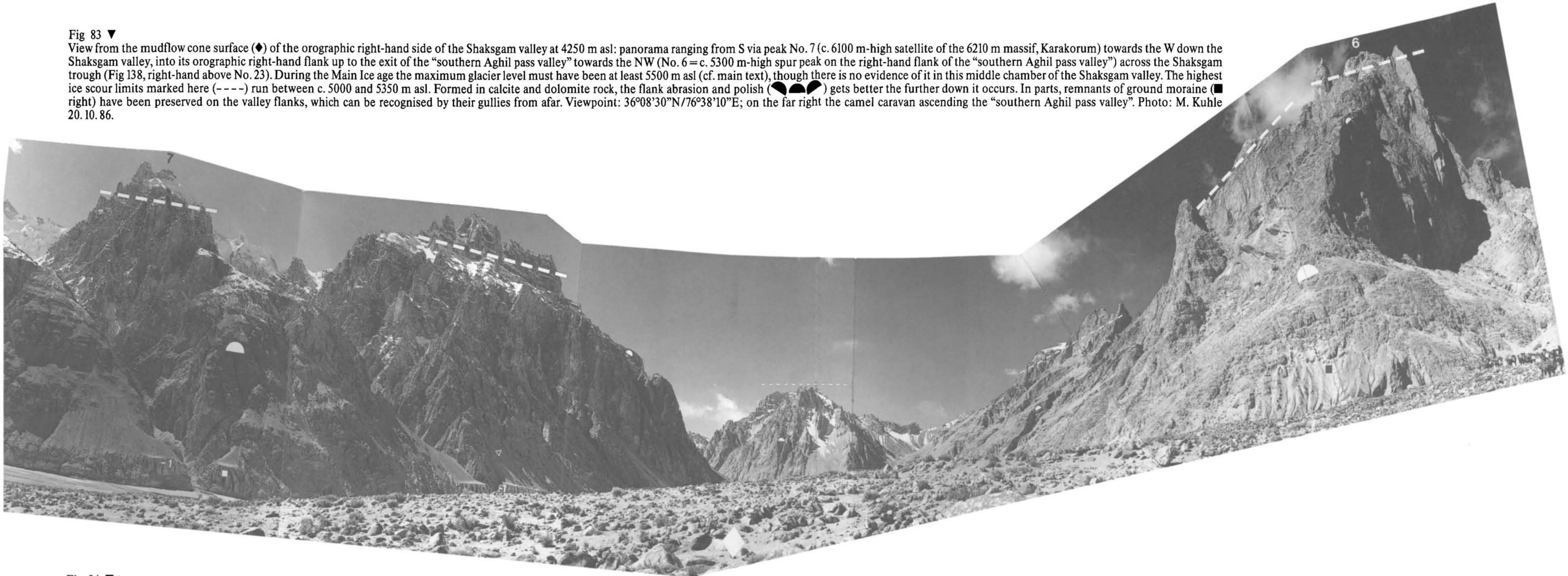


Fig 84 ▼
View from a mudflow cone surface (♦; 4200 m asl) on the right-hand side of the valley (Fig 138, right side above No. 23), seen the Shaksgam valley upwards. Panorama from NE (No. 2 = c. 6500 m-high peak of the Aghil ridge), via E and ESE (No. 4 = 6755 m-high peak and No. 3 = "Shaksgam Horn" 5466 m), via SE (No. 1 = Sia Kangri 7422 m) and S as far as SSW (No. 7 = c. 6100 m-high satellite of the 6210 m massif, Karakorum) into the orographic left-hand flank of the Shaksgam valley. The "Shaksgam Horn" (No. 3) was at least covered by the Main Ice Age Shaksgam glacier (- -). (There is no evidence of the true thickness of the ice transfluence across this peak). This implies a glacier thickness of at least 1400 m from top to valley floor (□). Coming down from W Tibet, this substantial, Main Ice Age outlet glacier consequently had a thickness of 1400 m plus the thickness of the then vacant drift floor down to the bedrock rock base. (▲) marks the well preserved Ice Ace flank abrasions and polishings; (- - - -) marks the mostly Early to Late Glacial ice scour limits. (▼▼) (in the third of the photo on the left) shows the Late Glacial lateral moraine ledges on the orographic right-hand valley flank. Below (■) ground moraine (basal till) material covers the solid rock slope. The mudflow fan (♦) which had been constructed from ressorted moraine material in the orographic right-hand side valley (below No. 2) was transported away from it in a fan of numerous mudflow streams (▽↓). Viewpoint: 36°07'30"N/76°38'20"E. Photo: M. Kuhle 20.10.86.

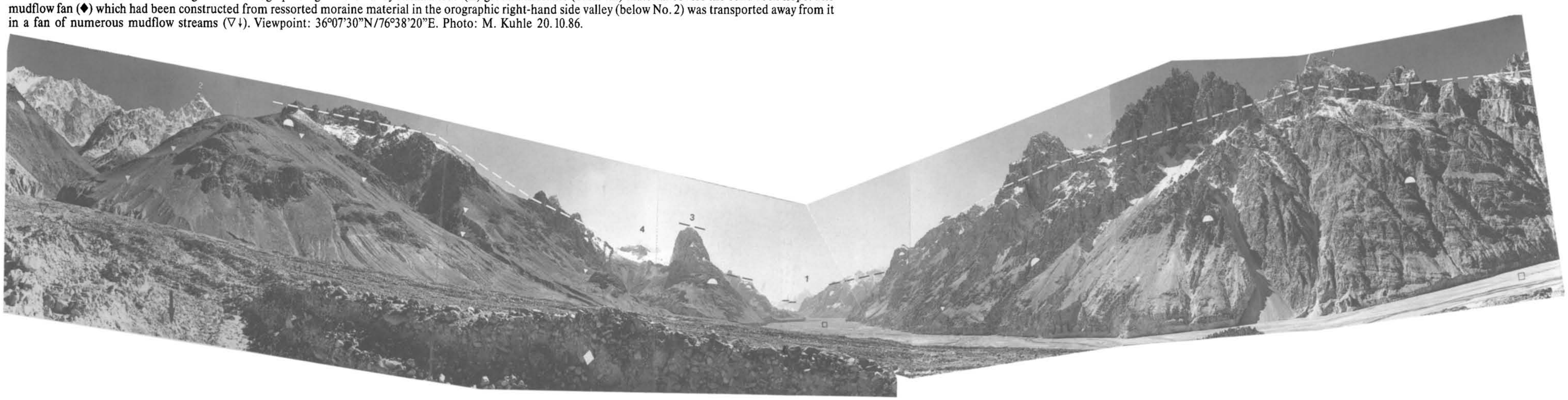



Fig 85 ▼
View from the drift floor of the Shaksgam valley (3960 m asl; Fig 138 between Nos. 12 and 20) down-valley towards the NNW into the right flank. Made up of limestones, the rock flank shows two flank abrasions and polishings of different quality (◓ lower, and ◓ upper abrasion or polish). Running at 5200 m asl, the upper ice scour limit (- - - - above) is attributed to the Main Ice Age ice stream level; (- - - - below) points to the Late Glacial Shaksgam valley glacier surface. (■) marks moraine material which is exposed along the right valley flank, partly at the core of more recent drift fans. (◓ far left) is the glaciated knob shown in greater detail in Figure 52 a. Viewpoint: 36°06'40"N/76°28'E. Photo: M. Kuhle 1. 9. 86.


Fig 87 ▼
View from the bottom of the "Northern Aghil pass valley" at c. 4740 m asl (Fig 138 No. 25) N of the 4863 m-high Aghil pass (/^). Panorama from SE (far left) via SSE with the Aghil pass (/^), via SW into the abraded and polished limestone flank (▲), via W to NW down-valley to the Surukwat-Yarkand valley system. On the far left, as also on the right of the photo, the orographic right-hand granite valley flank with flank abrasions and polishings (◢◣) and ice scour limits (- - - -) can be seen. The glacial flank abrasions and polishings on both sides of the valley (◣◢ in limestone and in granite) are evidence of the increase in the thickness of this Ice Age "transfluence glacier" from the Aghil pass, which came over from the Shaksgam valley and flowed down to the Surukwat valley. On the Aghil pass (/^) it only reached a transfluence thickness of c. 600 m (cf. Fig 86). Only the heights are wet enough to support pasture for the - here - rare yaks (foreground, left). Viewpoint: 36°12'N/76°37'E. Photo: M. Kuhle 30. 8. 86.

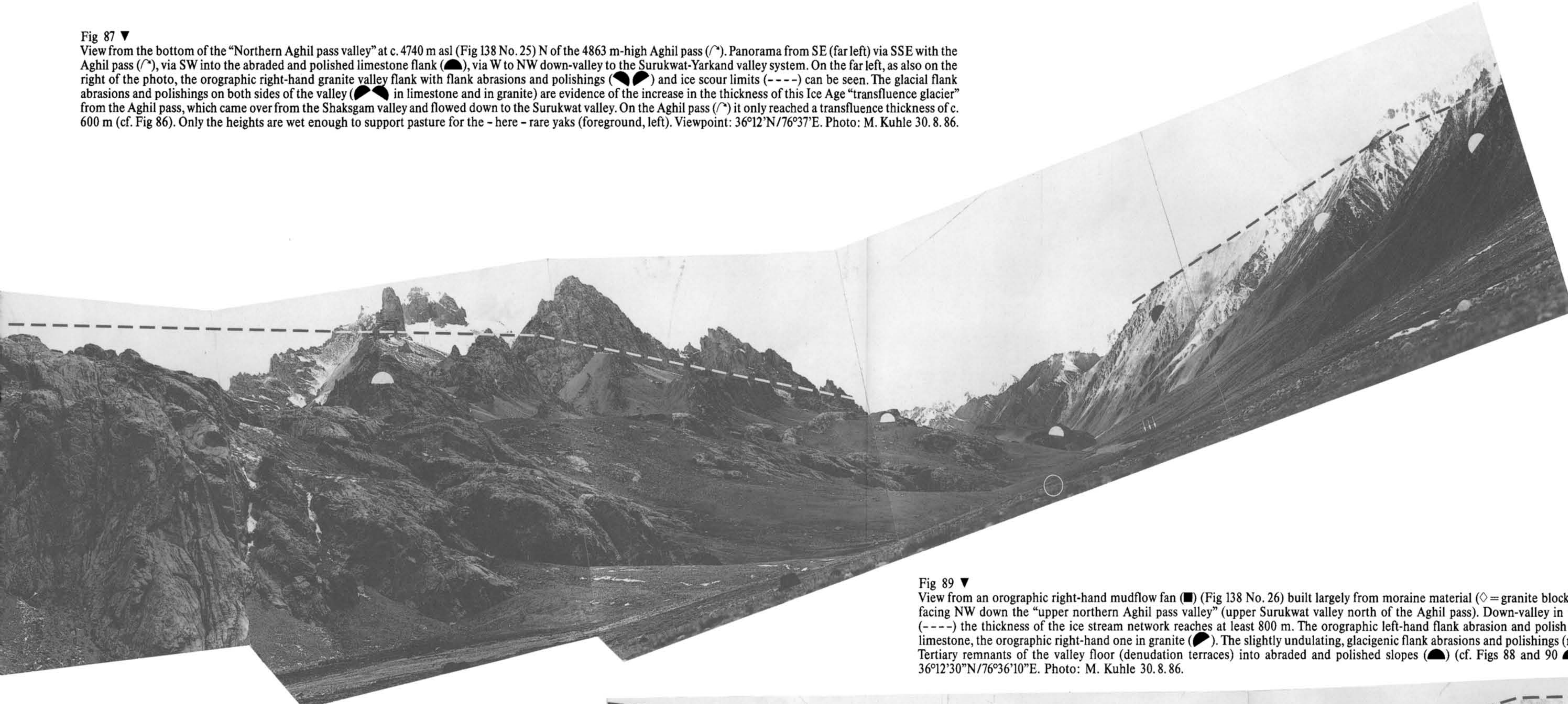
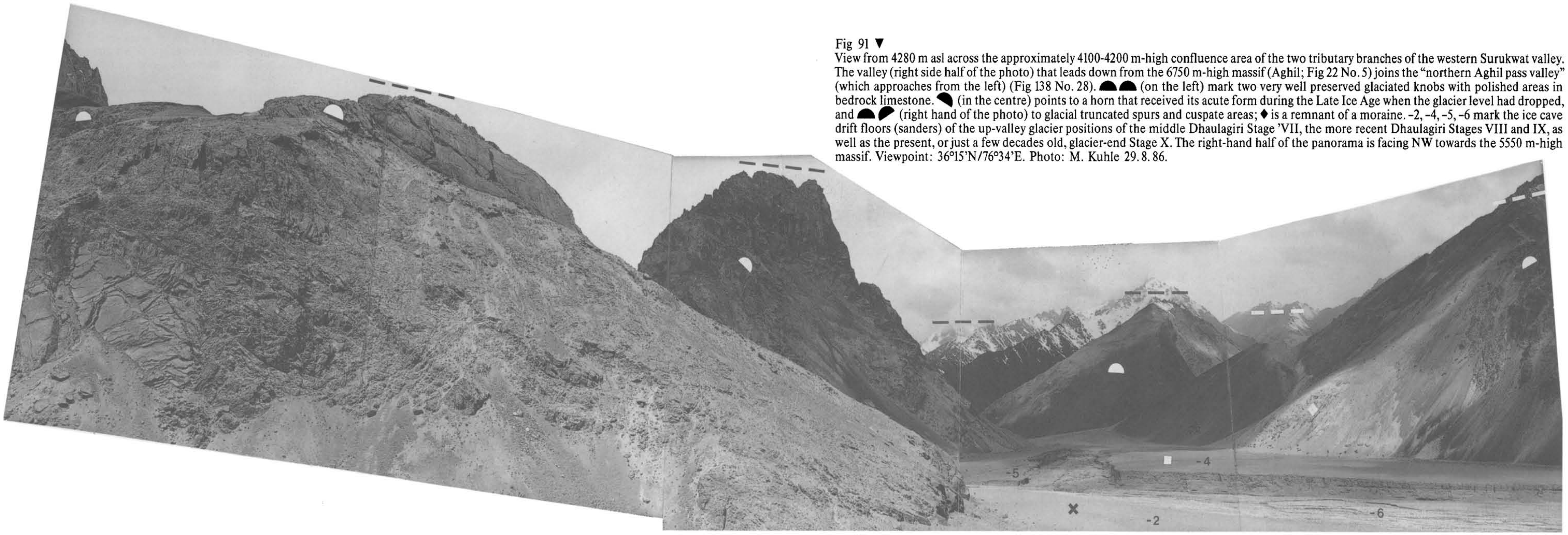


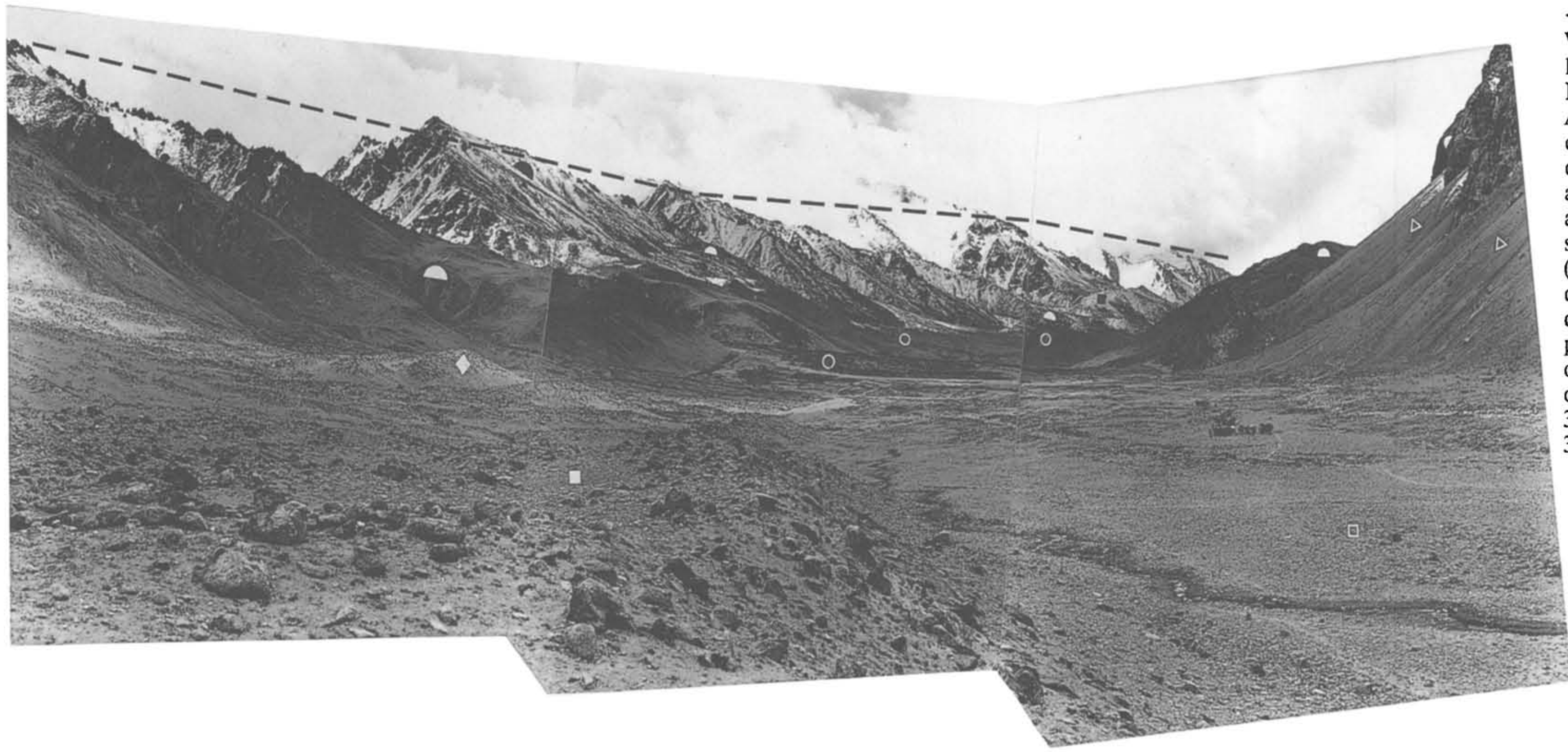
Fig 89 ▼
View from an orographic right-hand mudflow fan (■) (Fig 138 No. 26) built largely from moraine material (◇ = granite blocks) at 4670 m asl facing NW down the "upper northern Aghil pass valley" (upper Surukwat valley north of the Aghil pass). Down-valley in the background (- - - -) the thickness of the ice stream network reaches at least 800 m. The orographic left-hand flank abrasion and polish (◣) occurs in limestone, the orographic right-hand one in granite (◢). The slightly undulating, glacigenic flank abrasions and polishings (right) transform Tertiary remnants of the valley floor (denudation terraces) into abraded and polished slopes (▲) (cf. Figs 88 and 90 ▲). Viewpoint: 36°12'30"N/76°36'10"E. Photo: M. Kuhle 30. 8. 86.

Fig 86 ◄
View from 4880 m asl across the 4863 m-high Aghil pass (still free from snow in this particular October) (Fig 138 below No. 25) towards NW and on to the slopes of this transfluence pass (/^). Still covered by glacier ice in some places, these rock slopes were abraded and polished by a c. 600 m-thick glacier that branched off from the Shaksgam ice stream towards the NW (▲), forming glaciated knobs in bedrock limestone. Probably a result of the Main Ice Age, the level of the glacier, which joined up with the Yarkand ice stream network, thus creating a surface contact with the Shaksgam ice stream network, ran at about 5500 m asl (- - - -). || mark large blocks of granite, which are suspended in a matrix of fine ground moraine. Viewpoint: 36°11'25"N/76°37'20"E. Photo: M. Kuhle

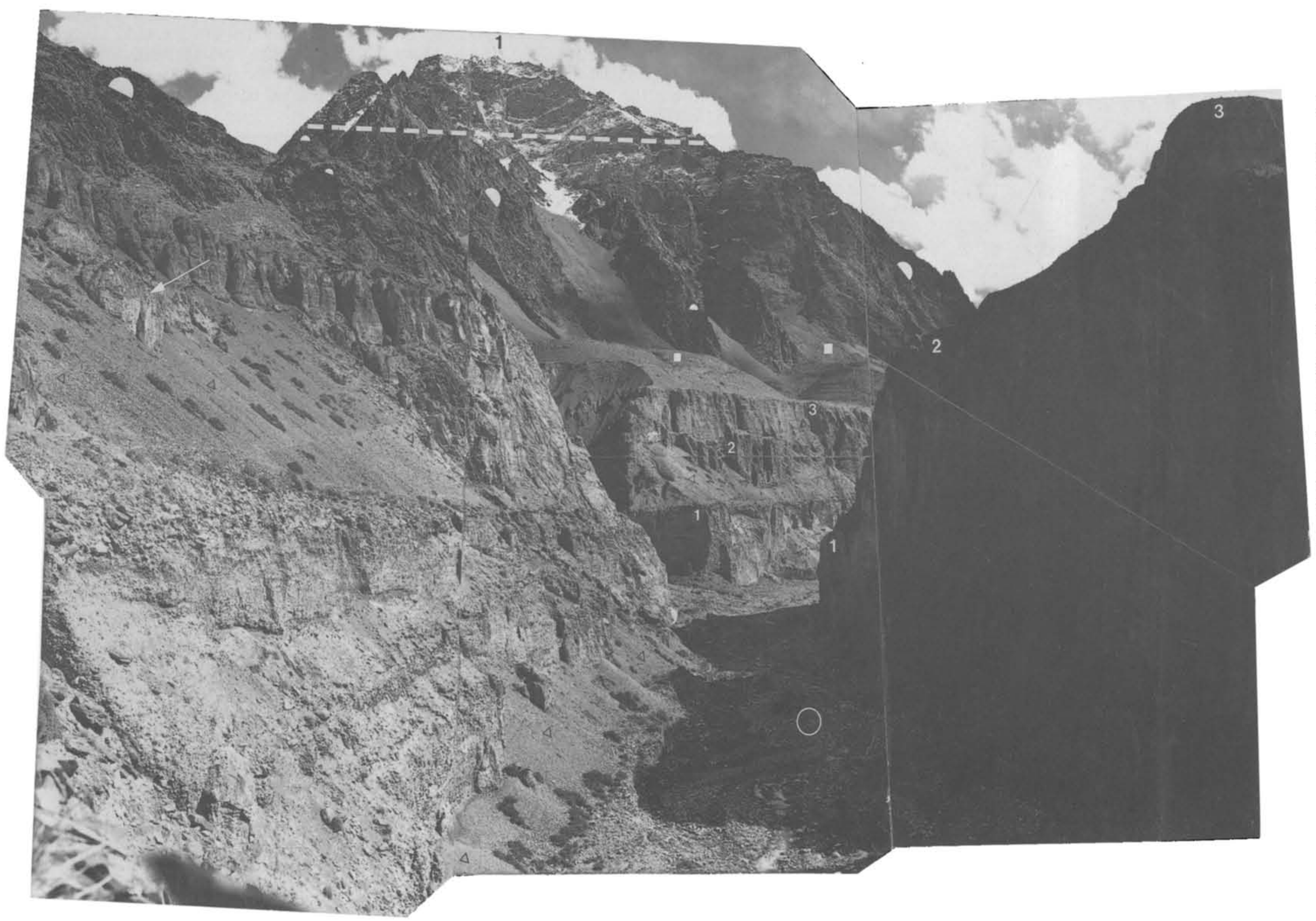
Fig 90 ▲
View from 4570 m asl towards the NE to the 6300 m-high massif (background) into the orographic right-hand flank of the "northern Aghil pass valley" (Fig 138 No. 26). The tributary valleys joining from the NE are glacigenic cuts. They divide the main valley flank into glacial cuspate areas and truncated spurs, which have undergone abrasion and polishing up to their highest points (- - - -). The side valleys release broad mudflow cones (O). The abraded and polished rock terraces (◒) preserve a Tertiary valley floor level (cf. Figs 88 ◒ left and 89 ◒ right). Weathered down to rough blocks, the granite only produced relatively insignificant scree slopes (∇) after deglaciation, but roughened up the glacier polish considerably. Viewpoint: 36°12'40"N/76°36'20"E. Photo: M. Kuhle 30. 8. 86.

Fig 91 ▼
View from 4280 m asl across the approximately 4100-4200 m-high confluence area of the two tributary branches of the western Surukwat valley. The valley (right side half of the photo) that leads down from the 6750 m-high massif (Aghil; Fig 22 No. 5) joins the "northern Aghil pass valley" (which approaches from the left) (Fig 138 No. 28). ◒◒ (on the left) mark two very well preserved glaciated knobs with polished areas in bedrock limestone. ◥ (in the centre) points to a horn that received its acute form during the Late Ice Age when the glacier level had dropped, and ◒◤ (right hand of the photo) to glacial truncated spurs and cuspate areas; ♦ is a remnant of a moraine. -2, -4, -5, -6 mark the ice cave drift floors (sanders) of the up-valley glacier positions of the middle Dhaulagiri Stage 'VII, the more recent Dhaulagiri Stages VIII and IX, as well as the present, or just a few decades old, glacier-end Stage X. The right-hand half of the panorama is facing NW towards the 5550 m-high massif. Viewpoint: 36°15'N/76°34'E. Photo: M. Kuhle 29. 8. 86.





◄ Fig 88
View from a Late Glacial orographic right-hand lateral moraine terrace (■) at 4500 m asl (Fig 138 No. 27) in SE direction up into the "northern Aghil pass valley". The valley floor (□, camel caravan further behind) consists of glaci-fluvial drift sediments and some mudflow dykes. It lies at 4450 m asl. The orographic right-hand flank abrasion and polish (◓) occurs in granite and shows glacial truncated spurs and cuspate areas (◓) between the side valley exits. Since deglaciation substantial debris slopes (▷) have developed below the partly crumbled flank polishings along the limestone walls on the orographic left-hand. O mark the mudlow cones of tributary valleys on the right. Viewpoint: 36°13'50"N/76°34'50"E. Photo: M. Kuhle 30. 8. 86.



◄ Fig 92
View from the orographic right-hand flank of the gorge section of the western Surukwat valley at 3840 m asl (Fig 138 No. 29) facing up-valley towards the S. Below the peak No. 1 (= a NW, c. 5430 m-high satellite of the 6300 m-high peak in the Aghil main ridge) a currently still glaciated orographic right-hand side valley joins. Its talweg reaches that of the Surukwat valley to the left of the two figures 1 in the valley bottom. In the very high parts of the steep walls especially (below No. 1), the glacigenic flank abrasions and polishings (◓◓) have been greatly affected and dissolved by denudation and rock-fall gully formation. Polished and abraded by Main Glacial glaciers up to its highest levels (till ----), the valley profile was filled with Late Glacial drift material (1, 2, 3), before its subsequent step-wise dissection into gravel terraces down to the present valley floor (O). Viewpoint: 36°17'20"N/76°35'E. Photo: M. Kuhle 29. 8. 86.

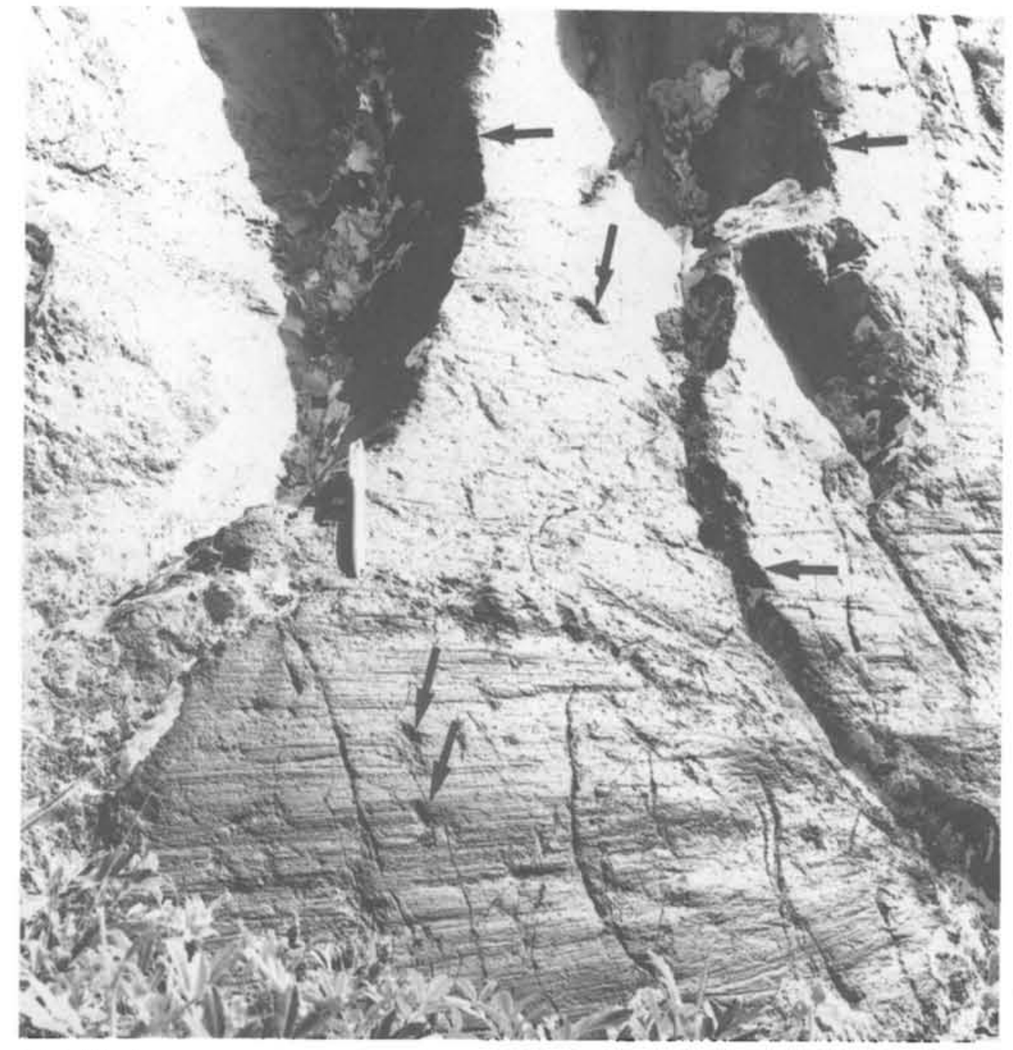


Fig 93 ▲
Detail of a quarzite rock face on the orographic right-hand flank of the western Surukwat valley at 3700 m asl, with striae from a prehistoric glacier (Fig 138 No. 46). The size of the striations (which are horizontally arranged) can be estimated by comparing them with a ball-pen (which is vertically arranged). ↙ mark the somewhat larger, more extensive injuries to the rock, like "chattermarks"; ← mark much more significant sickel-shaped rock outbursts in the direction of the ice movement (from right to left), which are to be attributed to detraction with the aid of regelation processes. The quarzite areas show iron manganese crusts, which point to considerable potential evaporation of this semi-arid to arid N-slope of the Aghil mountains. Viewpoint: 36°20'N/76°36'E. Photo: M. Kuhle 28. 8. 86.

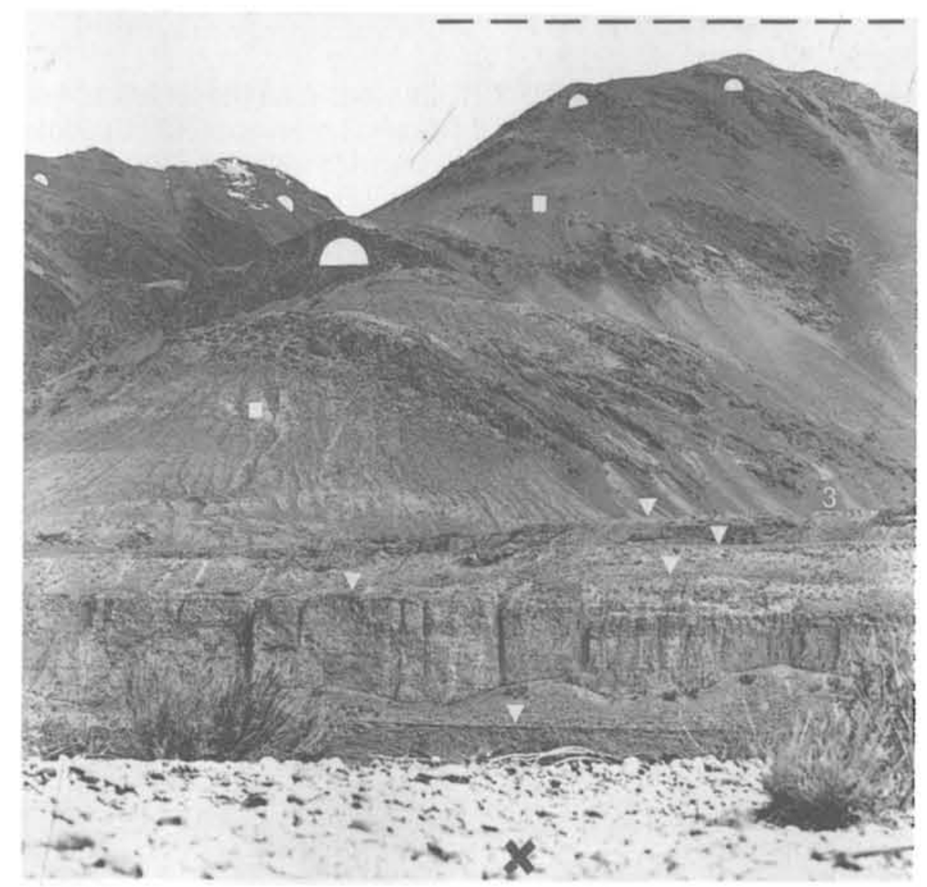
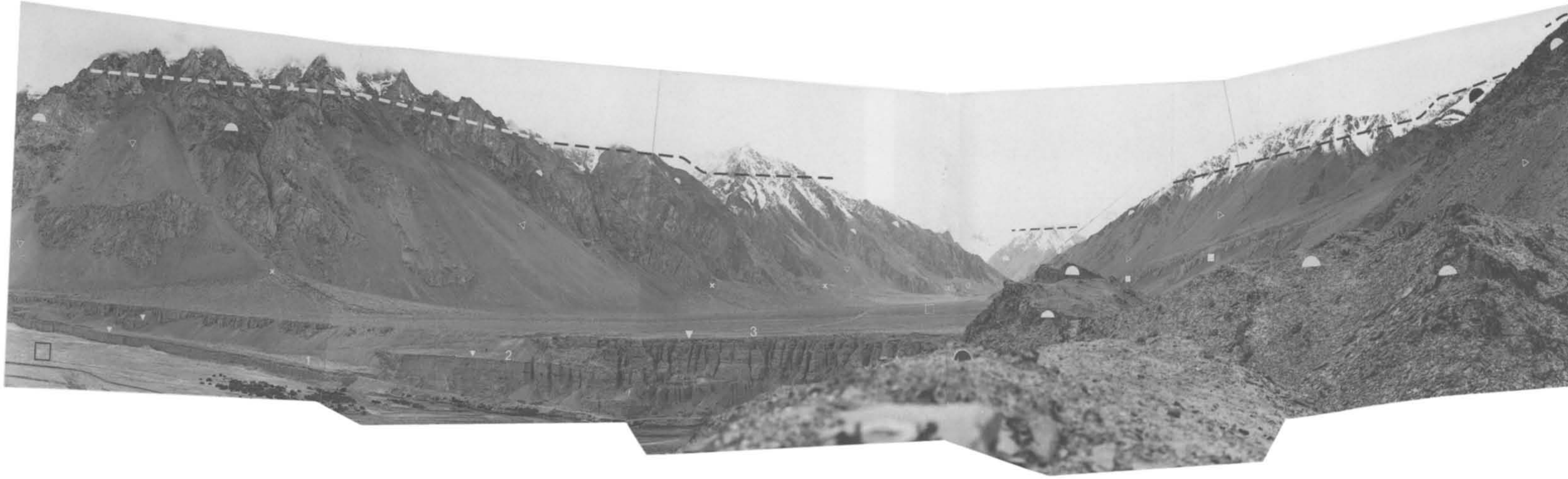


Fig 94 ▲
View from the lower western Surukwat valley at 3500 m asl (X) towards the orographic right-hand valley flank in the SE (Fig 138 No. 48). At its base five ice cave drift floor terraces (outwash terraces ▼▼) pile up as far as the outwash level 3 (middle Late Glacial period: Taglung Stage II). Further up they are followed by abrasions and polishings in the form of glaciated knobs (◓). They occur in the outcropping edges of the strata of reddish-brown sandstone. When seen from the perspective of Figure 95 (◓◓ far right) these flank polishings can be recognised as part of a glacigenic cuspate area (Fig 138 left of No. 48). Between the abraded and polished rocks early-Late Glacial ground moraine covers (■■) are deposited on the slopes. Viewpoint: 36°25'N/76°40'40"E. Photo: M. Kuhle 29. 8. 86.

Fig 95 ▲
View from the confluence of the eastern (left) and western Surukwat valley (Fig 138 between Nos 33 and 48) at 3490 m asl (X), showing a panorama from E (left side edge of the photo) by way of S (No. 6 = 5100 m-high ridge-back on the NE spurs of the 6300 m massif in the Aghil) to SSW (right side edge of the photo). Between the cuspate areas the Ice Age glacial flank abrasion and polish has caused (▲ right side of the photo) glacigenic V-shaped valleys (⇩) to terminate. They are now unglaciated up to the source basin of the valley (terminal facettes of the valley) (○). Above the present valley floor (X) the Late Glacial (3, 2, and 1) to Neo-Glacial and historic glacifluvial drift terraces rise like stairs (▼▼). Some of their areas are the recipients of alluvial fans from adjacent valleys (for instance, 3 on the left and 2 on the right). On the left side of the photo a granite mountain spur has been abraded to a great height (- - - -) by the eastern tributary of the Surukwat glacier (▲▲). Viewpoint: 36°20'15"N/76°41'20"E. Photo: M. Kuhle 28. 8. 86.

Fig 96 ▼
View from the area of terrace 3 ▼ (talus cones △ on the far left and mudflows are set in upon them) of the orographic right-hand side of the lower Surukwat valley at 3590 m asl down-valley towards NNE (middle of the panorama), to the confluence with the Yarkand valley (left below No. 1) (Fig 138, right of No. 33). Above the wide valley drift floor (□) and the drift floor terrace (▼) glacially abraded and polished trough flanks (▲▲) extend as far as the ice scour limits (- - - -) at 4400 m asl. In places Late Glacial embankments with cores of lateral moraine (bank formations) are deposited against these trough flanks (■). No. 1 marks up to 5250 m-high mountain ridges SE of the 5994 m-high peak (Kuenlun mountains). ▲▲ (above ↑) are the glaciated knobs in the confluence area, which are shown in detail in Fig 98. Viewpoint: 36°22'N/76°41'E. Photo: M. Kuhle 28. 8. 86.

Fig 97 ▲
View from a location near "Ilik" in the confluence area of the Yarkand and Surukwat valley at 3455 m asl (Fig 138 right-hand side above No. 33), facing S towards the Surukwat valley and up to the Aghil mountains (No. 6). The camel caravan is standing on the present drift floor among myricariae bushes. The highest, orographic left-hand, Late Glacial drift terrace (▼ 3 = drift floor of the Taglung Stage II) has received talus slopes (▷) as well as mudflow cones (X), ie they have formed after the middle Late Glacial period. The ice scour limits (- - - -) entered above the Main Glacial flank abrasions and polishings (▲▲) and run up to 1000 m above the drift floor (□). The polish of the glacial cuspate areas (right and left of ⇩) between the confluences of the V-shaped valleys (⇩) has been well preserved. Viewpoint: 36°22'50"N/76°41'E. Photo: M. Kuhle 28. 8. 86.



◄ Fig 98
View from the confluence area of the Surukwat valley (left edge of the photo) and Yarkand valley (right half of the photo) (Fig 138, approximately between Nos. 33 and 34) at 3580 m asl, looking down the Yarkand valley towards the WNW (□ right). Polished or abraded out up to an altitude of 4400 m asl (- - - -) during the Main Ice Age, the bottom of this trough consists of a fresh drift floor (□ left) and the Late Glacial drift terraces 1, 2 and 3 of the Sirkung Stage (IV), the Dhampu Stage (III), and the Taglung Stage (II) glacier stands. After deglaciation the flank polishings and abrasions (●◖◗) were transformed or covered by talus cones and slopes (▽), by mudlow fans (X), and by Late Ice Age kames with moraine cores (■). In the foreground and middle ground on the right glaciated knobs occur in vertical phyllites (●●) (cf. Fig 42). Below ▼ No. 2 the expedition camp with tents and grazing camels can be seen in the "Ilik" locality. Viewpoint: 36°23'30"N/76°41'35"E. Photo: M. Kuhle 27. 8. 86.

Fig 99 ▲
View from the present drift floor of the lower Surukwat valley at 3450 m asl in the confluence area with the Yarkand valley (Fig 138, right of No. 33) facing NE, up the glacial Yarkand trough. Above the glacigenic drift terraces (▼) 2 and 3 a glaciated knob (●) can be seen, which was created by the glacial abrasions and polishings of the early Late Glacial period (Ghasa Stage I) and of the Main Glacial period. During the post-Main Glacial period this glaciated knob (cf. Fig 128 ● in the background) was undercut by the Surukwat river on the side shown here. This caused steep crumbling (cf. Fig 101 right of the left ●). Even the terrace levels break - due to the effect of the undercutting (○). (- - - -) marks the Ice Age glacier level in the Yarkand trough throughout the valley with its sinusoidal flank polish profiles (◖◗). Rubble production (▷) after deglaciation has profited from bedrock slate, which is prone to frost weathering along the line of crevices. (■■) point to Late Ice Age lateral moraine terraces (bank formations). Viewpoint: 36°23'N/76°41'E. Photo: M. Kuhle 28. 8. 86.

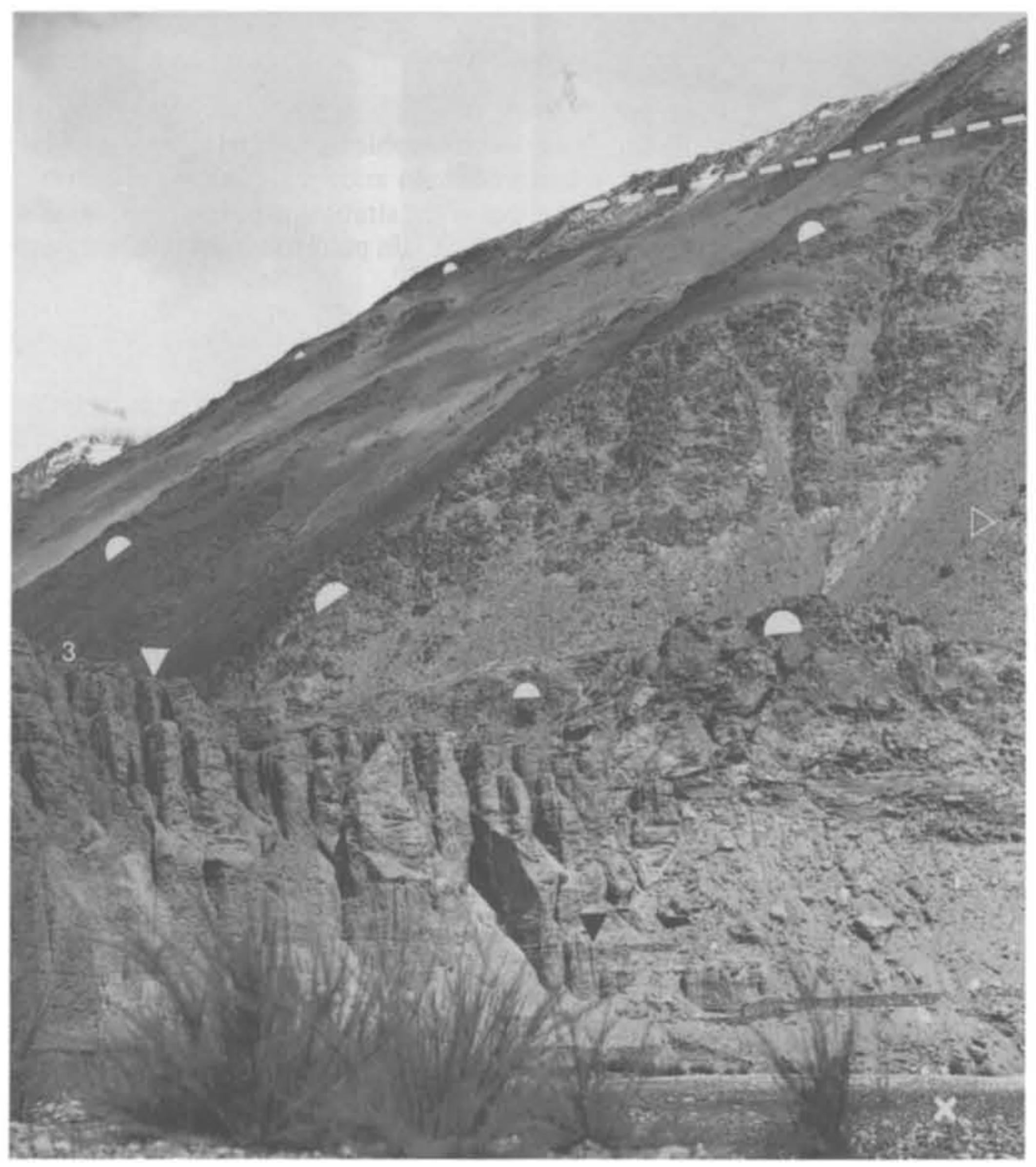


Fig 100 ▲
View from the drift floor of the lower Surukwat valley near "Ilik" in the confluence area with the main valley (Yarkand valley) at 3450 m asl (Fig 138 between Nos. 33 and 49), facing N into the right flank of the Yarkand valley. Built up from phyllites, this valley slope is glacigenically abraded and smoothed (◗) well above its outcrops up to an ice scour limit (- - - -) at c. 4400 m. Since deglaciation semi-arid, and moreover high continental, frost weathering has been particularly productive in these phyllosilicates (▷). Below the valley flank there are glaciated knobs (●) at 3580 m asl (see Figs 42 and 98 ● in the detail); these glaciated knob rocks, in turn, have drift floor terraces deposited below them (3 ▼▼). These glaciated knobs have "drowned" in the Late Glacial drift floors No. 3 (Taglung Stage II). Viewpoint: 36°23'N/76°41'10"E. Photo: M. Kuhle 28. 8. 86.

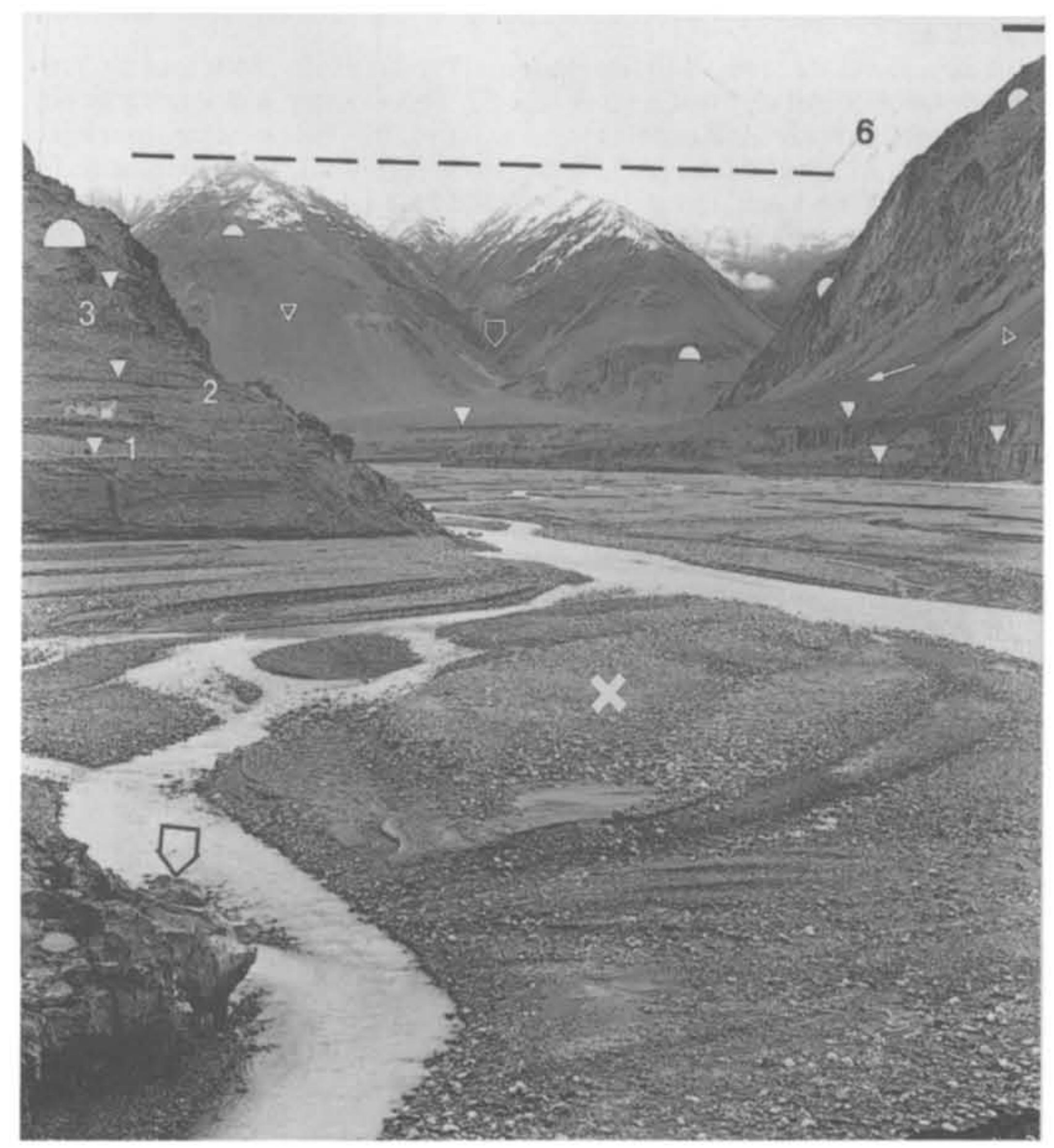
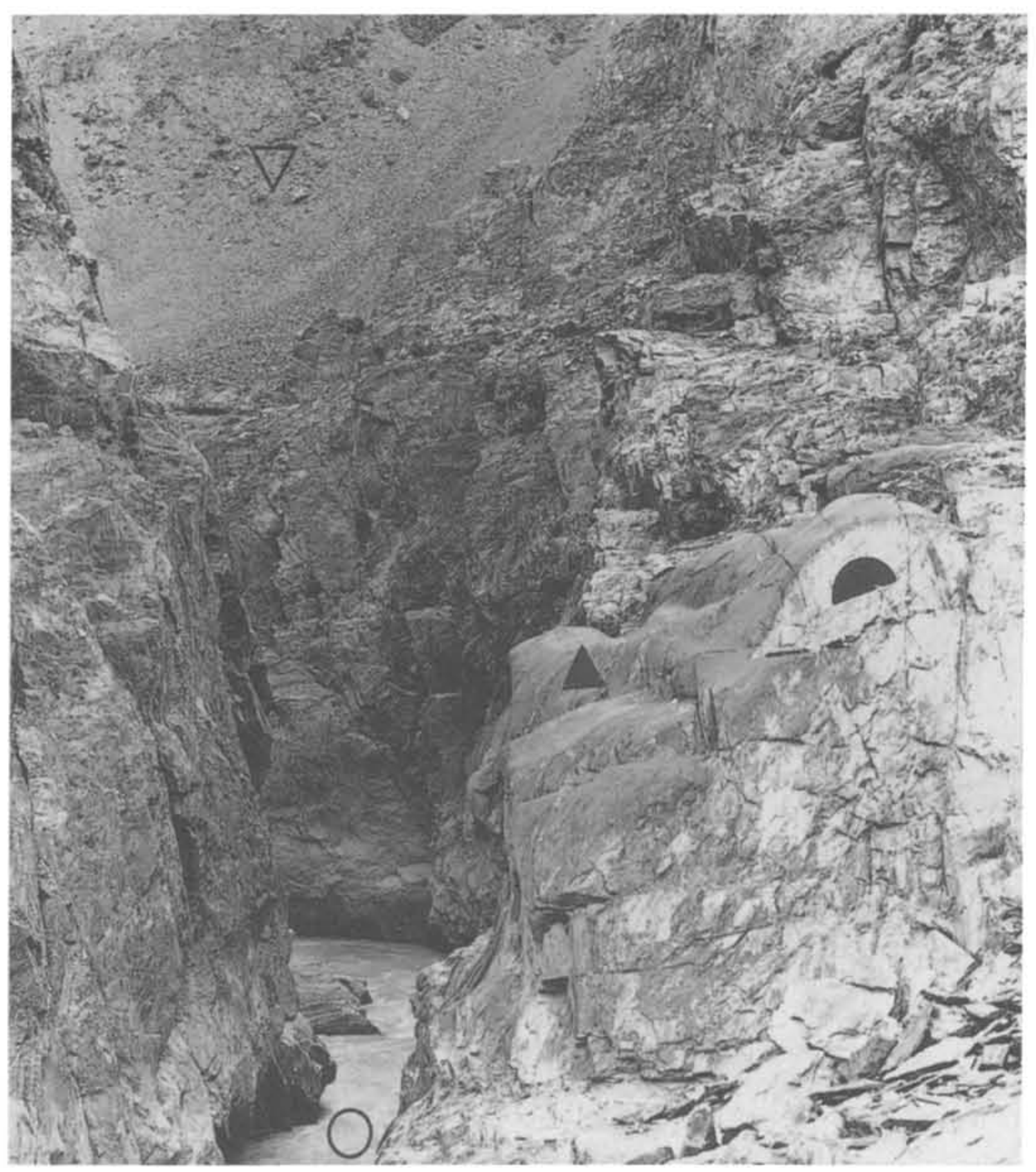


Fig 101 ▲
View from the locality where the Surukwat meltwater run- off (X) joins the Yarkand (Fig 138, somewhat higher to the right of No. 33) at 3460 m asl, facing S and up the Surukwat valley. ∇ (foreground) marks churn-like or pothole-like rock forms due to the activity of Late Ice Age subglacial meltwater run-off (locality see Fig 96 ↓). In the background glacigenic cuspate areas and truncated spurs (●●) between the V-shaped side valley exits (∇); in the middle ground on the left Late Glacial drift floor terraces (▼) 1, 2 and 3, and above a post-glacial fluvially undercut glaciated knob (●) (locality see Fig 96 ●, left above □). Viewpoint: 36°23'N/76°41'20"E. Photo: M. Kuhle 27. 8. 86.

Fig 103 ▲
View from one of the lowest drift floor terraces (▼) on the valley bottom of the Yarkand valley (Fig 138 between Nos 49 and 34) at 3680 m asl, looking into the orographic right-hand side valley. The panorama from N (left edge of the photo) to E (right-hand edge) shows a hanging valley, which is connected by a kilometre-wide exit step that is set in rock (□). This exit step, and simultaneously glacigenic confluence level, is divided up into separate glaciated knobs (▲▲ middle ground in the centre). These glacigenic polish forms of the bottom, which are formed in bedrock slate (phyllite) are covered by Late Glacial moraine material (■ middle ground in the centre). Below the ice scour limit (- - - - in the background) polished slopes, occuring on outcropping edges of the stratum, are preserved (▲▲) and further down even Late Glacial lateral moraines and Main Ice Age remnants of ground moraine (■ in the background on the right) (cf. Fig 99 ◣■ in the background). After deglaciation frost-weathering has covered the steep relief with talus cones and talus slopes (▽). In parts the older (higher) glacifluvial pebble terraces (▼▼) contain rhythmic limnites (varve clays) (X) which point to the damming back of a glacier lake in the lower Yarkand valley by the Late Glacial Surukwat glacier. Viewpoint: 36°25'N/76°43'30"E. Photo: M. Kuhle 27. 8. 86.



◀ Fig 102
At the point where the Surukwat joins the Yarkand (locality see Fig 96 ↑) it cuts (○) with a gorge through a bedrock slate threshold (3445 m asl; Fig 138 between Nos 33 and 49). A few metres above the river the fine reliefs of Late Glacial glacier polishings are preserved (▲▲). Likely to have been set down already in sub-glacial times, the gorge cut through the latter. Viewpoint: 36°23'N/76°41'20"E. Photo: M. Kuhle 27. 8. 96

Fig 104 ▼
View from the orographic right-hand drift terrace edge near the "Mazar" military station, a few metres above the Yarkand river at 3800 m asl facing SE (Fig 138 between Nos 38 and 39). The glacigenically V-shaped valley (right-hand edge of the photo) leads down from the 5880 m-high peak in the Aghil mountains, now displaying only minor glaciation, or firn shield trimmings (○) on the slopes of its source basins. The orographic right-hand flank of this side valley (◣), as well as the left flank of the main valley (Yarkand valley) experienced glacigenic flank abrasion and polishing (▲) on the bedrock metamorphites. Exposed since deglaciation, and weathering fast under freeze-thaw cycle conditions, the sedimentary rock bears near-surface frost debris covers, which merge with talus slopes (◆) further down. Five different levels of glacifluvial and fluvial terraces must be discerned here (▼▼). (- - - -) marks the highest established ice scour limit of the prehistoric Yarkand glacier at c. 4900–5000 m asl (cf. Fig 105). It ran c. 1000 m above the accompanying ELA. The forms, which have taken shape in the valley flank in the area of this ice scour limit (- - - -) belong to the Late Ice Age in respect of their formation. Viewpoint: 36°26'40"N/77°00'E. Photo: M. Kuhle 21. 8. 86.

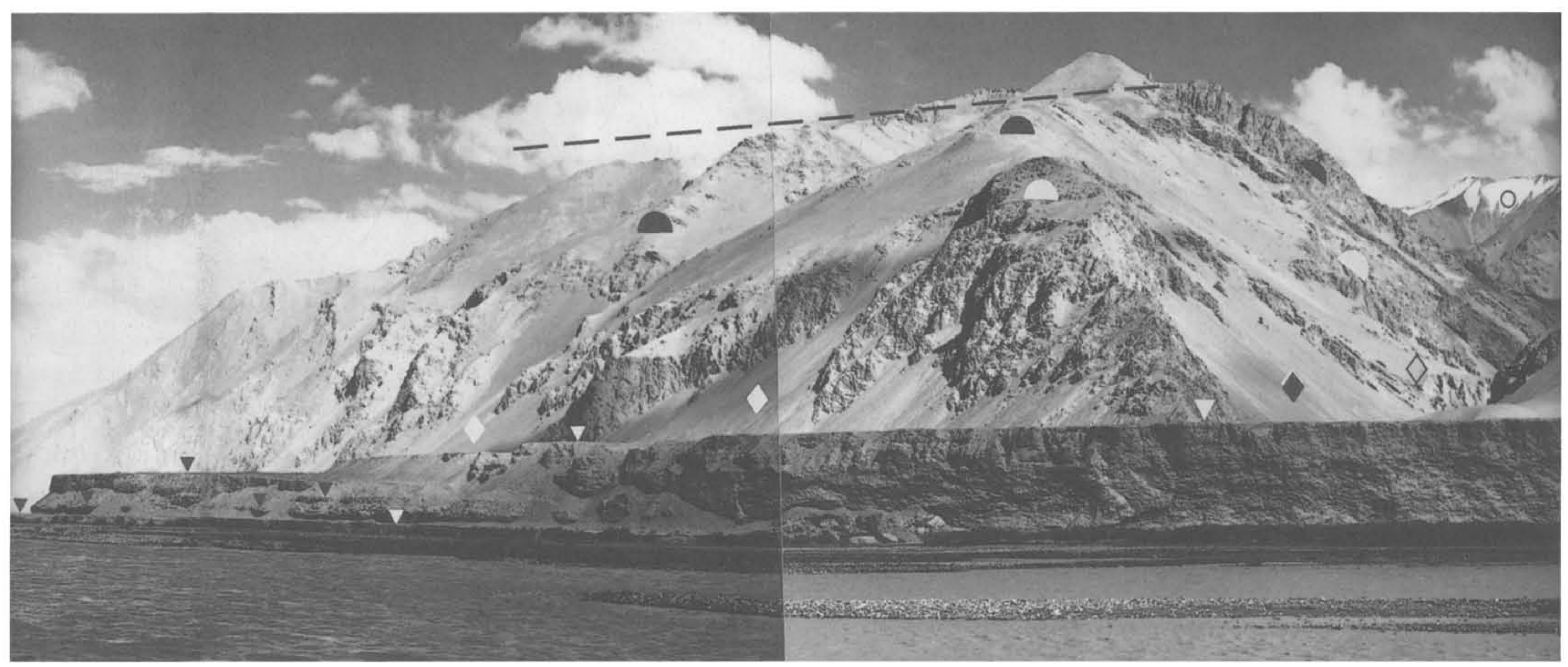


Fig. 105 ▲
View from the transfluence pass (◓) on the orographic right-hand flank of the Yarkand valley 600 m above the valley floor (□) at 4420 m asl, looking W down the valley (Fig 138, left next to No. 53). Largely polished by glacigenic flank abrasion and polishing (◓◓) up to the ice scour limit (- - - -) at 5000–5100 m, the outcropping edges of the strata of bedrock metamorphites are more or less steeply cut by the slopes, mountain ridges and transfluence pass areas (cf. Fig 104). The cross-profile of the Yarkand valley shown here is that of a classic trough, the bottom of which was infilled by a braided river to form a canyon (□). Periglacial debris formation which cause slopes of frost compensation, concordantly transforms its flanks (▷). Late Glacial bank formations and moraines have been locally preserved (■). ○ and ▼ mark alluvial fans from side valleys, as well as terrace levels from glacifluvial drift floors. Viewpoint: 36°28'30"N/77°05'15"E. Photo: M. Kuhle 24. 8. 86.

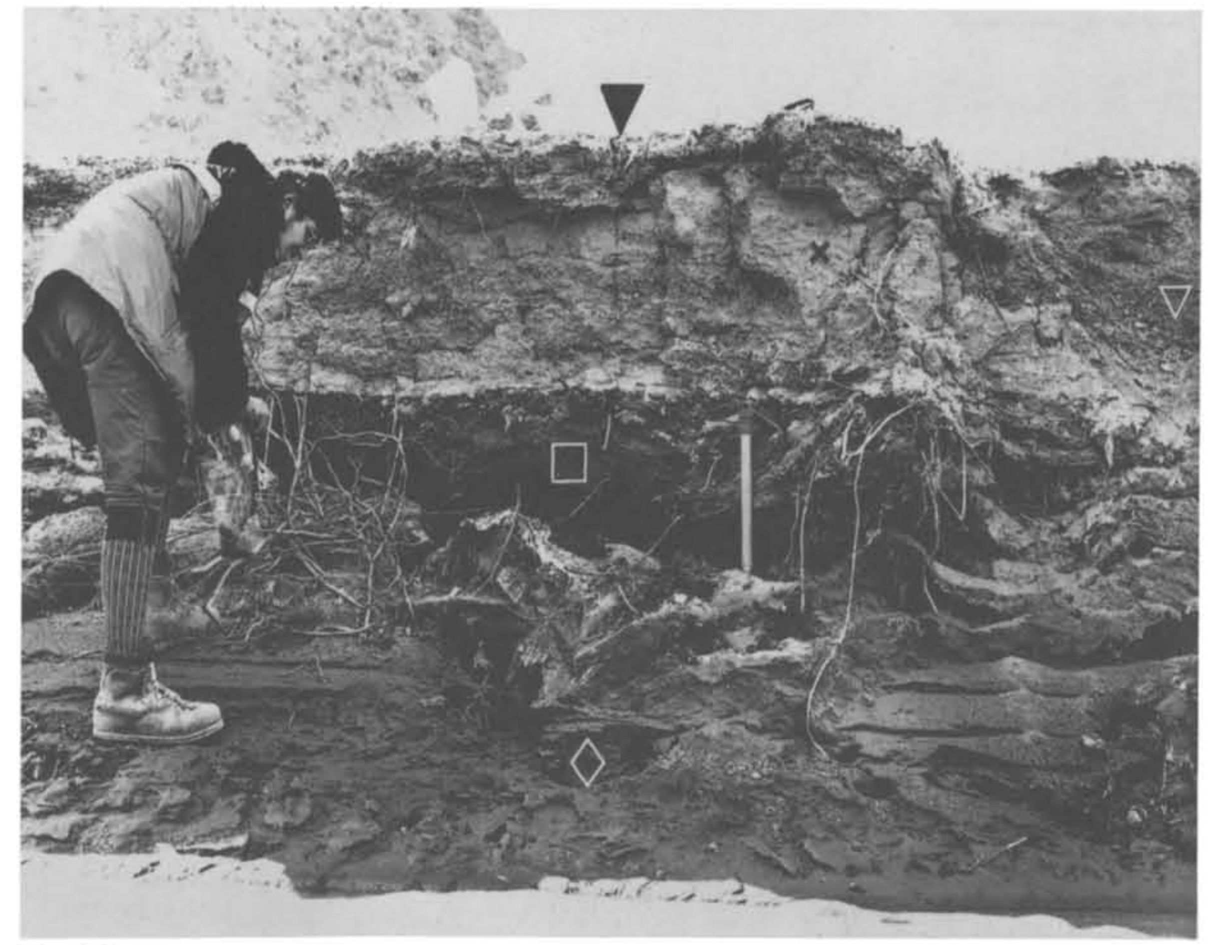
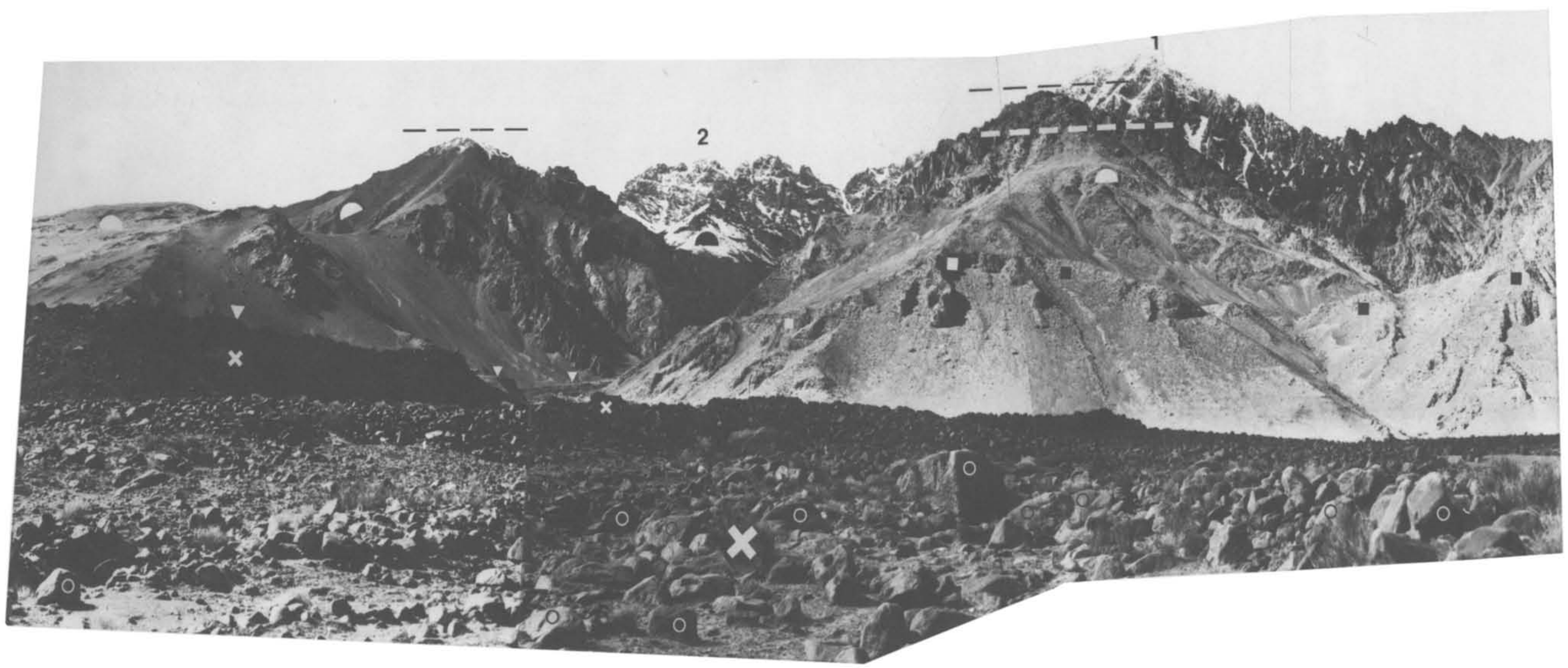


Fig 108 ▲
Exposure at 3760 m asl on the orographic right-hand bank of the Yarkand river, a few decimetres above the level of the fore-flood level (Fig 138 No. 37, cf. Tab 2 samples 24. 10. 86/ 4/1b/1c/1d). There is river sand and gravel (◇ at the base of the exposure, and above a stratum of peat (□) (the ice axe is 55 cm long), which being between 0.60 and 1.0 m below the surface of the exposure (▼) has been radio-carbon dated to be 110 ±60 YBP, 4580 ±65 YBP and 5935 ±85 YBP. They are covered (X) by more recent alluvial fan material. The most recent (first) date is explained by the fresh, recent root network. The two older dates are evidence of the time of origin of glacifluvial valley drift floors (sanders) of Neo-Glacial glacial locations. This contains evidence of a totally ice-free main valley floor in this valley chamber in the Neo-Glacial period, which is significant in this context. The Yarkand glacier had already left here during the Late Ice Age. Viewpoint: 36°24'N/76°52'E. Photo: M. Kuhle 24. 10. 86.



◀ Fig 106
View from the edge of a mudflow fan (X) near the talweg of the Yarkand valley at 3780 m asl into the orographic right-hand valley flank (Fig 138 No. 37). The exposure is facing N into the 6532 m massif of the Kuenlun main ridge, with the satellite peaks Nos. 2 and 1, which are visible here. The 6532 m-high main peak lies a little outside the angle of vision where the ridges of the peaks No. 2 and 1 meet (left, behind and above No. 1). The mudflow fan (Xx) consists of dislocated granite moraine material with rough blocks (○), which has been transported out of the orographic right-hand side valley (below No. 2). On the lower parts of the slopes of the orographic right-hand main valley flank a lower (■ left) and a higher lateral moraine terrace, with kame sediments, have been deposited (■ right). They belong to the last Late Glacial glacier stages to have had a main valley glacier. At that time the glacier surface was already far below the ELA. The very different state of preservation of the glacigenic flank abrasions and polishings (◓◓) permits a differentiation of two ice scour limits (- - - - below and above) or glacier levels. The lower limit belongs to the earliest Late Ice Age, to Ghasa Stage (I); the upper one to the Main Ice Age. In both cases the upper surface of the ice stream network was above the snow line. Viewpoint: 36°23'50"N/76°51'10"E. Photo: M. Kuhle 26. 8. 86.

◀ Fig 109
View from 4200 m asl down the "southern Mazar pass valley" towards the Yarkand valley in the SSE (background) (Fig 138 left above No. 39). In this glacial trough valley with rock abrasion reaching far up the flanks (◖◗) of crystalline slates (phyllites) a drift floor (□) was laid down, which in turn received at least five levels of drift terraces (▼), thus creating a canyon-shaped cross-profile of the valley. Frost weathering after deglaciation created decimetre- to metre-thick debris covers, as well as talus slopes (△▷) that rise up many hundreds of metres. Steep wall gorges or large gullies produce mixed forms of mudflow/alluvial fans (○). In places where the river undercuts these tall slopes on precipices, dry avalanches cause successively rising cracks (↗). Viewpoint: 36°29'35"N/76°59'35"E. Photo: M. Kuhle 20.8.86.

Fig 110 ▼
View from 4000 m asl towards the SE across a ridge and up the Yarkland valley (right) into an orographic right-hand side valley (left) (Fig 138 No. 53). Composed of metamorphosed sedimentary rock of varying hardness (phyllites with quartzite strata), the ridge has been abraded by Main Ice Age glacier filling of the valley system (◗). ---- marks the accompanying glacier level on the basis of glacigenically abraded and polished areas of the valley slopes and valley slope spurs (◗). The rough gorge flanks of the most recent Post-Glacial fluviatile linear erosion (↓) present a contrast to their soft forms. (■) indicates a block glacier and the presence of permafrost in this valley landscape above 3800 m asl. (○○) label valley-head basins suitable for Ice Age and Late Ice Age cirque formation; (▼▼) mark the edges of Late to Post-Glacial drift floor terraces, some of which must be regarded as glacifluvial sander formations. Viewpoint: 36°28'10"N/77°05'20"E. Photo: M. Kuhle 23.8.86.

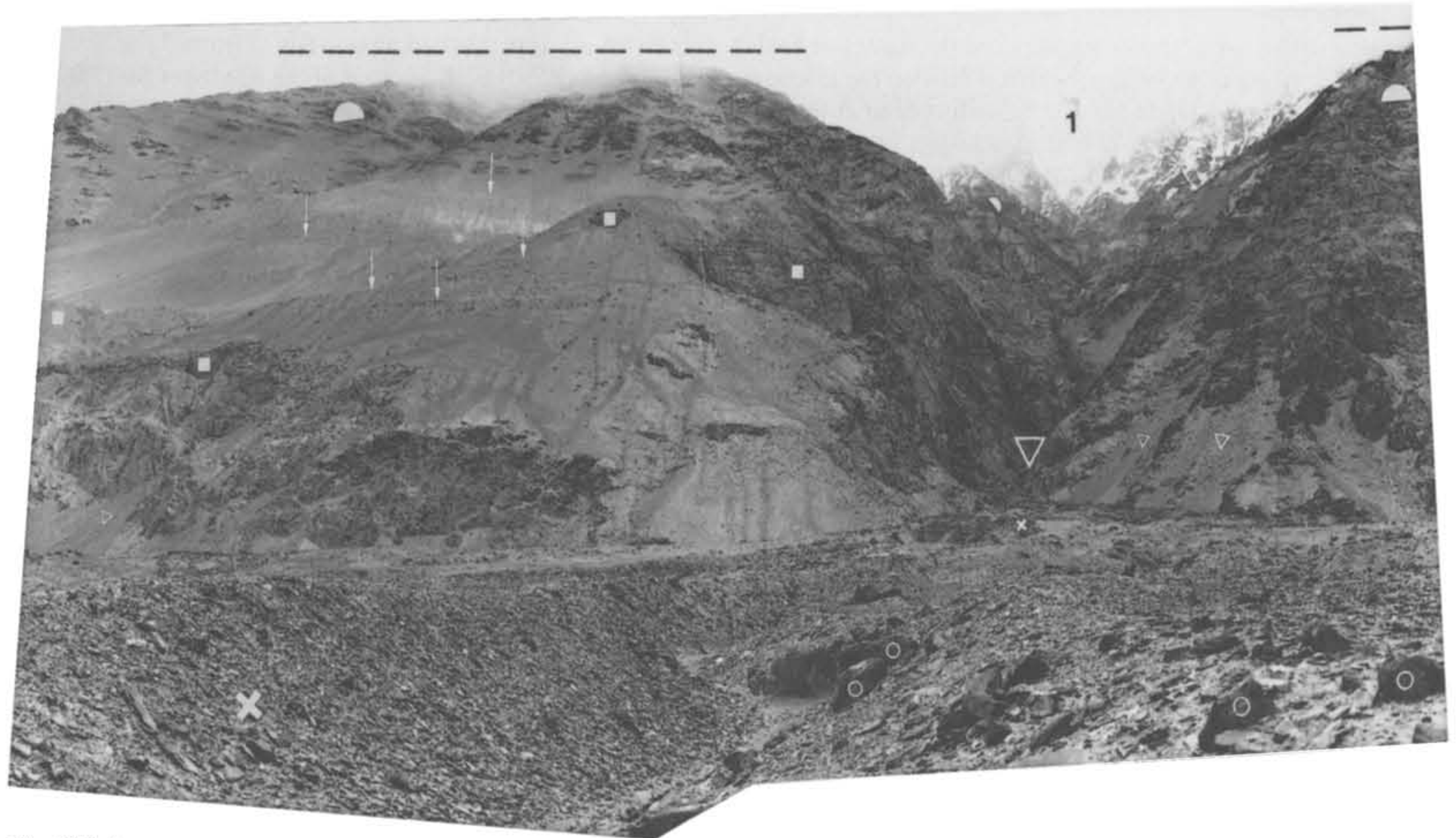
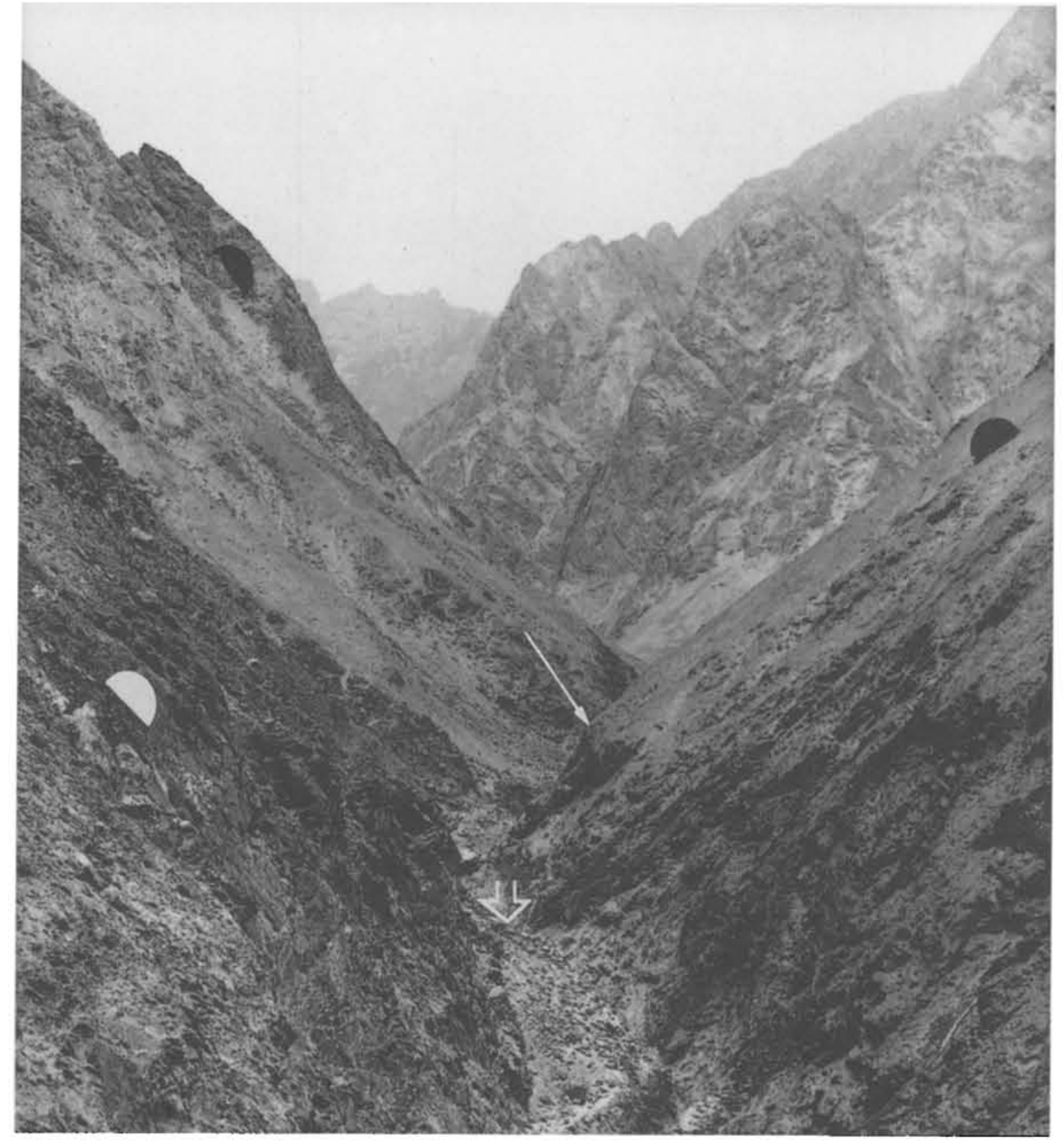


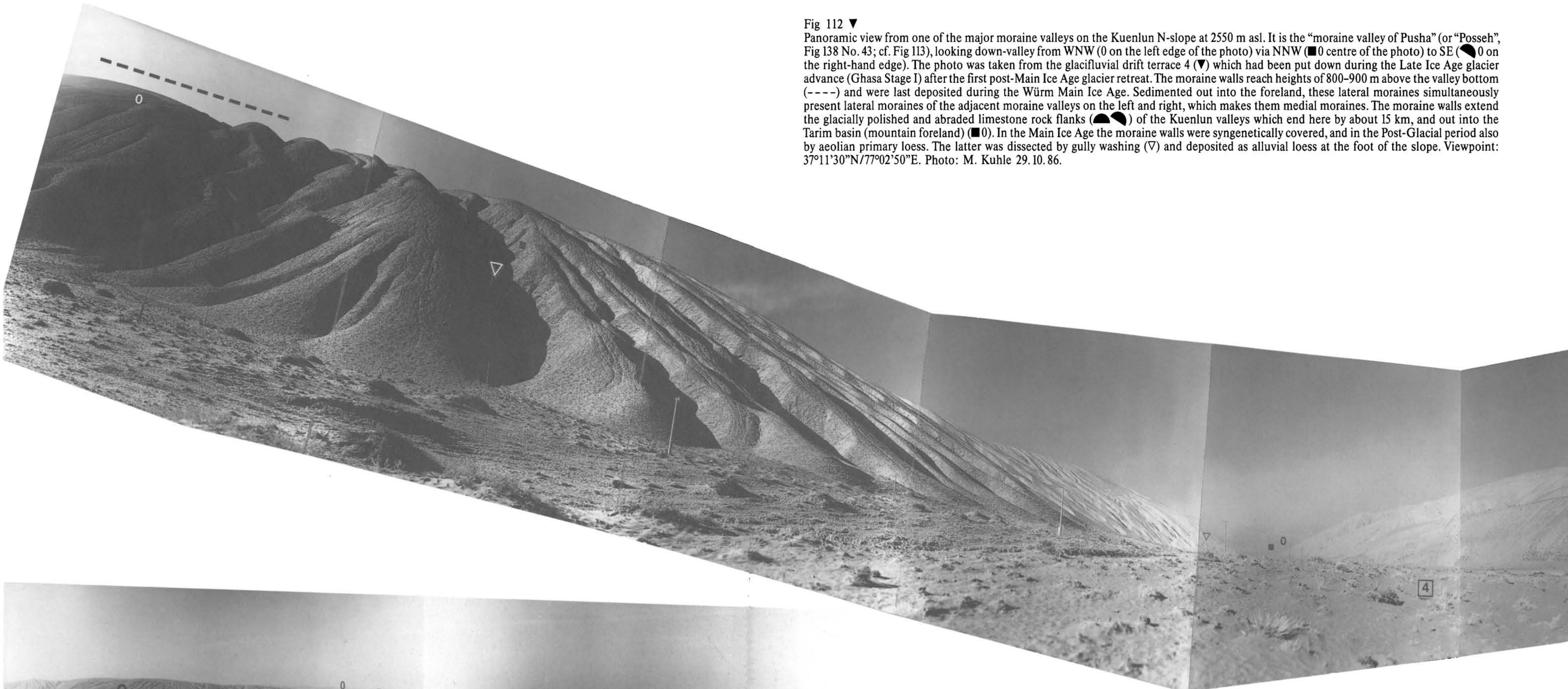
Fig 107 ▲
View from 3700 m asl across a mudflow fan (X) facing S into the orographic left-hand flank of the Yarkand valley and into a steeply descending side valley (Fig 138 above No. 49). No. 1 = c. 5300 m-high peak in the highest catchment area of this V-shaped side valley. It is set in phyllites, with the upper slope sections shaped by glacigenic flank polishing (◥◤). Running along a gully-like narrow gorge, the talweg (∇ large) is the result of subglacial cutting. While passing over its outcropping edges of the stratum, the main glacier (◓) has abraded and polished the main valley flank to an altitude of c. 4700–4800 asl (- - - -). Below it is connected to a ground moraine cover (■■ left), with exaration furrows and lineaments of rough blocks (↓↓), which lies on top of the bedrock rock flank. In the side valley exit there is an orographic right-hand lateral moraine of the tributary glacier (■■ right), which has pushed across the Late Glacial main glacier or fitted themselves to its side. Here, too, the major part of the mudflow cone consists of dislocated Late Glacial moraine material with rough blocks (○○). Viewpoint: 36°24'50"N/ 76°43'20"E. Photo: M. Kuhle 27. 8. 86.



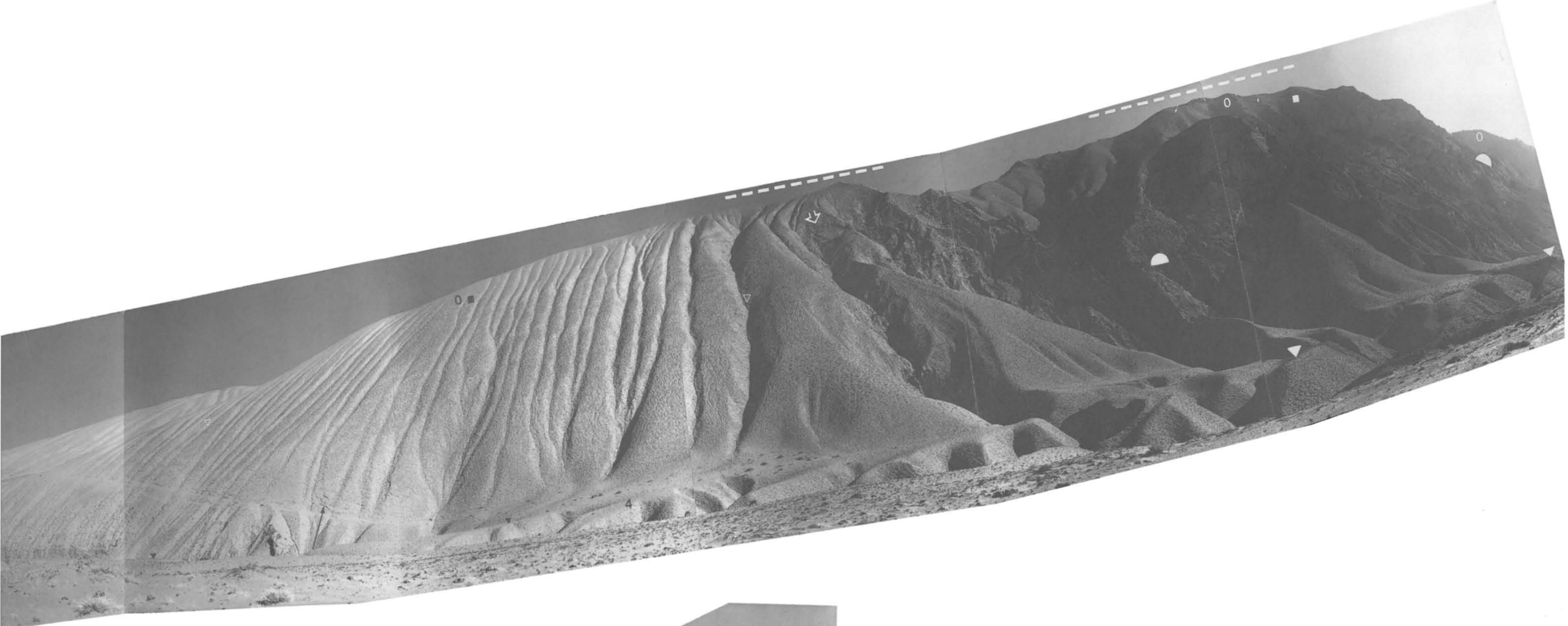
◀ Fig 111
View of an orographic right-hand side valley of the "Kudi valley" at c. 3000 m asl, facing E and up-valley (Fig 138 below No. 54), which must be considered a representative glacigenic, V-shaped gorge valley of the Kuenlun N-slope. There are glacial flank abrasions and polishings in the bedrock granites (◥◤), which result in a slightly concave broadening of the gorge profile. At the base of this "gorge-shaped trough profile" there is a sharply incised cut profile which stands out against the flatter upper slope areas with a rocky ledge on each side (↘). Set into the present talweg (⇩), this cut was created by sub-glacial meltwater erosion during the Last Ice Age, and subaerially worked upon since deglaciation. Its drift filling is evidence of a currently weak state of erosion, and the fact that V-shaped profile at the bottom of the valley could not have been formed without sub-glacial metlwater erosion. Viewpoint: 36°50'50"N/ 76°58'40"W. Photo: M. Kuhle 18. 8. 86.

Fig 113 ▼
View from the orographic right-hand flank of the "moraine valley of Pusha" in the northern mountain foreland of the Kuenlun at 2550 m asl (Fig 138, above No. 43; as for the viewpoint cf. Fig 112 in the right-hand valley flank) across this moraine valley and other corresponding parallel moraine valleys. The panorama extends from SW (0 on the left side edge of the photo) to W (right-hand edge of the photo). All the ridges marked 0 are moraine walls from the Main Ice Age. Those shown in this photo attain relative heights of 500 m to more than 700 m above the valley floor, or tongue basin floors, which hold the very substantial outlet glacier tongues. The photograph was taken from 550 m above the glacifluvial drift floor (No. 4 - drift floor of Ghasa Stage I) in the "valley of Pusha". The formation of this end moraine landscape of parallel stripes is polyglacial. It took place in the course of the Pleistocene Ice Age era when the outlet glaciers from W-Tibet and the Kuenlun N-slope repeatedly reached the Tarim basin. On the moraine ridge (foreground) 25–30 cm long erratic blocks of green, massive crystalline rock were dug up from a decimetre-thick loess cover at 100 m above this viewpoint (at 2650 m asl). Further S, at the edge of the next mountain range, limestone occurs as bedrock. ● mark small alluvial fans which serve as depositories for alluvial loess and dislocated moraine material from the gullies. Viewpoint: 37°16'40"N/77°09'20"E. Photo: M. Kuhle 30. 10. 86.

Fig 112 ▼
Panoramic view from one of the major moraine valleys on the Kuenlun N-slope at 2550 m asl. It is the "moraine valley of Pusha" (or "Posseh", Fig 138 No. 43; cf. Fig 113), looking down-valley from WNW (0 on the left edge of the photo) via NNW (■0 centre of the photo) to SE (◥0 on the right-hand edge). The photo was taken from the glacifluvial drift terrace 4 (▼) which had been put down during the Late Ice Age glacier advance (Ghasa Stage I) after the first post-Main Ice Age glacier retreat. The moraine walls reach heights of 800-900 m above the valley bottom (- - - -) and were last deposited during the Würm Main Ice Age. Sedimented out into the foreland, these lateral moraines simultaneously present lateral moraines of the adjacent moraine valleys on the left and right, which makes them medial moraines. The moraine walls extend the glacially polished and abraded limestone rock flanks (▲◥) of the Kuenlun valleys which end here by about 15 km, and out into the Tarim basin (mountain foreland) (■0). In the Main Ice Age the moraine walls were syngenetically covered, and in the Post-Glacial period also by aeolian primary loess. The latter was dissected by gully washing (▽) and deposited as alluvial loess at the foot of the slope. Viewpoint: 37°11'30"N/77°02'50"E. Photo: M. Kuhle 29. 10. 86.



◄ Fig 114
View from 2680 m asl on to a Main Ice Age glacier tongue basin in the northern (NNE) Kuenlun foreland 15 km E of the "valley of Pusha" and 6 km W of the "valley of Tess" (Fig 138 left side, somewhat below No. 55). Exposure facing W, taken from the orographic right-hand 500-550 m high wall of lateral or medial moraines (0 X) across the talus sander 4 of the Ghasa Stage (I) which covers the floor of the tongue basin, to the orographic left-hand wall of lateral or medial moraines (0 background). The saddle in the latter points to a Main Ice Age transfluence (↷↶). (↓↓) mark exaration rills and furrows in the ground moraine material (horizontally arranged) on the flow direction of the glacier tongue. The ground moraine is undercut and exposed by the present meltwater stream (▽△). Two low gravel terraces (▼) were formed. Run-off precipitation water has dissected the loess-covered moraine surface into gullies (▽). In the area where the photo was taken large dark green quartzite pebbles were found on the moraine culmination. They are erratic, ie. they travelled here over a distance of tens of kilometres. They present evidence of the intensive involvement of meltwater in the sedimentation process of this large end moraines, the base of which lies between 2100-2200 m asl (4). Viewpoint: 37°20'20"N/77°23'20"E. Photo: M. Kuhle 31. 10. 86.



◄ Fig 116
Panoramic view across the middle Shaksgam valley, taken at 4880 m asl a little above the Aghil pass (4863 m asl; Fig 138 right-hand below No. 25) and ranging from SE (left edge of the photo) to SSW (right-hand edge); No. 6 = Apsarasas, 7245 m; Nos 5 and 8 = Teram Kangri group, 7462 m; No. 3 = Sia Kangri, 7422 m; No. 4= Urdok c. 7300 m; No. 1 = Gasherbrum I (Hidden Peak), 8068 m; No. 2 = Gasherbrum II, 8035 m or Broad Peak group, 8047 m; No. 7 = 6210 m peak, N-satellite of the Skyang-Kangri group. □ marks the Shaksgam valley floor at 4100 m asl. The glacial flank abrasions have polished the valley shoulders and glaciated knob-like rock heads in the bedrock limestone up to at least 5500 m asl (- - - - left and right). - - - - (in the centre) marks the early Late Glacial glacier level at 5000–5200 m asl. The Aghil pass (where the photo was taken) was consequently overflowed by a 600 m-thick Main Ice Age glacier arm which moved NW towards the Yarkand ice stream. The high peaks of the Karakorum towered 2000–2500 m above the Shaksgam ice stream network which had the Tibetan inland ice flow-off towards the NW. Viewpoint: 36°11'N/76°37'E. Photo: M. Kuhle 20.10.86.