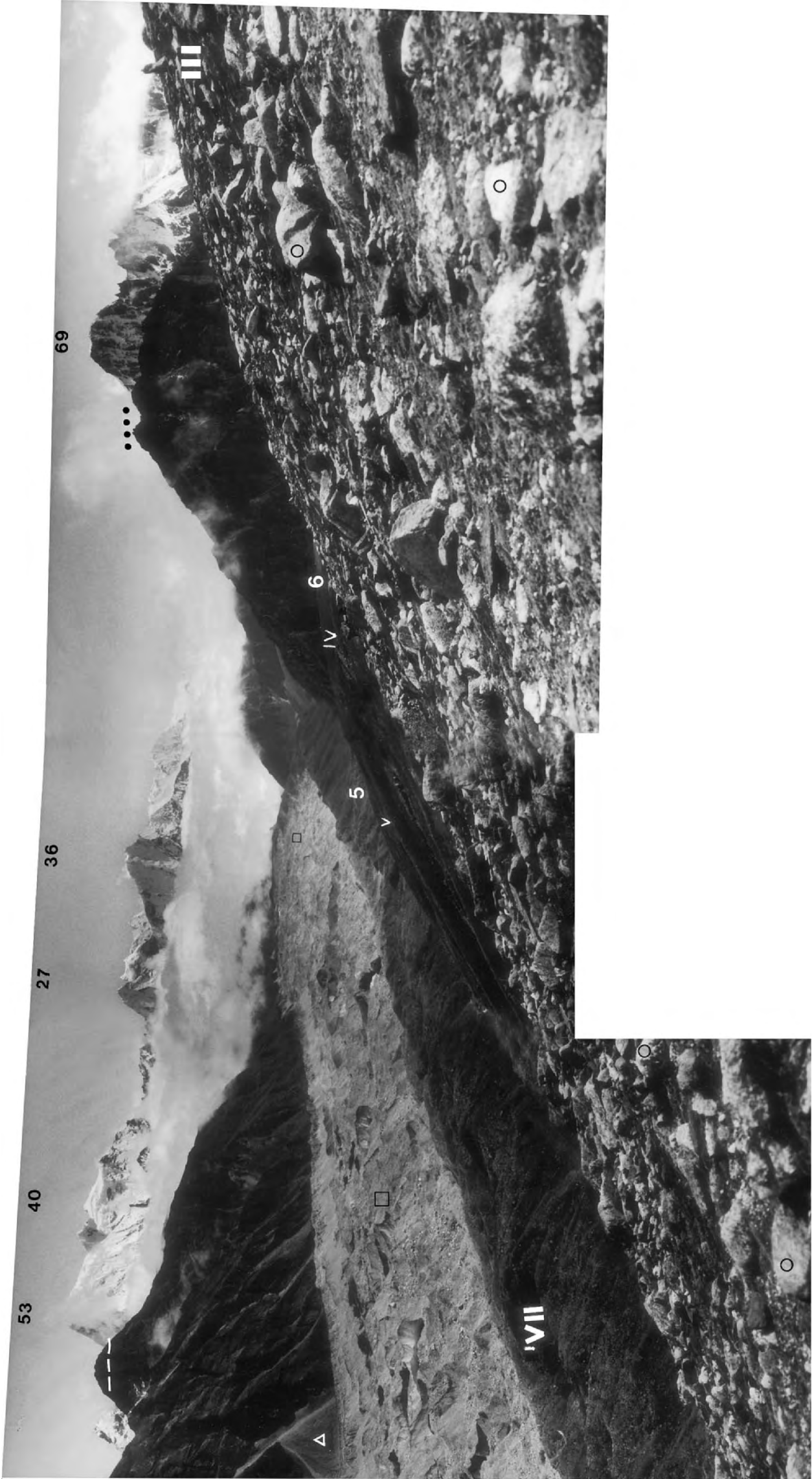
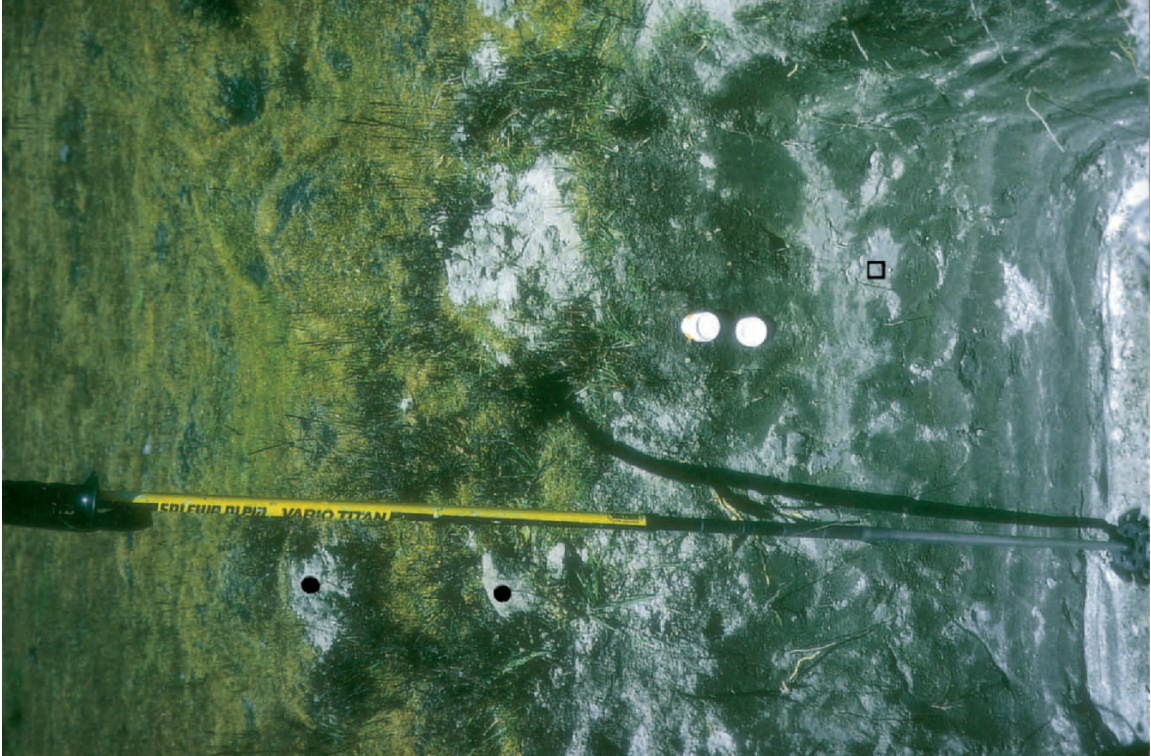
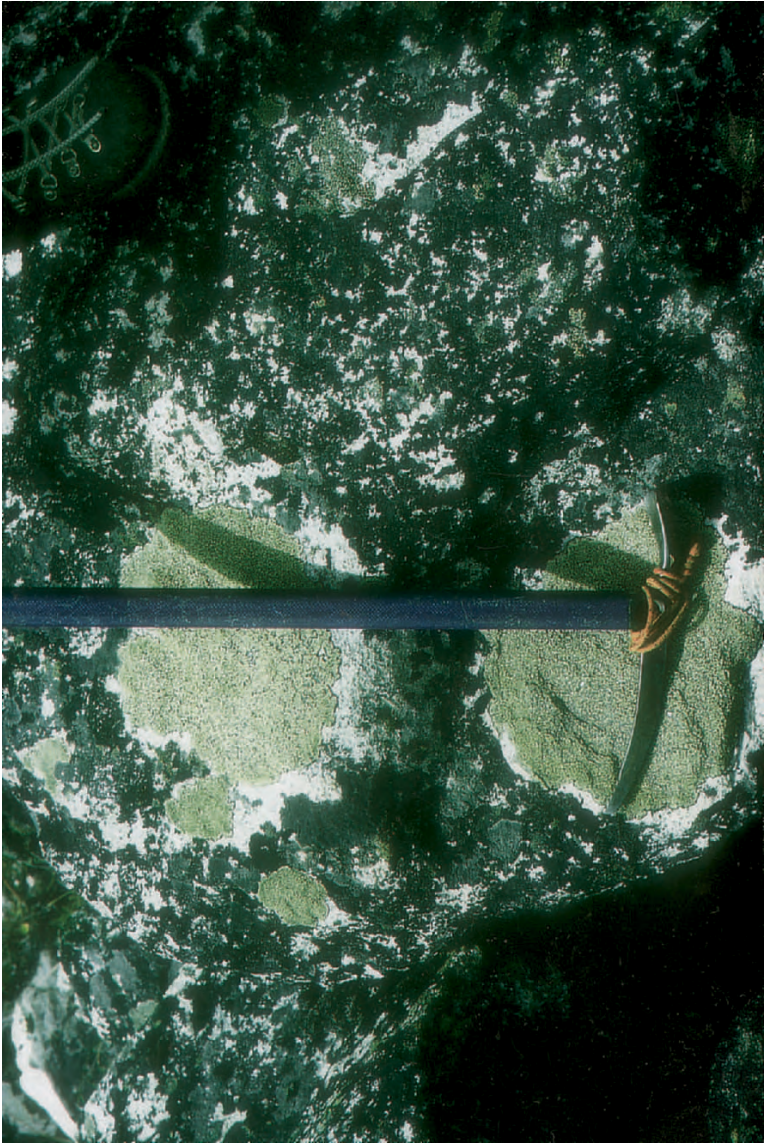




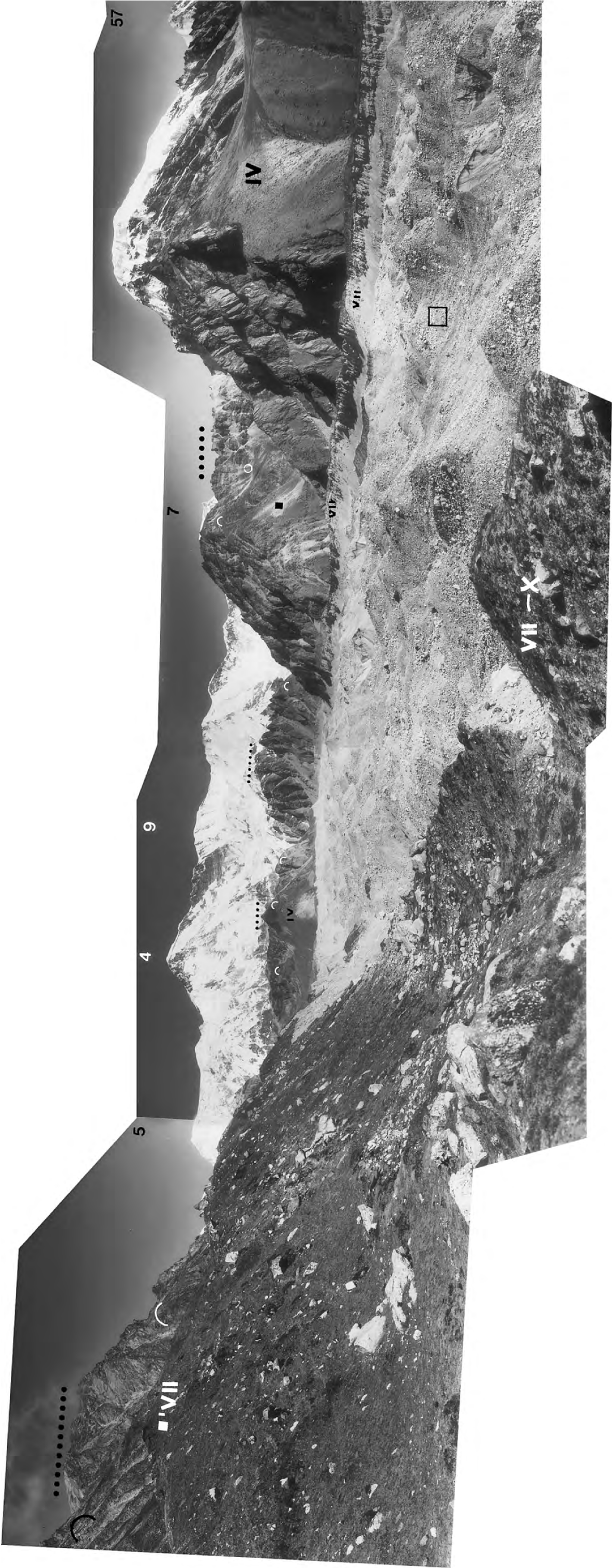
↑ *Photo 124.* Panorama at 5300 m a.s.l. from the orographic right valley slope of the Ngozumpa Drangka (Figure 3, Panorama 124) from facing SE on to the 6440 m-high Jobo Laptshan (No. 53) and the 6542 m-high Taboche (No. 40), via facing SSE to Kang Taiga (No. 27; 6779 m) and Tramserku (No. 36; 6608 m) and the Ngozumpa glacier tongue (□) looking down-valley, via facing S to the 6073 m-high Pa Ri (No. 69), up to facing SSW (right margin) looking diagonally up-slope across the ground moraine cover of the Late Glacial Dhampu Stage (III). (○) are round-edged and faceted moraine boulders of gneiss and tourmaline granite; Lower Tibetan gneiss (66) outcrops in the underground, so that the boulders of tourmaline granite originating from the Upper Tibetan granite (6a) have travelled here over 10–13 km from the Himalaya main crest (Cho Oyu). Somewhat below, the younger Late Glacial ground moraine terrace (IV) sets in. It is a pedestal moraine terrace. (V and 'VII) are younger (Table 1), i.e. neoglacial ground- and lateral moraines grading continuously down to the current glacier (□). In places the at most a few metres thick surface moraine (□) is interrupted by dirty ramps of sheer ice. Between ('VII) and (V) runs the actual orographic right lateral valley in which the brook flows. Nos. 6 and 5 are sampling localities of C14-datings (see Figure 19 and Table 2). (Δ) is one of the numerous cones of the debris of crumbings, heaped up in the orographic left lateral valley. (--- and ...) is the High Glacial glacier trim-line at ca. 5700 m a.s.l. Analogue photo M. Kuhle, 25.09.1982.



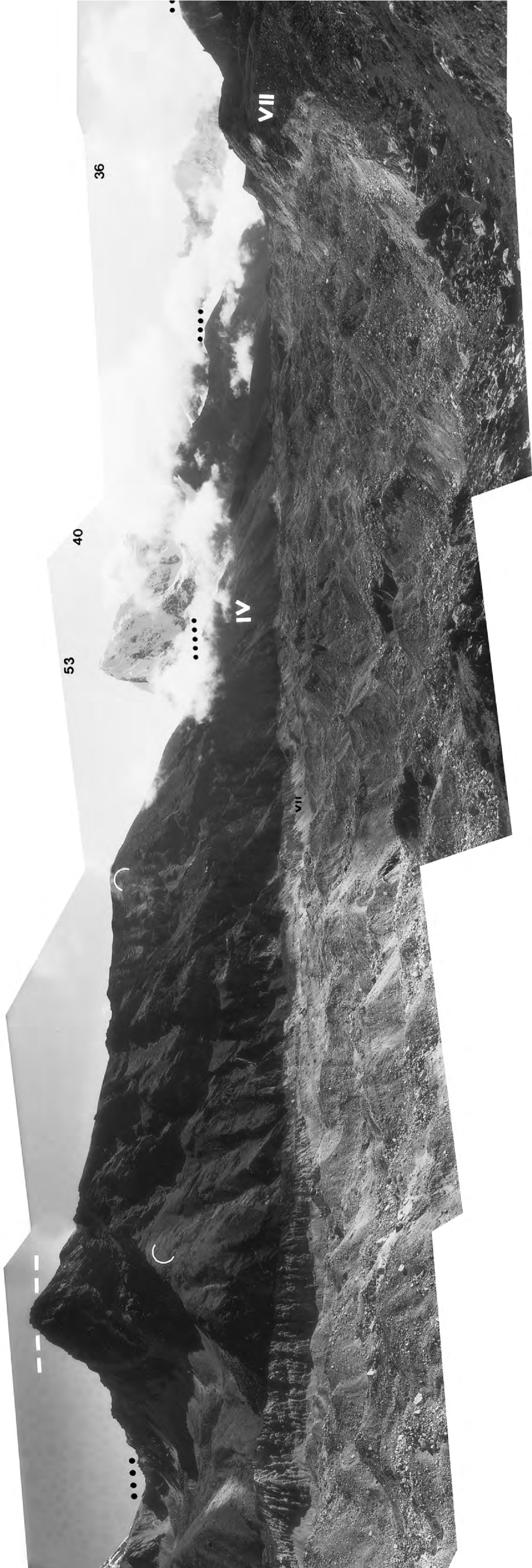
↑ *Photo 126.* Excavation exposure in the orographic right lateral valley of the current Ngozumpa glacier on the S-margin of the Kendezhung locality at 4910 m a.s.l. (Figure 3, Photo 126; Figure 19 and Photo 124, sample locality No. 5). The exposure shows irregularly bedded glaciofluvial sand (□), sedimented between large moraine boulders (●) as lateral sander and para-glacial feature. The vegetation cover is alpine meadow of Cyperaceae. The sample, taken from a depth of 12 cm (= white sample-case below), has been dated to 3345 ± 550 YBP with C14-containing Cyperaceae turf (see Table 2). Analogue photo M. Kuhle, 22/9/1982.



↑ *Photo 127.* Surface of moraine boulders in the orographic right lateral valley of the current Ngozumpa glacier at 4760 m a.s.l. (Figure 3, Photo 127; Figure 19 lichen-diameter 25) with Rhizocarpon geographicum, showing diameters up to 25 cm (= length of the ice ax). At a medium growth rate of 1 cm^2 per 60 years – as can be applied to the medium geomorphological altitude concerned in the European Alps on rain-exposed silicate boulders (written information kindly communicated by the lichen-specialist Prof. Dr. G. Follmann, Museum of Natural History, Kassel, Germany, 26/3/1982), this is equivalent to a lichenometrical age of ca. 29,452 years ($\pi r^2 \times 60 = 3.14159 \times 12.5^2 \times 60 = 3.14159 \times 156.25 \times 60 = 490,874 \times 60 = 29,452.41$). However, even with regard to a large specimen such as this, this is too long by the tenth power. Because at a growing extent of the lichen the growth rate exponentially increases, Follmann estimates this specimen of Rhizocarpon geographicum to be 3000–4000 years of age. Up to now the hygro-thermal conditions of the growth of lichens in this S-exposed Himalaya valley have not been investigated. Analogue photo M. Kuhle, 19/9/1982.

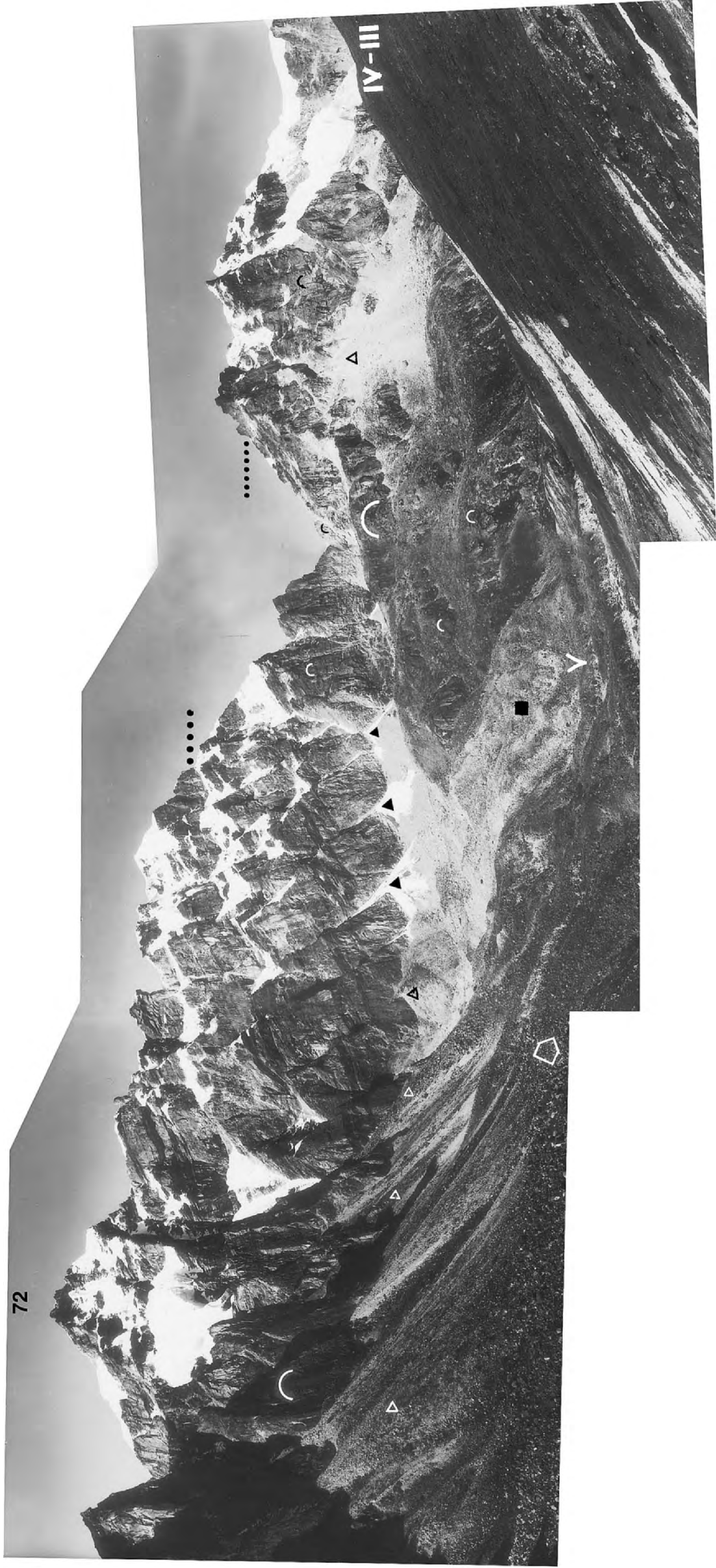


↑ *Photo 125.* Panorama at 4840 m a.s.l. from the orographic right lateral moraine of the Ngozumpa glacier (Figure 3, Panorama 125) looking from facing NNW (left margin) diagonally up the orographic right valley flank, to the 5 km-long 7000-m-crest of Nāngpai Gosum (No. 5, 7352 m) and the 8202 m-high Cho Oyu (No. 4), facing N to the 7806 m-high Ngozumpa Kang (No. 9) up the Ngozumpa glacier (□), via facing ENE to the 6103 m-high Kangchung (No. 57; on its left side the Kanchung W-summit, 6089 m) with the orographic left Ngozumpa valley flank, via facing SE to the 6440 m-high Jobo Laptshan (No. 53) and the 6542 m-high Taboche (No. 40), facing SSE down the valley and the glacier to Tramskerku (No. 36, 6608 m), up to facing S into the orographic right Ngozumpa valley flank (right margin). In depressions the surface moraine is in part several metres-thick (□) covering the glacier completely. The lateral moraine of the younger Dhaulagiri Stage (Table 1) is attached to the modern Ngozumpa valley glacier (VII); in the cross-profile of this viewpoint its current surface has decreased against it by 10–40 m. Only in some places younger remnants of lateral moraines can be observed (X). Above, moraine remnants of the neoglacial middle Dhaulagiri Stage (■ ‘VII) and of the late Late Glacial Sirkung Stage (IV) are preserved (cf. Figure 19). Partly, the latter form pedestals of ground moraine (pedestal moraines) (Figure 3, IV on the right of Panorama 125 and IV on the right of Photo 132) between 200 (IV on the left below No. 57) and 320 altitude metres (IV on the right) above the current glacier surface. In places High- to Late Glacial (Stages 0–IV) ground moraine covers, too, are preserved on the slopes (■, ○, ∩, ∪) are glacialic flank abrasions which, due to their upper break-off, make the Ice Age trim snow-lines (... and —) recognizable. They have run (...) below Nos. 4 and 9 at almost 6600 m a.s.l., (... and —) on the left of No. 5 and below No. 7 at 5800 m, across the transfluence pass on the right of No. 57 about 5700 m, down-valley (...) below No. 53 and on the right of No. 36 at 5600 m and again down-valley (...) on the left below No. 36 at ca. 5500 m a.s.l. (cf. Figure 30). On the left side of a small Late Glacial cirque (○) a classically smoothed, glacially triangular-shaped slope (∩ on the left of ∪) is preserved. The classic glacialic truncated spur on the left below No. 7 has been roughened by crumbings and the development of gullies since deglaciation. Analogue photo M. Kuhle, 7/10/1982.





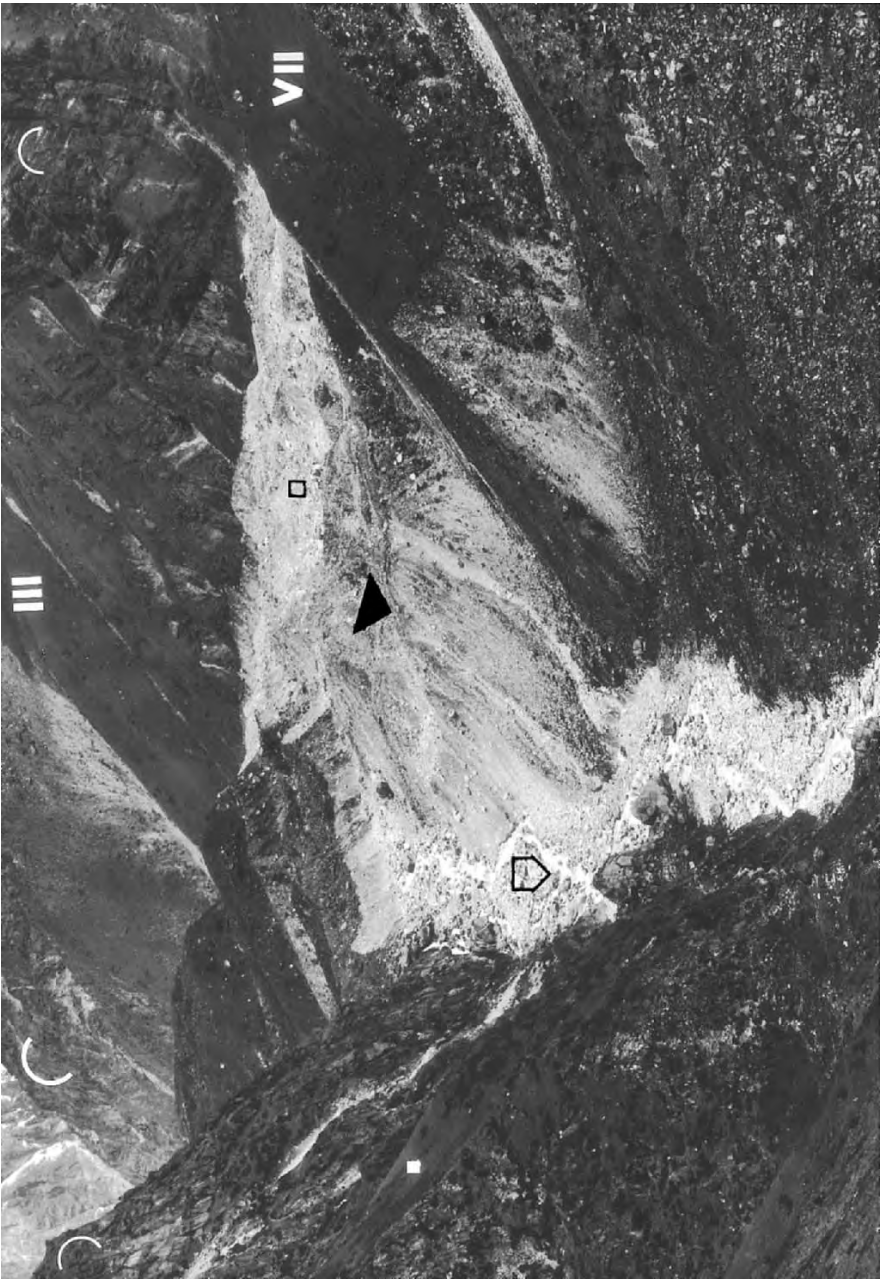
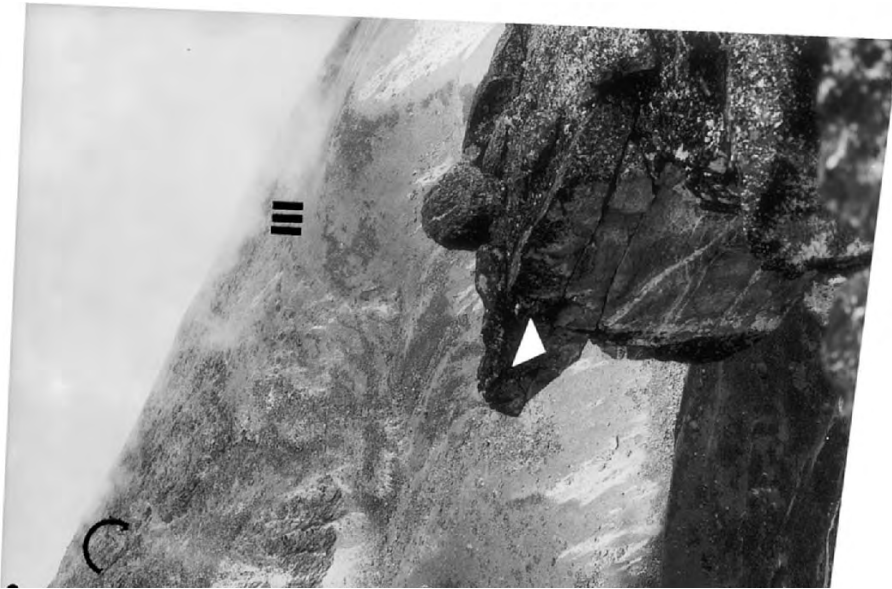
† *Photo 128.* Panorama at 5070 m a.s.l. from the orographic right lateral moraine of the Ngozumpa glacier on the N-margin of the Kendezhung locality (Figure 3, Panorama 128) from facing WSW (left margin) looking into the orographic right flank of the Gyazumpa Drangka with a 5873 m-high, slightly glaciated summit, via facing W to the 5927 m-peak (No. 71) up to facing WNW into the orographic left flank of this tributary valley. The latter is covered with ground moraine of the youngest Late Glacial Stage, the Sirkung Stage (second to fourth IV from the left), built up of polymict, dark (metamorphite) and light (granite), metre-sized, edged, round-edged and faceted boulders, embedded into a fine material matrix (below IV white and IV black on the right). The ground moraine remnant of this stage on the orographic right side (IV on the very left) in the Gyazumpa Drangka is partly overflown by a rock glacier (⚡) which is still active (Figure 3 above Photo 123). (○) is the Gyazumpa Tso, situated in the exit of the tributary valley and at the same time in the orographic right lateral valley of the Ngozumpa glacier behind the moraine of the neoglacial older Dhaulagiri Stage (VI), (VII and VII) are front moraines of the tributary valley glacier of the middle Dhaulagiri Stage (VII) and younger Dhaulagiri Stage (VII) (cf. Table 1, Figure 19). (□) is a small remnant of a cirque glacier located at the level of the 5493 m-high Ice Age transfluence pass (on the right next to □ and ⌒ above and on the right of □) (Figure 3 below No. 71) into the W-adjacent Sumna Drangka. (△ and ▽) are current debris cones and -slopes below the steep back-walls of cirques, mainly developed during the late Late Glacial up to early historical glacier positions (Stages IV–VII). (⌒ white on the left below No. 71 and ⌒ black on the right below No. 71) are High Glacial glacialic flank polishings. They testify with their upper limits to synchronous glacier trim-lines at at least 5600 and 5800 m a.s.l. (...). Correspondingly, the ice thickness above the transfluence pass amounted to ca. 300 m. Due to glacialic uncutting by the Late Glacial (Stages I–II) glacier level (... on the right), the 5843 m-high rock summit on the orographic right side has been sharpened into an especially clear form of a glacial horn; on its right side a then transfluence pass into the N-adjacent Lhabishan Drangka is situated. Analogue photo M. Kuhle, 25/9/1982.



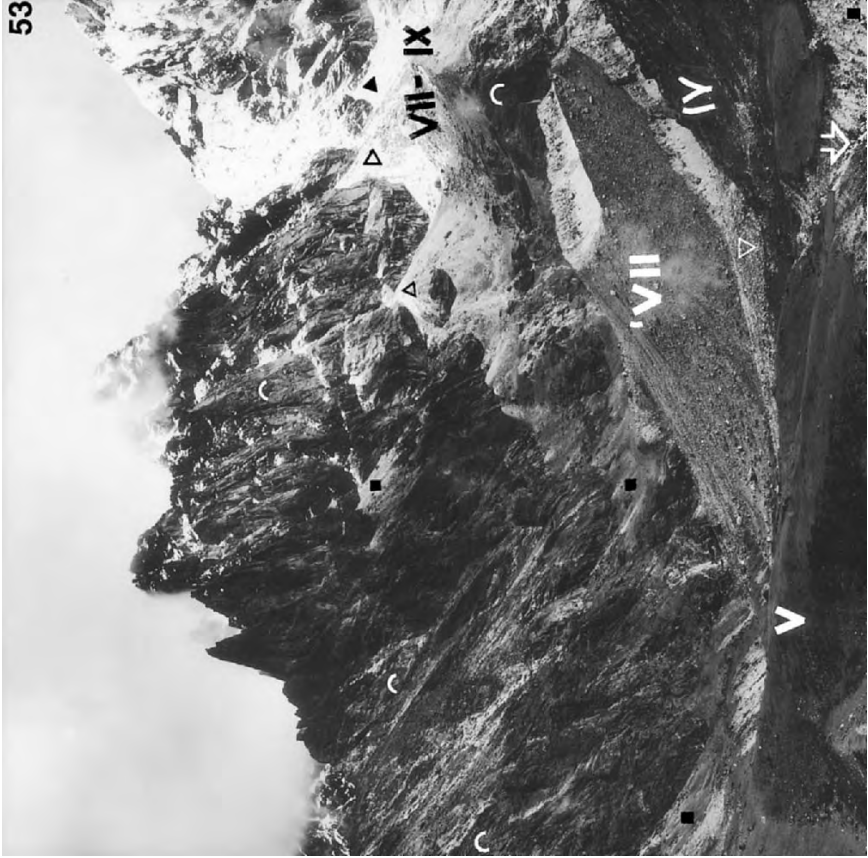
† *Photo 129*. Panorama at 4970 m a.s.l. from the orographic right lateral moraine of the Ngozumpa glacier on the S-margin of the Kendezhung locality (Figure 3, Panorama 129; Figure 19) from facing SW (left margin) into the orographic right flank of the Donag Drangka with the 5941 m-peak (No. 72), via facing WSW with the 5486 m-transfluence pass (C black on the left) into the adjacent Bote Koshi (valley), up to facing WNW into the orographic left flank of the Donag Drangka (right margin). Still during the Nauri Stage an ENE-exposed glacier, the E-Donag glacier (Table 3), has reached the valley bottom at 5000–4960 m a.s.l. (V) (Figure 19). Its tongue form has been pseudomorphically preserved by a dumped end moraine with a coarse-blocky cover of ablation moraine (■). The poverty of vegetation there has partly been caused edaphically, i.e. in dependence on the coarse-blocky surface. On the other hand, the fluxion structures of the moraine tongue (■) point to a rock glacier phase during the last 4000–5500 YBP, which has taken place after the back-melting of the glacier tongue. The avalanche cones at the foot of the back-wall (▲) still supply the permafrost with water. This process has been intensified when the ELA had decreased by at least 40–100 m during the Holocene up to the Little Ice Age (Stages VI–IX); it was favourable to the development of rock glaciers. (S) are also movements of boulder debris related to rock glaciers, as they occur on glacial lateral formations in the area of an orographic right past lateral kame of the E-Donag glacier or of a remnant of a ground moraine pedestal. They are inactive today, as the dark lichen-cover of the boulders shows. This could be a pre-stage of a protalus rampart which may develop from lateral moraines (Kuhle 1983c, among others p. 46, Abb.5) or from a ground moraine terrace. (IV–III) is an orographic left ground moraine terrace, reshaped for the last time by the glacier ice during the late Late Glacial (Sirkung Stage IV; Table 1), as is evidenced by the lateral moraine ledge (above IV). (Δ) are debris cones and -slopes with ground moraine cores. Since deglaciation, the moraine cores have been buried by the debris of crumbplings originating from the wall gorges. The glacial flanks abrasions (the two white C from the left and C black) are situated on pillar-shaped remnants of walls developed by obsequent wall gorges which have been set into the outcropping edges of the strata of the Lower Tibetan gneisses and phyllites (6b). (C white on the right above ■) is a classic alpine landscape of roches moutonnées (Figure 3 above No. 72). (...) marks the geomorphologically probable High Glacial glacier surface at 5650–5700 m a.s.l. Analogue photo M. Kuhle, 21/9/1982.



† *Photo 130.* Panorama at 5100 m a.s.l. from the central section of the valley exit of the Gokyo Drangka, an orographic right tributary valley of the Ngozumpa Drangka (Figure 3, Panorama 130; Figure 19), from facing WNW (left margin with the E-crest of the 5941 m-peak; No. 72) up to facing ENE (right margin) looking across the three spur-summits of the mountain crest behind of which the Donag Drangka runs; the left one (▼ black) is 5598 m-high and the very right (○) is 5483 m-high. (○, ○) are spur-summits, mountain crests and -flanks and roches moutonnées rounded by glacial abrasion. During the Late Glacial the ice level had dropped and the phyllite- and gneiss-bedrocks (6b) crumbled away (▼ black) in many places, so that debris cones and -slopes (△) developed in the cirque-like, wide, high depressions. (■) are ground moraine remnants situated far above; the left one belongs to moraine terrace IV (Sirkung-Stage; Table 1), the right one to the Dhampu-Stage (III). The latter has been dislocated postglacially as a rock glacier (b). During the neoglacial period the wide rock bottom of the large cirque (○) was covered by the ice of the East Gokyo glacier (northern source component (Table 3, Figure 19). Its tongue has overthrust the lateral- to end moraine (V) of the Nauri Stage (Table 1). (□) is the modern gravel floor, i.e. alluvial fan surface. (▼ white) are glacial forms of detraction on which, due to regelation, large angular components have been torn out of the gneiss bedrock on the lee-slope of a roche-moutonnée-like form. (...) mark the High- to Late Glacial (Stages 0-I) minimum glacier level about 5600 m (... bold) to 5700 m a.s.l. (... fine) locally verifiable here. Analogue photo M. Kuhle, 6/10/1982.



↑ *Photo 132.* Picture taken at 4520 m a.s.l. from the orographic right lateral valley of the Ngozumpa glacier (Figure 3, Photo 132; Figure 19) facing NNE up-valley on to a current tributary glacier tongue (▼) of the Ngozumpa glacier, breaking through its right historical lateral moraine of the younger Dhaulagiri Stage (VII). This break-through has taken place not until after 1955–1963. (b) is one of the Ngozumpa meltwater brooks. (□) is the surface moraine of the current Ngozumpa valley glacier which here – only 1000–500 m away from the glacier terminal – is up to several metres thick. (○, ◌, ◌) are glacialic flank abrasions on the outcropping Lower Tibetan gneisses (6b), (■) are remnants of ground moraine on a rock ledge in the steep valley flank. (III) is the corresponding large-scale ground moraine cover on the orographic left valley flank, which for the last time has touched the glacier during the Late Glacial Dhangpu Stage (III) (Table 1). Analogue photo M. Kuhle, 15/9/1982.



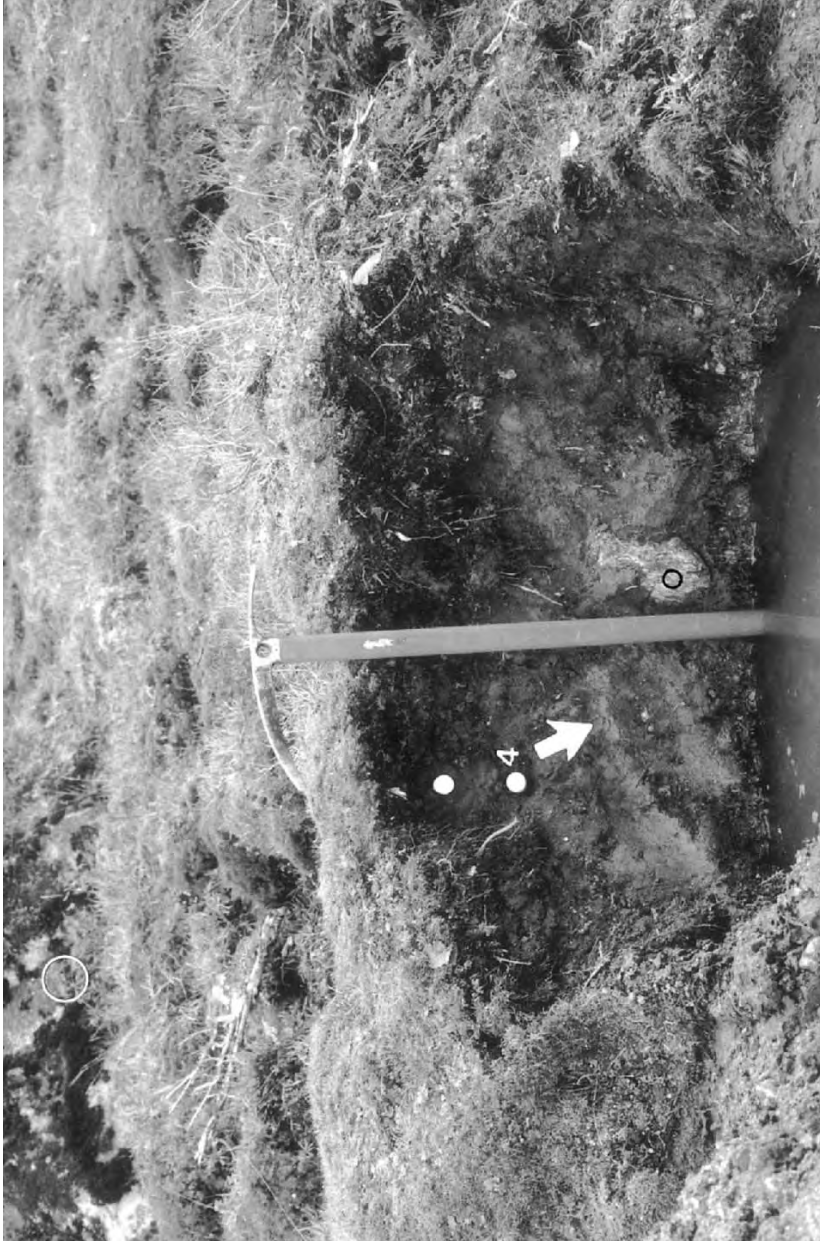
↑ *Photo 133.* Picture taken at 4720 m a.s.l. from the Ngozumpa Drangka (Figure 3, Photo 133) facing ENE into the southernmost orographic left side valley of the Nymagawa Drangka (Figure 3 on the left of No. 53) with the W-face of Jobo Lhabishan (No. 53; 6440 m a.s.l.). (IV; V; VII, VII–IX) are the Late Glacial, neoglacial to historical moraines, laid down in an increasing proximity to the Jobo Lhabishan-W-glacier between ca. 13,500 and 180 YBP (Table 1; Figure 19). The current glacier tongue ends at 5120 m a.s.l. (on the right beyond the picture), (■) are remnants of ground moraine; the higher the altitude above the valley bottom (V) the less they occur. At the top they are only preserved on a few rock ledges. (▲) is a contemporary ice- and snow-avalanche cone contributing to the glacier feeding. (◌) are Late Glacial glacialic flank abrasions in the outcropping gneisses and phyllites (6b) situated near to the rock ledges. (△ black) are debris cones below polygenetic couloirs and rock ravines. They have been created by rock fall and snow avalanches which destroy the glacialic abrasion faces. Further remnants of ground moraine are found in the cores of these cones. (▽ white) is a glaciofluvial alluvial fan (sander) made up of the end moraine material dislocated by the meltwater brook (||) is the incision of the meltwater brook into the material of end- and ground moraines (■ on the right below) of Stages V and IV. Analogue photo M. Kuhle, 15/9/1982.



† *Photo 131.* Panorama at 5100 m a.s.l. from the central section of the valley exit of the Gokyo Drangka, an orographic right side valley of the Ngozumpa Drangka (Figure 3, Panorama 131; Figure 19), from facing ENE (left margin) to the Ngozumpa glacier covered with surface moraine (□ black), down the Gokyo Drangka, via facing SE and SSE into the orographic right valley flank and on to the 6073 m-high Pa Ri (No. 69) up to facing S (right margin). (○) is the Gokyo Tsho at 4744 m a.s.l., which the Ngozumpa glacier with its right lateral moraine of Stage VII (younger Dhaulagiri Stage; Table 1) has dammed up as a glacial lateral lake. (IV) is the S-slope of a Late Glacial terrace of a ground moraine pedestal (Figure 3 on the right of Panorama 130). (V) (cf. Photo 130) and (VI) are the orographic left neoglacial lateral- to end moraines of the East Gokyo glacier (Figure 19). (⊗ 9) is the C14-sample described in Table 2, dated to 1165 ± 110 YBP. It proves that the alluvial debris fan, i.e. the delta accumulation (□), has taken place after the back-melting of the East Gokyo glacier of the Stages V to 'VII (see Table 2 and Figure 19; No. 9). (■ X) are historical moraine remnants of the East Gokyo glacier (Table 1). (■) mark High- to Late Glacial remnants of ground moraine on the valley bottom, on rock thresholds (○) and on the slope; the latter have been buried by crumblyings (▽) (Figure 3 on the right below Panorama 131). (●) shows a roches moutonnées landscape with rock smoothings in the gneiss, created by glacial scouring (below Panorama 131). (...) is the highest glacier trim-line verifiable by rock abrasions at 5700 m a.s.l. Analogue photo M. Kuhle, 6/10/1982.



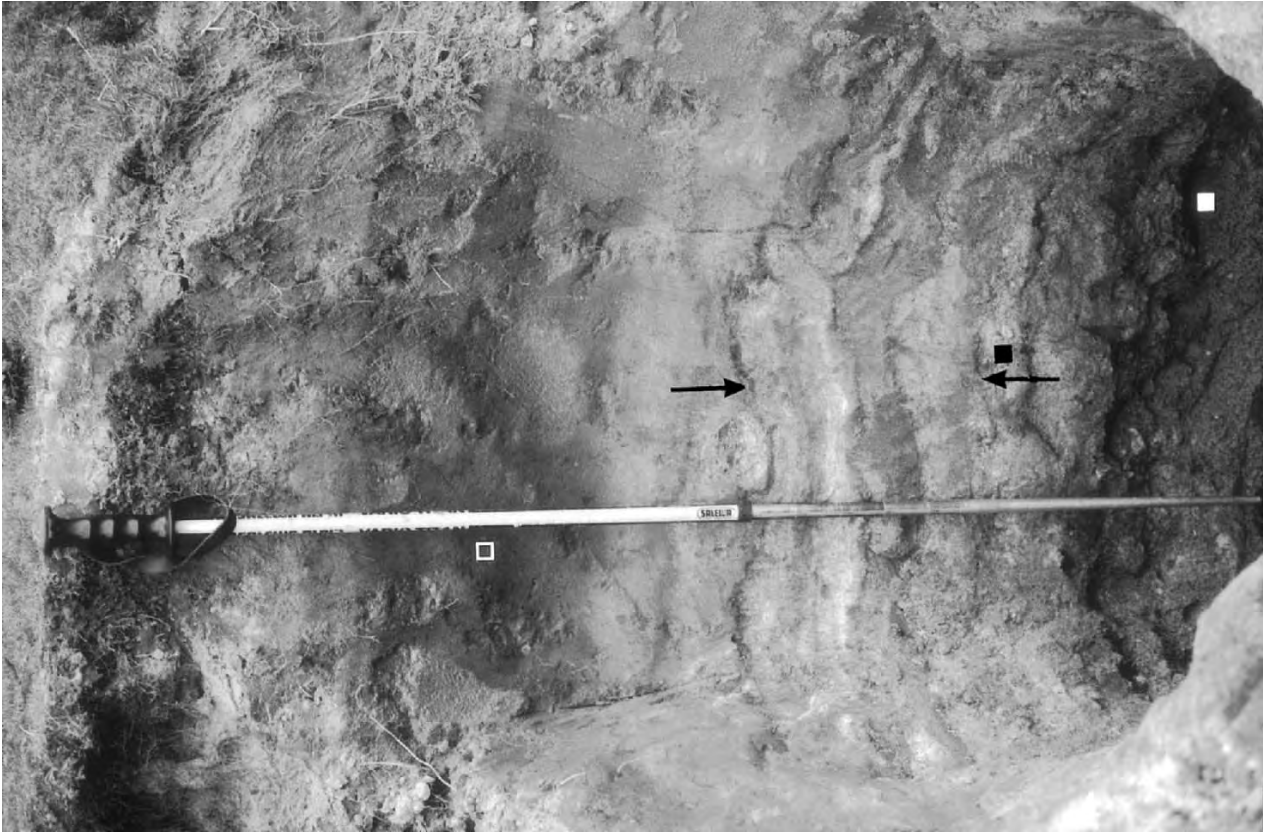
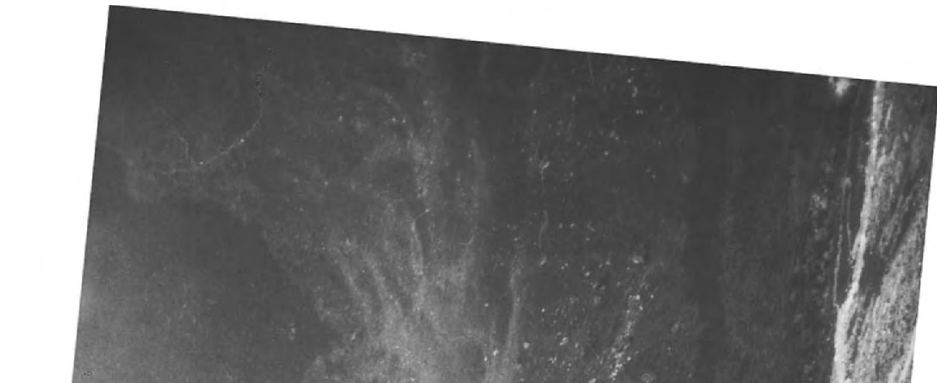
↑ *Photo 135.* Panorama at 4460 m a.s.l. from the orographic right side of the Machhermo Drangka, an orographic right side valley of the Ngozumpa Drangka, seen from the late Late Glacial inner slope of the lateral moraine near the valley exit (Figure 3, Panorama 135) from facing WNW (left margin) up the side valley up to facing NNW (right margin) to the corresponding left inner slope of the lateral moraine. (□) is the Machhermo glacier meltwater stream cut into the past ground moraine on the valley bottom. It has developed a ground moraine terrace (■). Since deglaciation the terrace surface has received its plain form by glaciofluvial reworking, whilst its up to 2 m-thick cover of glaciolimnic sands (see Photo 136) derives from a lateral lake dammed up by the Ngozumpa main glacier. (IV) is the orographic left lateral moraine of the Late Glacial Sirkung-Stage (Table 1); (▼) are further lateral moraine ledges of the youngest sub-stages of the Sirkung-Stage. (The two ▼ below) mark a corresponding right lateral moraine offset against the older inner moraine slope by a small lateral valley. (○) is one of the round-edged gneiss boulders the size of a hut situated on the inner moraine slope. (▽) is a fresh slide on a ground moraine- and solifluction slope which has torn the covering alpine meadow. (○) are glacialic flank abrasions in the Lower Tibetan gneiss (6b) on the orographic right trough valley flank. (⊗4) is the sampling locality of C14-sample 4 (see Photo 136; Table 2 No. 4). (†) is the excavation-locality of Photo 137. Analogue photo M. Kuhle, 15/9/1982.



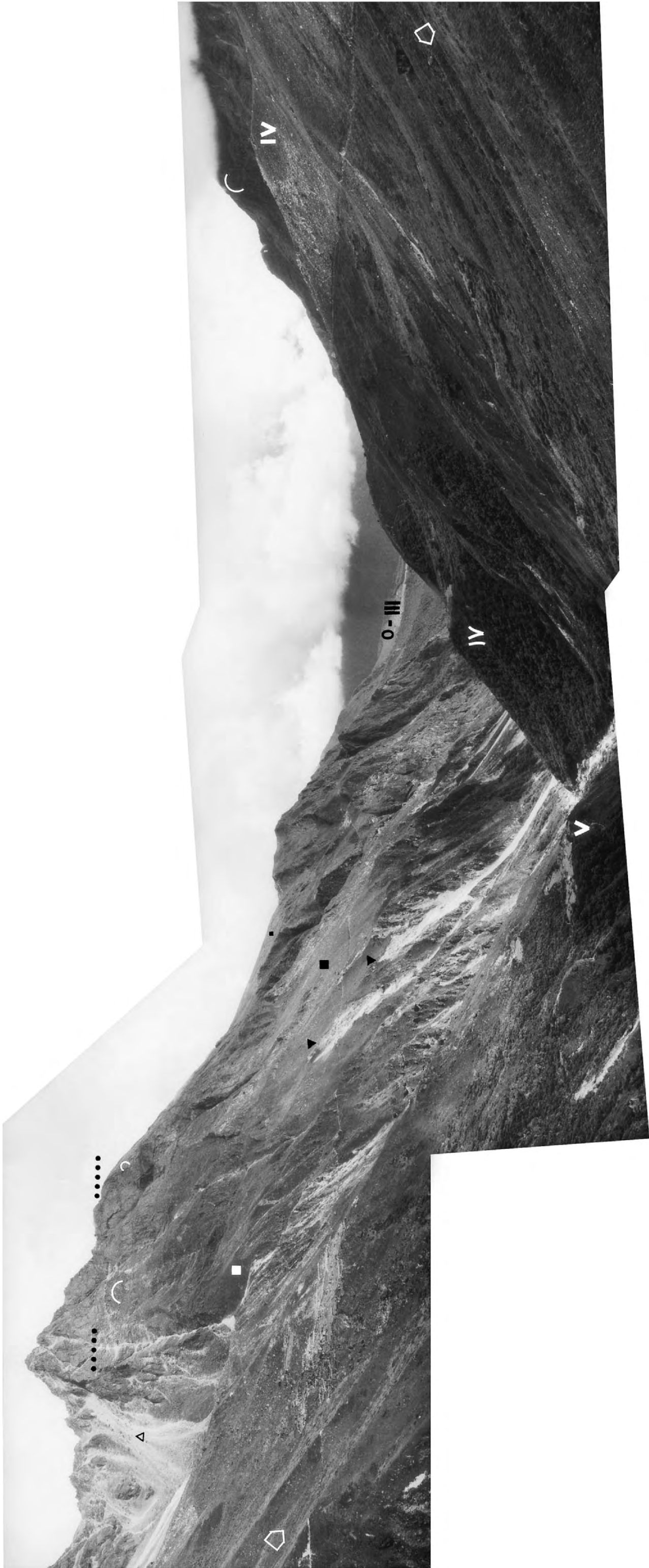
← *Photo 136.* 0.8 m-deep excavation at 4440 m a.s.l. in the orographic right lateral- to end moraine ledge in the Machhermo Drangka (Figure 3, Photo 136; Figure 19 No. 4; Photo 135 (⊗4)) facing S. Below the current vegetation of alpine turf and moist alpine scrub (● above) a C14-sample of humus soil and peat has been taken (●†; see Table 2 No. 4); the sampling-location is situated just above the rock base, consisting of moraine material with gneiss components (○ black). The C14-age amounts to 2350 ± 295 YBP. (▼) is one out of several peat layers arranged in parallel and tilted to the E by glacialic compression. The excavation pit contains water of the thawed frozen ground. (○ white) is a 3 m-long faceted gneiss boulder. Analogue photo M. Kuhle, 15/9/1982.



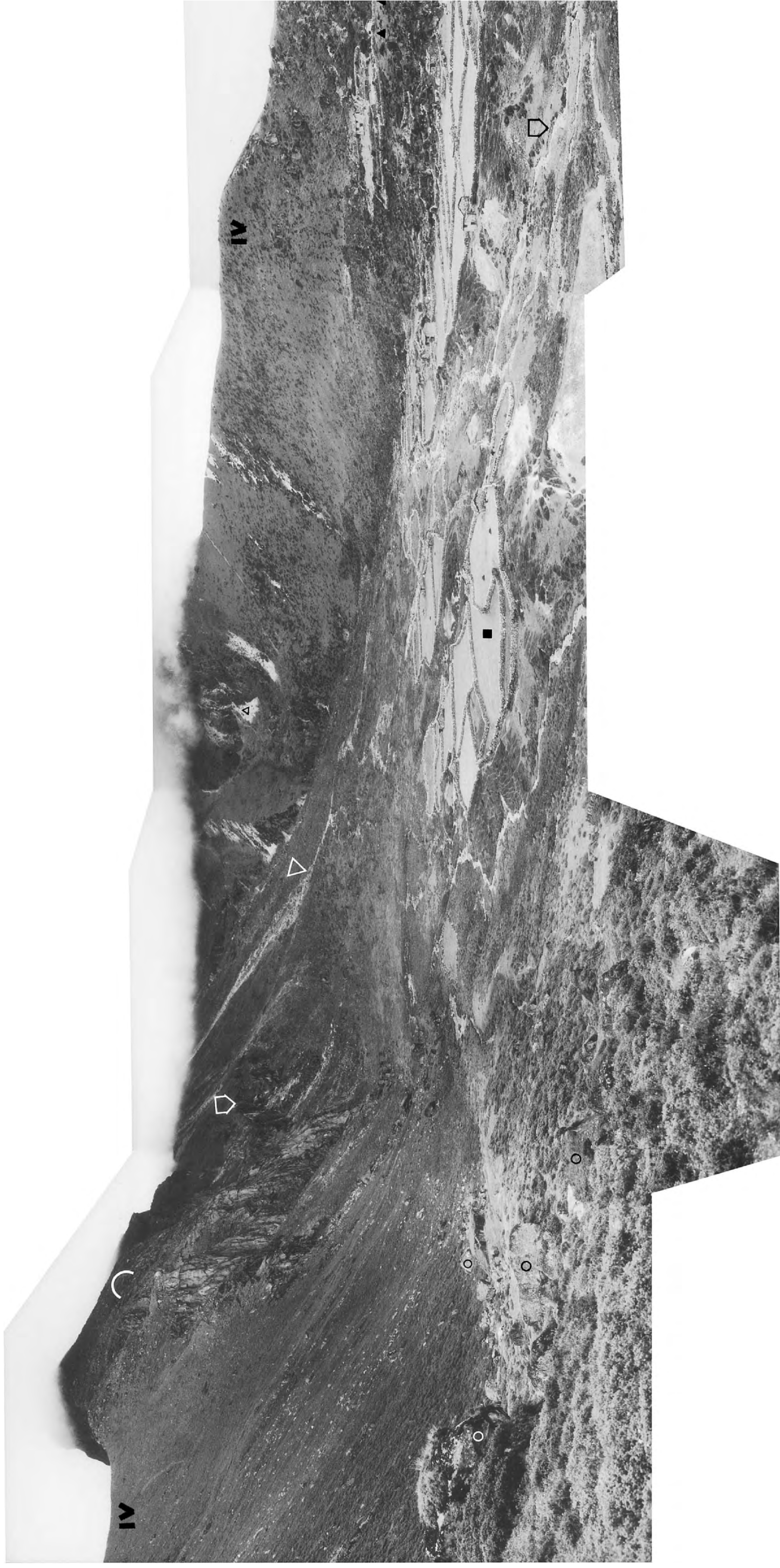
↑ *Photo 134.* Panorama at 4500 m a.s.l. from the orographic left late Late Glacial lateral moraine (IV on the left) of the Machhermo Drangka, an orographic right tributary valley of the Ngozumpa Drangka (Figure 3, Panorama 134; Figure 19) from facing ESE (left margin) diagonally to the main valley (■ white) via facing SSE into the orographic right flank of the Machhermo Drangka on to the inner slope of the corresponding right late Late Glacial lateral moraine (IV centre), up to facing WSW (right margin). (○ small) are polymictic (gneiss- and tourmaline granite) metre-sized moraine boulders which, due to congelifraction *in situ*, are partly broken into at least two pieces (○ small white). (■ white) is the High- to Late Glacial (Stages 0–III) ground moraine cover of the orographic left main valley flank; (■ black on the left) is the end moraine area of a ground moraine pedestal which the Machhermo glacier of Stage IV has pushed into the main valley and against the Ngozumpa glacier. (■ black on the right) is ground moraine covered with glaciofluvial or glaciolimnic sand since deglaciation (cf. Photo 136). As a flat plain it is used for the cultivation of potatoes and secondarily as a pasture. (□) marks the meltwater brook of the current Machhermo glacier cutting the ground moraine pedestal (■ black). (▼) are remnants of lateral moraine ledges of minor oscillations of the glacier tongue during the Sirkung Stage (VI); additionally, they show solifluidal reworking. (○ large) is a dead ice depression. (IV black) is the outer slope of the orographic left lateral moraine of the Sirkung-Stage of the S-adjacent Luza Drangka. Analogue photo M. Kuhle, 15/9/1982.



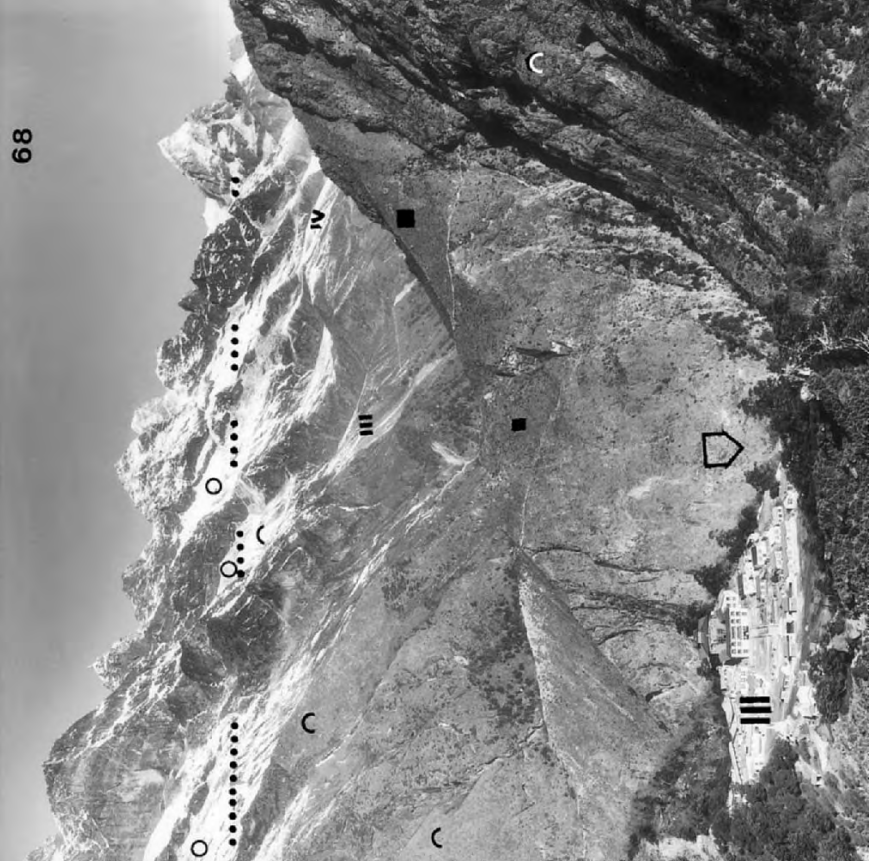
↑ *Photo 137.* 1.5 m-deep excavation at 4415 m a.s.l. into the ground moraine terrace of Machhermo on the valley bottom of the Machhermo Drangka (Figure 3, Photo 137; Figure 19 No. 4; Photo 135 (↓)). Below the vegetation of the alpine pasture (Cobresia spec.), a 13 cm-thick soil horizon (compare 13 cm-long handle of telescope-stick) is situated; (between □ and ■ black) are slightly banded glaciolimnic sands with 3–4 humus horizons (↓↑) indicating intercalated dry phases which have interrupted the limnic sedimentation and allowed the development of soil. (On the left of ↓) a gneiss drop-stone the size of a head is situated. (■ white) are polymictic glaciofluvial terrace gravels of phyllites and gneiss in a sandy matrix, which lower down pass into ground moraine (cf. Photo 135 on the right below ■ black; Photo 134 below ■ on the right). The stationary intervals in the lower part of the measuring stick are 5 cm. Analogue photo M. Kuhle, 15.9.1982.



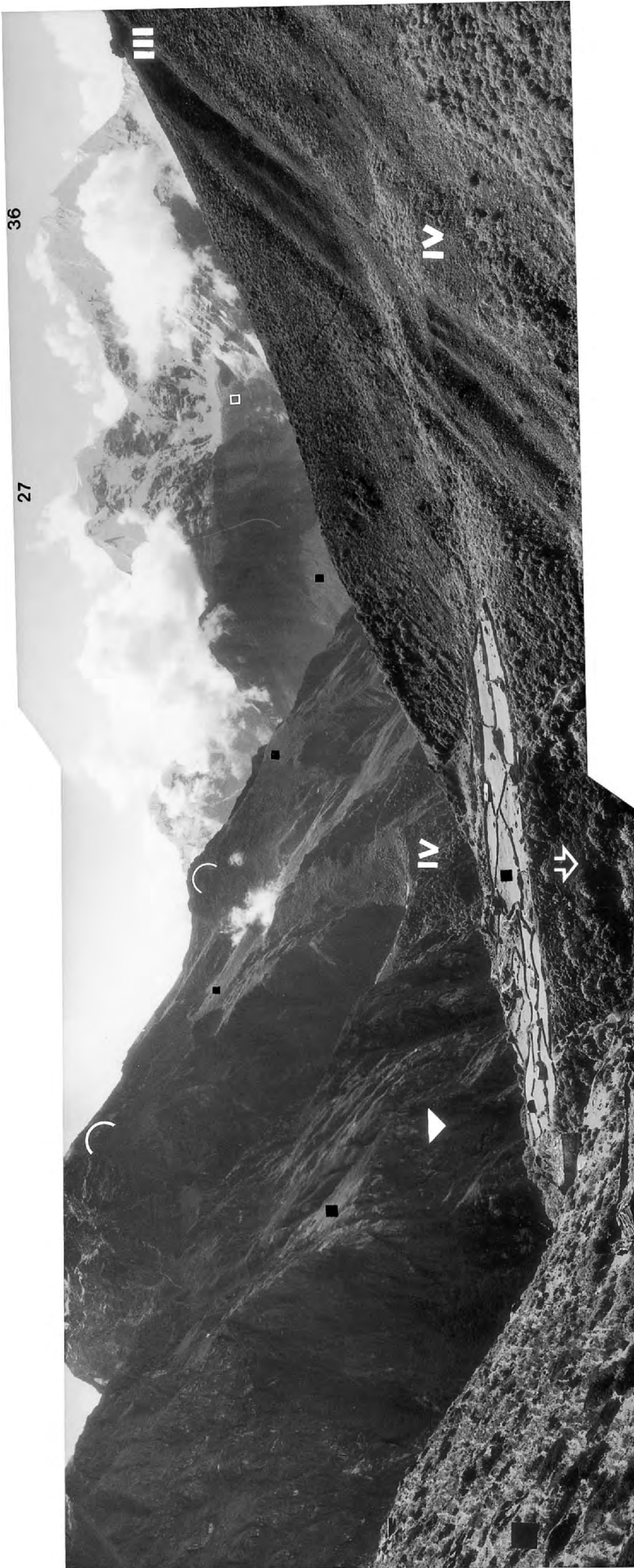
↑ *Photo 138.* Panorama at 4400 m a.s.l. from the junction of the orographic right side valley, the Machhermo Drangka, and the Ngozumpa Drangka (main valley) (Figure 3, Panorama 138; Figure 19) from facing ESE (left margin) up to facing SSE (0–III) via the orographic left main valley flank and down-valley to the confluence with the Inja Drangka, up to facing S seen into the orographic right valley flank (right margin). (V), ca. 50 m above the talweg, is a moraine remnant of the neoglacial Ngozumpa glacier (Nauri-Stage; Table 1) (Figure 3 on the right above Panorama 139); (IV on the left), 160 m above the Ngozumpa talweg, is the remnant of the late Late Glacial ground moraine pedestal on which the Ngozumpa glacier has flowed down (Figure 3 on the left below Panorama 139). (IV on the right are lateral moraines of the Luza side valley- and hanging glacier (see Figure 3 and 19) thrust against the Ngozumpa parent glacier and ending there. (0–III) is the ground moraine overlay on the rock terrace of Phortse. It has been sedimentated by the Inja- and Ngozumpa glacier (Figure 3 below Panorama 148) during the High Würmian period (Stage 0) up to the Dhampu-Stage (III; cf. Table 1), (■) mark the corresponding High- to Late Glacial ground moraine cover in the orographic left valley flank reaching 1000–1300 m above the talweg (up to 4800–5000 m a.s.l.). The glacialic flank abrasions simultaneously created (○, ◌, ◌) on back-polished mountain spurs, i.e. glacialic triangular- shaped slopes (Figure 3 on the left somewhat below No. 40) indicate by their breaking-off in an upward direction (polish line) a maximum past glacier trim-line at 5400–5300 m a.s.l. (...) between Profiles 20 and 21 (Figures 30 and 31). (△) are debris cones fed by fresh crumbplings which destroy a back-wall of a cirque, (▼) are current soft breaks and slides in the past ground moraine cover which develop regressively up the slope. (⌘ and ⌘) are comparable past slope rills and tracks of meltwater, which, from the direction of the talweg, have been shaped regressively by undercutting of the Ngozumpa river segmenting the ground moraine covers of both valley flanks. Analogue photo M. Kuhle, 15/9/1982.



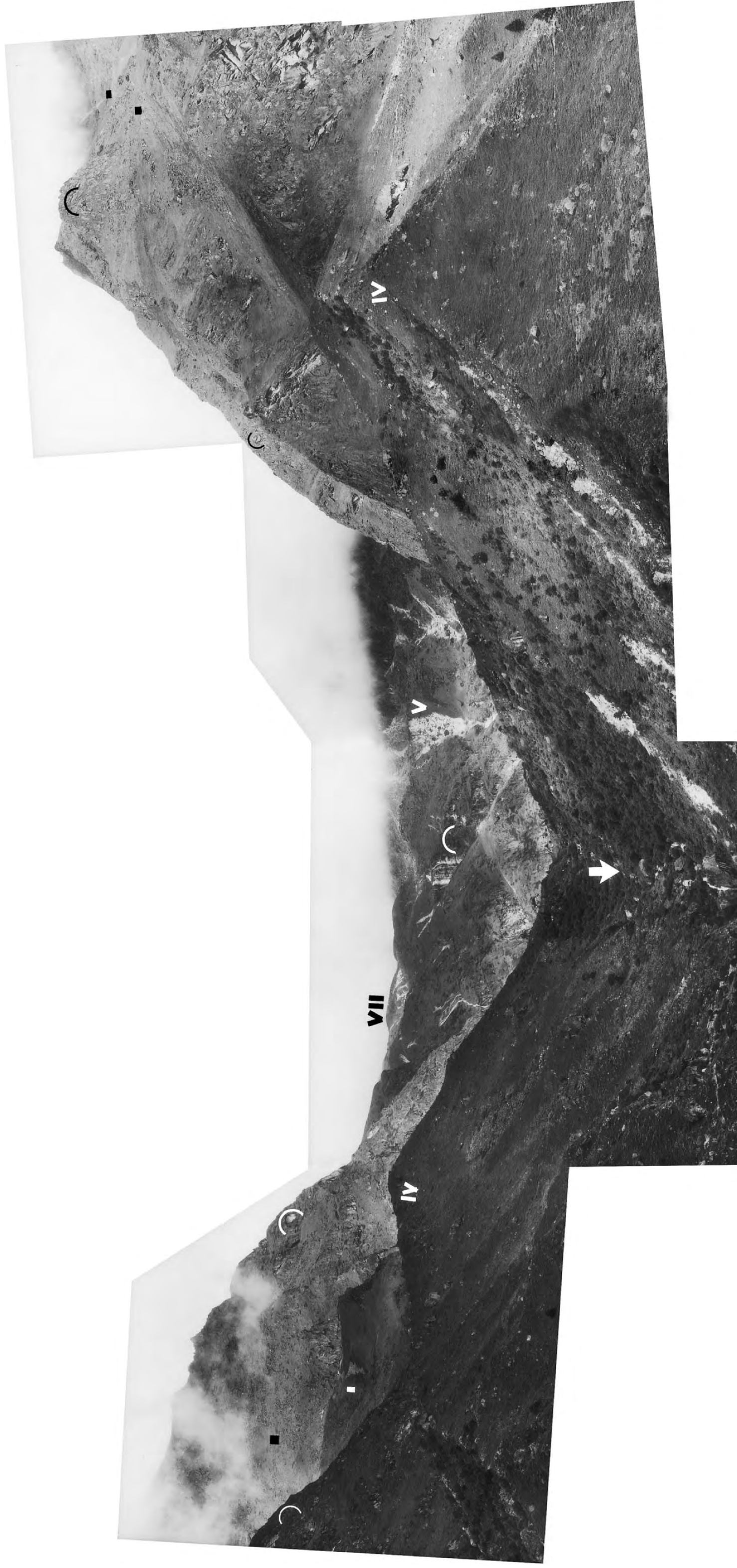
↑ *Photo 139*. Panorama at 4390 m a.s.l. from the orographic right inner slope of the lateral moraine (from IV on the left) of the Luza Drangka (Kholo), a further right tributary valley of the Ngozumpa Drangka (Figure 3, Panorama 139; Figure 19) from facing WSW (left margin) with the orographic right late Late Glacial lateral moraine (IV centre), via facing NW with the corresponding orographic left lateral moraine (IV on the right) up to facing N up the main valley with the orographic left valley slope of the Ngozumpa Drangka (right margin). (○) are metre- to hut-sized, partly rounded and round-edged, but mostly angular moraine boulders, which during the Holocene have slid and rolled down from the inner slope of the Sirkung moraine (IV on the left). This concerns mainly boulders of Lower Tibetan mica gneiss (6b) outcropping up-valley and showing traces of glacialic abrasion (○) there. (♣ white) marks postglacial crumbles in these gneiss rocks. (∇) is a current debris flow fan the track of which is active during the summer monsoon. It dislocates past moraine material. (Δ) is an active debris cone because a vegetation cover is lacking. (▲▲) show a lateral moraine ledge or a bank kame of a Late Glacial sub-stage of the Sirkung-Stage (IV centre). (The two ■ from the left) are faces of ground moraine on the ground moraine pedestal or -base of the late Late Glacial Luza glacier, which joined the Ngozumpa parent glacier. A glaciofluvial gravel cover only few metres-thick is situated on it; on top are glaciolimnic sands of a lateral lake of the former Ngozumpa glacier (Figure 3 on the left above Panorama 139). These faces are used as the Luza settlement's fields. (♣ black) is the modern meltwater stream of the current Luza hanging glacier. Together with its tributaries (on the left of ■ on the very left) it regressively dissects the ground moraine pedestal. (◆) is the crest of an earth-pyramid (Figure 3 below Panorama 138) which, due to the postglacial cutting of the Ngozumpa river (□) into this ground moraine by slope erosion and -denudation, has been cleared out of the ground moraine of the past Ngozumpa main valley glacier. (■ on the very right) is the remnant of a corresponding orographic left ground moraine. (○) show glacialic abrasions below a rather thin, metre- to decimetre-thick ground moraine. (IV on the very right) is the ground moraine pedestal of the Nymagawa Drangka tributary glacier in the confluence area with the Ngozumpa Drangka (Figure 3 IV on the right of Photo 132) which has been accumulated during the Sirkung-Stage (IV: Table 1). Analogue photo M. Kuhle, 9/9/1982.



↑ *Photo 143.* At 4010 m a.s.l. from the mountain spur between the exit of the Phunki Drangka and the orographic right flank of the Injia Drangka (Figure 3, Photo 143) facing NW across the Injia- (♢) and Ngozumpa Drangka into the orographic right flank of the Ngozumpa Drangka with its numerous steep side valleys. No. 68 is the 6186 m-high Kyajo Ri, (III large) is the Late Glacial ice margin position of the Injia glacier during the Dhampu Stage; on this moraine platform the Tengpoche Gonda monastery settlement (Figure 3 below Photo 103) is situated. (○ black on the very left and white) are the early-Late Glacial (Stages I and II) glacialic flank abrasions on the orographic right flanks of the Ngozumpa- and Injia Drangka. (Second and third ◡ from the left) are High Glacial (Stage 0, Table 1) flank abrasions on the truncated spurs polished back by the Ngozumpa glacier (Figure 3 from the left of Photos 136 to 103). They mediate to the highest verifiable glacier trim-line of the Ngozumpa glacier (...) from ca. 5500 m a.s.l. (... below No. 68) (Figure 30) to 4500 m a.s.l. (...) on the very left) (Figure 31). (III small and IV) are exemplary late Late-Glacial ground- and lateral moraine remnants of the Ngozumpa glacier, which through the hanging valley tributary glaciers, the Maccherno-, Luza-, Dole- and East Khumbui Yul La glacier just reaching the trunk glacier, have been modified into lateral moraines of tributary valleys orientated to the E (Figure 3, Photo 136 up to Panorama 144; Figure 19). (○) are the steep, freshly snow-covered source depressions and - cirque forms (Figure 3 between No. 68 and Panorama 105) of these past hanging valley glaciers. In part they still contain small cirque glaciers. (■) are remnants of ground moraine covers with large erratic boulders (Photo 95) on the mountain spur between Ngozumpa- and Injia Drangka above the Phortse settlement. This mountain spur shows a trough-shaped concave profile-line. (♢) is a gorge-like narrowing of the Injia Drangka valley bottom due to subglacial meltwater erosion. Analogue photo M. Kuhle, 15/3/2003.



↑ *Photo 142.* Panorama at 4100 m a.s.l. looking down the Dole Drangka (Khola; valley of Dole) (Figure 3, Panorama 142; Figure 19) from facing ENE (left margin) along a Late Glacial (Stage III; Figure 19) inner slope of a lateral moraine (■ on the very left) across the Ngozumpa Drangka into its left flank, via facing ESE to the inflow of the Ngozumpa Drangka into the Imja Drangka, the orographic left flank of which is formed by the 6779 m-high Kang Taiga (No. 27) and the 6608 m-high Tramserku, up to facing SE (right margin) on to the orographic right lateral moraine of the Dhampu Stage (III), laid down by the Late Glacial Dole hanging valley glacier (see Table 3). Here, the morainic mantling of the Dole valley is shown, 0.8–1 km down-valley of the 4165 ± 150 YBP old moraine sample (see Table 2 and Figure 19 No. 3). (IV on the right) is a moraine remnant belonging to the Sirkung Stage. (■ below IV on the left) is the still intact remnant of the Late Glacial ground moraine pedestal (or -base; Figure 3 on the right of Panorama 142) on which and via which the Dole hanging valley glacier has joined the Ngozumpa trunk glacier. Currently this is the terrace where the Dole settlement is situated. (⬇) marks the deep erosion of the Dole river which since deglaciation of the Ngozumpa Drangka has regressively cut into the ground moraine pedestal. (IV on the left) is a corresponding ground moraine pedestal (or -base; Figure 3 above Panorama 145) at the exit of the Konar Drangka across which the Konar glacier has joined the Ngozumpa main glacier (Photo 144). (□) is the current Phunki glacier. (The upper 4 ■ are High Würmian to Late Glacial (Stages 0–III) partly fluted remnants of a ground moraine cover on the left Ngozumpa- and left Imja Drangka flank: (?) are the glacialic smoothings of abrasion, which above these ground moraines reach up to at least 4500 m. Near the inflow of the Ngozumpa Drangka into the Imja Drangka they prove a glacier trim-line at ca. 4500 m (see Figure 31). (▼) marks the linear erosion of the Ngozumpa river which has already been developed subglacially and has synchronously dissected the trough bottom. Analogue photo M. Kuhle, 9/9/1982.



↑ *Photo 144*. Panorama at 3650 m a.s.l. from the Ngozumpa Drangka, ca. 1 km NW of the Phortse settlement (Figure 3, Panorama 144) from facing NNE (left margin) via facing NE looking up the trough-shaped Konar Drangka, up to facing ENE (right margin). (IV) mark the ground moraine pedestal (Figure 3 on the right above Panorama 144) cut into two moraine ridges (IV on the left and IV on the right), which the Konar glacier for the last time has pushed against the Ngozumpa main glacier during the Late Glacial Sirkung Stage (IV, Table 1) (cf. Photo 142). The Konar glacier stream (V) has dissected the ground moraine pedestal, so that, due to removal of the matrix, moraine boulders up to the size of a hut have remained at a great density in this talweg. (V) indicates moraine material of the neoglacial Nauri-Stage and (VII) of the historical Younger Dhaulagiri Stage (see Figure 19); in the area of the two moraine complexes, a rock step abraded by ground polishing is situated, which can be addressed as a *roche moutonnée* landscape (○ white, ■) are up to a few metres-thick remnants of a ground moraine cover located on the orographic left flank of the Ngozumpa main valley up to an altitude of 4500 m a.s.l. (Figure 31). (○ and ○) are glacialic flank abrasions on the outcropping Lower Tibetan schist, phyllite and gneiss (6b) in the confluence area of the Konar trough valley into the Ngozumpa main valley, synchronously created partly by the Konar tributary glacier and partly by the Ngozumpa main glacier. Analogue photo M. Kühle, 8/9/1982.



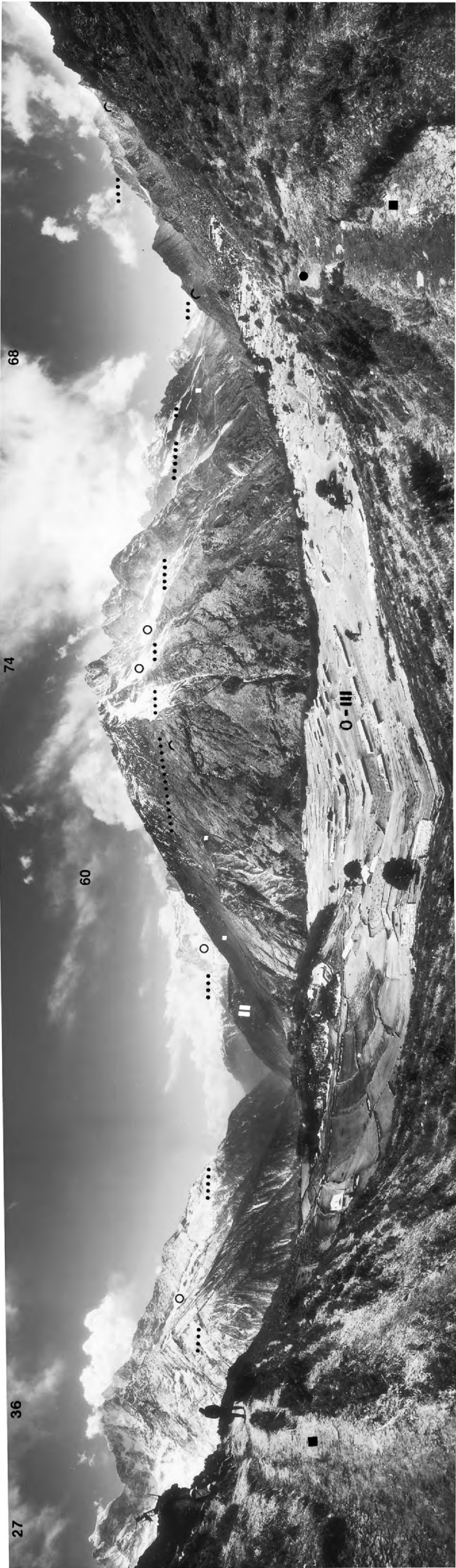
← *Photo 145.* Panorama at 3800 m a.s.l. from the NW-margin of the rock- and ground moraine terrace on which the Phortse settlement is situated, looking up the Ngozumpa Drangka (Figure 3, Panorama 145) from facing WNW into the orographic right valley flank (left margin) via facing NNW along the valley axes up the Ngozumpa Drangka (↓), up to facing NNE into the orographic left valley flank (right margin). (III) is a remnant of a lateral moraine- or lateral kames terrace (three farm houses for scale) of the Late Glacial Dhampu Stage (Table 1) at an altitude of 4060 m (Figure 3 on the right next to Photo 146); below, a ground moraine cover (■ black) stretches up to the talweg with the Ngozumpa river (∇). (□) are sub-recent glaciofluvial gravel floor terraces on both sides of this river. (● black) are further occurrences of ground moraine deposited between High-Würmian Glacial and late Late Glacial (Stages 0–IV). (○) and (◊) are glaciogenic abrasion forms which have rounded the valley flanks and truncated spurs between the junctions of the tributary valleys. They testify to a glacier trim-line (..., ----) between ca. 5500 m (... above ↓) (Figure 30) and 4500 m a.s.l. (... on the very left) (Figure 31). The remaining polish lines (...., ----) are situated at an altitude in between. The cross-profile of the lower Ngozumpa Drangka is bipartite: the upper part (above ↓) is that of a wide, relatively flat trough valley, the lower one (↓) that of a V-shaped valley set into the trough ground (Figure 3 between Photos 133 and 147). Analogue photo M. Kuhle, 22/3/2003.



← *Photo 146.* At 3560 m a.s.l. from the orographic left side of the Ngozumpa Drangka ca. 40 m above the talweg, 0.5 km N below the rock terrace of the Phortse settlement (Figure 3, Photo 146) facing NE an active track of debris flow upward (↑), looking up the orographic left valley slope. The debris flow has cut through the entire forest belt of Betula utilis trees from the limit of forest growth about 4100 m down to the talweg with up to 4 m-high marginal dams (○). Its material consists of removed High- to Late Würmian ground- (■) and lateral moraine, as can be recognized by the metre-sized, round-edged, i.e. faceted granite boulders (◊) 'swimming' in a fine material matrix and additionally dislocated by a debris flow. The primary position of the moraine (■) is on glaciogenically smooth-polished gneiss rock (6b) (below ■). Analogue photo M. Kuhle, 22/3/2003.



→ *Photo 147.* At 3520 m a.s.l. from the talweg of the Ngozumpa Drangka ca. 0.6 km N below the rock terrace of the Phortse settlement (0–III) (Figure 3, Photo 147) facing SSW looking down the current gravel floor of the Ngozumpa river (■ large), (■ small) are 1–3 m-high subrecent gravel floor terraces used as pasture by the Sherpas. (◊) are angular to secondarily glaciofluvially rounded, mostly round-edged granite and gneiss boulders of moraines, in size from metres to that of a hut. (○ on the right below 0–III) are moraine boulders in a primary position, deposited 250 and 240 m above the glacial gorge stretch on the terrace slope of Phortse, whilst since deglaciation the remaining marked large boulders (◊) due to the work of the Ngozumpa river, which has washed out the fine material, have been dislocated and condensed near to the talweg. (0–III) is the ground moraine cover on the rock terrace of the Phortse settlement (cf. Photo 148), laid down during the High Würmian period up to the Late Glacial Dhampu Stage (Table 1). Analogue photo M. Kuhle, 22/3/2003.

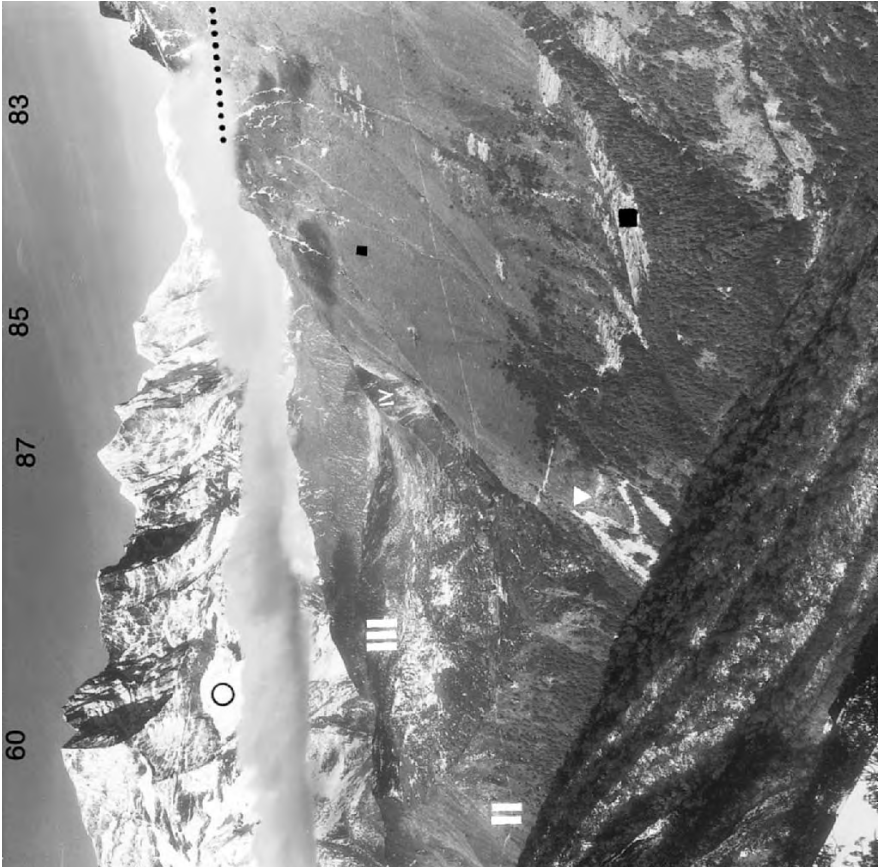


↑ *Photo 148.* Panorama taken at 4000 m a.s.l. from NE above the Phortse settlement (0–III) (Figure 3, Panorama 148) on the mountain spur between Ngozumpa Drangka (right half) and Imja Drangka (left half) from facing SE (left margin) with the 6779 m-high Kang Taiga (No. 27) and the 6608 m-high Tramserku (No. 36) beside it, via facing SW down the Imja Drangka, via facing WSW to the 6187 m-high Kongde Ri (No. 60) and facing NW up the Ngozumpa Drangka to the 6186 m-high Kyajo Ri (No. 68) up to facing NNE (right margin) looking into the orographic left valley flank. (■ black) is material of ground moraine. During the High Würmian to Late Glacial period, when the glaciation of the Dhampu Stage has still covered this area, it has been laid down on the entire rock terrace, on which Phortse has been settled (0–III). After the stones and boulders have been picked out, the ground moraine presents a very good, i.e. highly fertile soil quality to grow potatoes and cereals. This ground moraine (■ black) contains polymict, edged and round-edged granite- and quartzite boulders (● in size up to a hut (on the left side of the person, left margin of the panorama), (■ white) are ground moraine covers in the orographic right valley flank. (○, ⌋) are High Glacial flank abrasions indicating the maximum height of the then glacier level (...). It has run in the middle Ngozumpa Drangka at 5600 m (... below No. 68) (Figure 3 between Profiles 19 and 20) and has dropped to ca. 4100 m (... on the left below No. 60) (Figure 4, Profile 28) at the Imja Drangka/Bote Koshi confluence forming the Dudh Koshi. (II) is the ice margin position with the end moraine of Namche Bazar up to which the Imja glacier has at least reached during the Taglung Stage (Table 2). (○) are past cirque floors, in part still covered by a glacier until the neoglacial period. Analogue photo M. Kuhle, 22/3/2003.

← *Photo 149.* In the orographic right valley flank of the Imja Drangka above the Mondara locality (Figure 3, Photo 149) between the Phortse (Figure 3, Panorama 148) and Trashinga (Figure 3 above Photo 102) settlements at 4100 m a.s.l., looking up-slope facing NW. (⌋) are glacial abrasion roundings preserved in the outcropping mica augen-gneiss (6b) up to 4400 m a.s.l. (■) is a 2–4 m-thick ground moraine cover (Figure 58; 37 No. 28). (●) are several of the polymict 40–50 cm-long ground moraine boulders which, despite their in part significant hardness, are round-edged to rounded. They consist of different varieties of gneiss (fine- and coarse-grained banded gneisses), erratic tourmaline-granite boulders (● on the left) made up from coarse- and fine-grained granite, and metamorphic boulders from five different phyllites, as e.g. schist and very hard, fine-grained greenish quartzite. Part of them has slightly been dislocated by the trampling of cattle, but they are also exposed in their original position in the ground moraine exposure (■) (person for scale). The superficially weathered ground moraine shows a slightly Sesquioxide-coloration ($\text{Fe}^{2+}\text{O}^{3-}$, $\text{Al}^{2+}\text{O}^{3-}$). Analogue photo M. Kuhle, 23/3/2003.

→ *Photo 150.* At 3860 m a.s.l., looking from W above the Trashinga settlement along the orographic right valley flank of the Imja Drangka (Figure 3, Photo 150; Photo 151 below ■ small) facing NNE up-valley via the Mondara locality (on the crest on the right below ○) on to the 6542 m-high Taboche (No. 40). (⌋) are glacial abrasion roundings preserved in the outcropping mica gneiss (6b) as far as 4400 m a.s.l. (■ below) is a decametre-thick, rib-shaped remnant of ground moraine (Figure 58; 37 No. 28); the entire slope is covered with thick ground moraine such as this, thinning out in an upward direction (■ above). (●) are polymict, edged, round-edged to faceted gneiss- and granite boulders in size up to one metre (persons for scale) which beside the clayey matrix make up the ground moraine – here cut across by the cattle track (Figure 60; 37 No. 29). Analogue photo M. Kuhle 23/3/2003.





← *Photo 151.* Taken at 4140 m a.s.l. from the orographic left valley flank of the Imja Drangka SE above the Tengpoche monastery (Figure 3, Photo 151/Panorama 94; see Photo 152) facing W up the Imja Drangka to the confluence with the Nangpo Tsangpo (lower Bote Koshi) with Kongde Ri (No. 60, 6187 m), Teng Kangpoche (No. 87, 6500 m), Pigpherago Shar (No. 85, 6718 m) and Tangi Ragi Tau (No. 83, 6940 m); in the middleground is the orographic right flank of the Imja Drangka. This valley flank is covered with ground moraine up to an altitude of 4160 m a.s.l. (■ small) (cf. Photos 149, 150, 152). (■ large) is a pedestal ground moraine terrace on which the Trashinga settlement (II,III,IV) is situated (Figure 3 above Photo 102). (▼) are freshly ripped fissures of a slide created by undercutting of the slope through the Imja river. Khumjung and Syampoche settlements (see Figure 59). (○) is a late Late Glacial, neoglacial to historical cirque, the steep back wall of which is still glaciated. (...) is the highest Würmian glacier trim-line at ca. 4300 m (Figure 32). Analogue photo M. Kuhle, 15/3/2003.

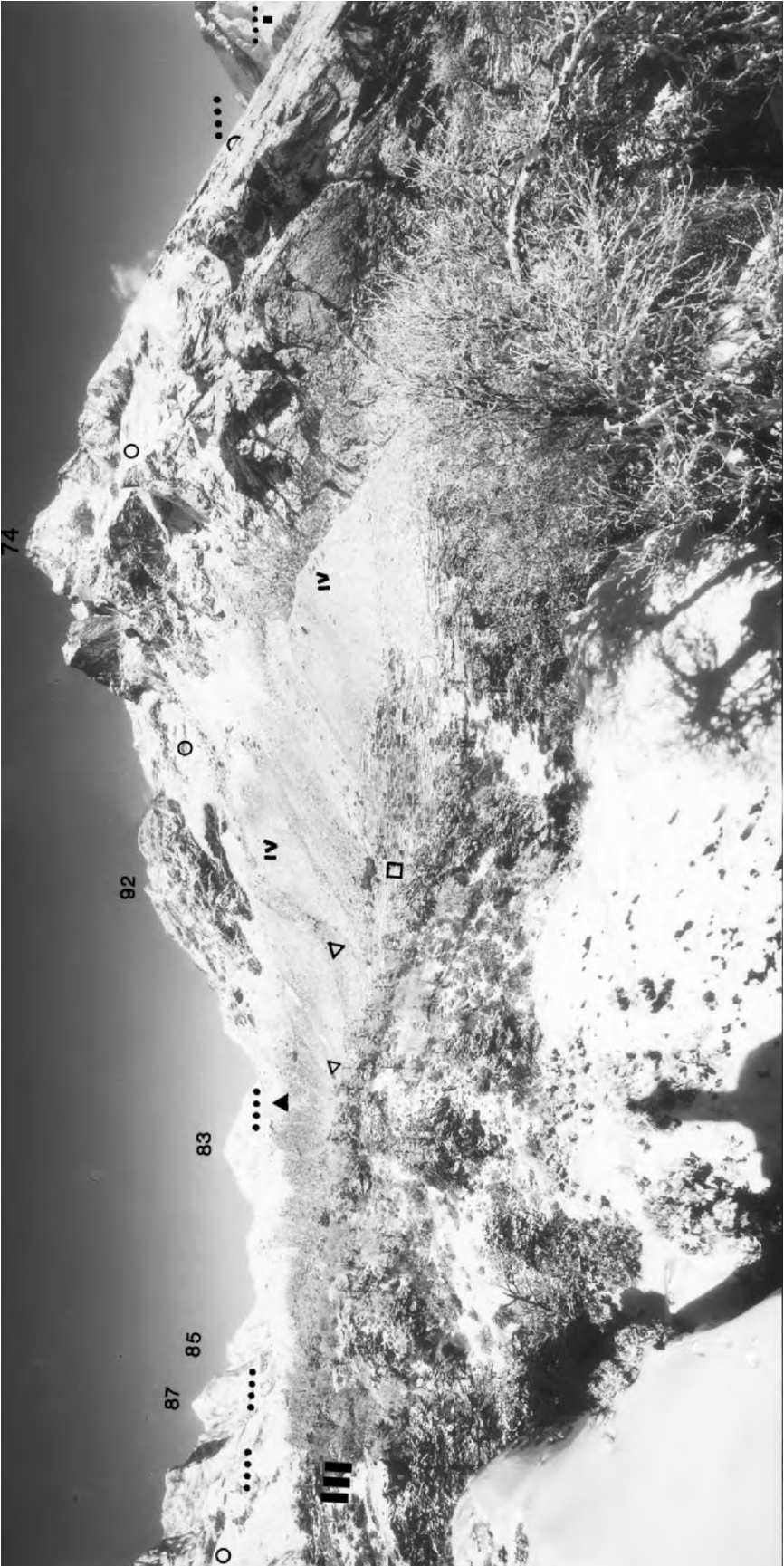


← *Photo 152.* Panorama taken at 3830 m a.s.l. from the orographic right flank of the lower Imja Drangka from westward above the Trashinga settlement (Figure 3, Panorama 152; Photo 151 below ■ small) looking facing NNW up-valley, via facing NNE to the 6542 m-high Taboche (No. 40), via facing ENE into the orographic left valley flank on to the 6856 m-high Amai Dablang (No. 20) and the 6779 m-high Kang Taiga (No. 27). (■ on the right below No. 20) is the position from which Photo 151 has been taken. (○) are glacial abrasion roundings preserved up to 4400 m a.s.l. in the outcropping gneiss (66) of the next cross-profile (○ on the left). (■ on the very left) is the ground moraine cover (Figures 58 and 60) containing erratic boulders (●) from which samples have been taken. It nestles against the glacial moraine granite; isolated from each other they “swim” in a clay-containing fine material matrix. The sharp-edged to faceted and round-edged boulders up to one metre in size (●; length of the stick = 150 cm) consist of gneiss- and erratic tourmaline granite; isolated from each other they “swim” in a clay-containing fine material matrix. (The two ■ below on the right) are the ground moraines increasing in thickness down to the valley bottom (Figure 32). They have made up the pedestal moraine basement on which the Late Glacial (Stages I–II) Imja parent glacier has flowed. Due to the incision of the Imja river, a terrace has been developed, used for the settlement of the village of Trashinga. (■ small below Nos. 40–27) are further deposits of ground moraine reaching at most 4500 m (■ on the right below No. 20; Figure 27). (...) is the Würmian glacier level (Stage 0) at the exit of the Ngozumpa Drangka (... on the right below No. 40) (cf. Figure 31) and in the middle Imja Khola (... below Nos. 20–27) (cf. Figures 26 and 27); here it leads down to ca. 4400 m a.s.l. (... on the right). (○) is the currently glaciated cirque-like valley head of the Konar Drangka SW below the summit of Taboche (No. 40; Figure 3). Analogue photo M. Kuhle, 23/3/2003.

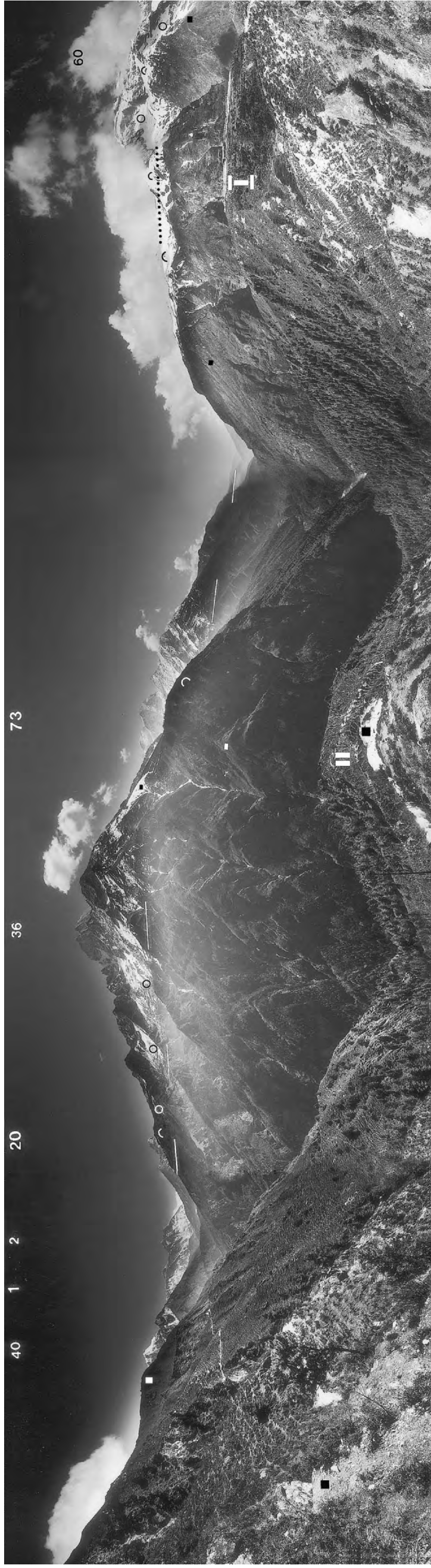


← *Photo 153.* Exposure in the orographic right valley flank of the Imja Drangka, 420 m above the talweg with the Imja river, on the ground moraine terrace near the Trashinga settlement at 3650 m a.s.l. (27°53' N/86°44' E) (Figure 3, Photo 153; Photo 152 second ■ from the right below) taken facing W. Glaciolinnic sand several metres-thick (□) (person for scale) has been attached to the ground moraine cover (■) on the slope. In part it has been covered by solifluidally dislocated moraine material (with boulders of the situmetric groups I and IV arranged in lines) (➤). This glaciolinnic sand shows a comparable composition of the grain sizes as the glaciolinnic sands on the lateral- and ground moraine terrace of Namche (Figure 59; Photo 158; Figures 65, 66). The 1–3.5% of a clay portion still contained, are characteristic. They prove that the substrate has been developed by washed-out moraine. Analogue photo M. Kuhle, 7/11/1982.

→ *Photo 154.* Taken from the orographic right valley flank of the Imja Drangka in the confluence area of the hanging valley from Khumjung and Khunde looking from WSW above the Trashinga settlement (Figure 3, Photo 154) at 3810 m a.s.l. facing W. (○) is a rock form in the area of the orographic right valley flank, abraded and polished round by the nearly horizontally overflowing glacier ice. A several metres-thick ground moraine cover is situated upon it (■ above). The lee-slope of the former ice stream shows angular roughenings (⇒) created by the extraction of large boulders. This has been caused by the regelation due to the leeward relief of the ice-pressure and the freezing of the glacier ground to the rock. The shape and size of the boulders is performed by the clefts in the gneiss bedrock. (▷) is one of the numerous postglacial boulders caused by crumbplings, (IV) is a lateral- i.e. end moraine dam of the late Late Glacial Sirkung-Stage (Table 1) NE of the Khumjung settlement (Figure 3 on the left of Photo 154; Photo 151 IV). (■ below) is further moraine material of the Würmian to Late Glacial period. Analogue photo M. Kuhle, 23/3/2003.



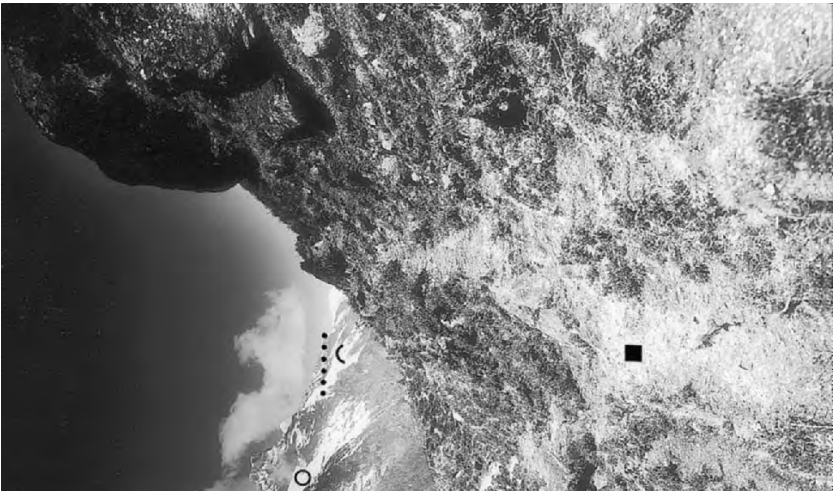
← *Photo 155.* Panorama taken at 3790 m a.s.l. from the junction area of the Khumjung hanging valley with the lower Imja Drangka, ESE of the Khumjung settlement (□) (Figure 3, Panorama 155; Photo 151 on the left below III), from facing SSW (left margin) to WNW up the hanging valley of Khumjung with the mountains Teng Kangpoche (No. 87, 6500 m), Pighperago Shar (No. 85, 6718 m), Tangi Ragi Tau (No. 83, 6940 m) in the background, i.e. in the orographic right flank of the Nangpo Tsangpo Drangka and lower Bote Koshi, in front of it in the middleground Kabsale (No. 92, 5583 m); via facing NW to the Khumbui Yul Lha (No. 74, 5761 m), up to facing N along the orographic right valley flank looking up the Imja Drangka. (○) are currently non-glaciated cirques. (III and IV) are local lateral- and end moraines of the Late Glacial Dhiampu- and Sirkung Stages (Table 1) (Figure 59 III and IV); at the slope-foot of IV, field terraces and buildings of Khumjung (□) can be seen. (▷) are cone sanders of the neoglacial to historical glacier positions of Khumbui Lha (No. 74) S-slopes, forming debris cones (Figure 3 on the left of Panorama 155). (■ and ○) are remnants of ground moraines and glaciogenic flank abrasions lying high up the main valley flanks, which provide evidence of a Würmian (Stage 0) ice level at 4300 m (... on the right below No. 74; Figure 32) up to 4500 m a.s.l. (Figure 31) (... on the very right), (... from left up to below No. 83) are the synchronously communicating ice levels of the Bote Koshi between 4400 (... on the left below No. 87) (Figure 36) and c. 5000 m a.s.l. (... on the right below No. 83) (Figure 35). (▲) is a small Würmian transfluence pass to the Kyajo Drangka evidenced by the moraine cover (Figure 324/3/03/1; Figure 63). Analogue photo M. Kuhle, 13/03/2003.



← *Photo 156.* Panorama taken at 3750 m a.s.l. from the head of the morainic hanging valley (Figure 3, Panorama 156) in which the Namche Bazar settlement is situated (Figure 59), below the Syampoche locality, from facing E into the orographic left flank of the Imja Drangka (left margin) with the 6779 m-high Kang Taiga (No. 27), via facing SSE down the Dudh Koshi Nadi below the confluence of the Imja Drangka and Nangpo Tsangpo, with the massif of the 6369 m-high Kusum Kanguru (No. 73), via facing WSW with the Namche Bazar settlement in the middleground and the orographic right flank of the Nangpo Tsangpo above, formed by the 6187 m-high Kongde Ri (No. 60), up to facing WNW (right margin) along the orographic left flank of the Nangpo Tsangpo looking up-valley. (I) are the Late Glacial ground-, lateral and medial moraine remnants of the Ghasa-Stage (Table 1), in part covered by glaciolimnic sands (Figure 59). On the right and left in the foreground their composition of edged, faceted to round-edged polymict boulders of granite, gneisses and different phyllites is exposed. They “swim” isolated from each other in a clay-containing matrix. The boulders reach several metres in size. (▼ from left to right) is the sequence of the sampling localities Figures 65/66 (▼ on the very left), 67, 68, 71 and 70. (■) are High Würmian (Stage 0; Table 1) remnants of ground moraine. (○, ◌, ◐) are glaciogenic flank abrasions reaching up to the marked polish lines (...). These provide evidence of the High Würmian glacier trim-lines (cf. Figures 32, 36, 52, 53) at 4300 m a.s.l. (... below No. 36; Figure 32), at 4400–4300 m a.s.l. (... from the right margin up to left below No. 60; Figure 36) and from ca. 4000 m (Figure 52) up to 3500 m a.s.l. (Figure 53) and still further down (... bold on the right below No. 73). (... fine) is the High Würmian altitude of the glacier level of the steep Kyashar tributary glacier flowing into the Dudh Koshi parent glacier. (○) are Würmian to historic cirques (Stages 0–VII; see Table 1). Analogue photo M. Kuhle, 12/3/2003.



→ *Photo 158.* Exposure E above the Namche Bazar settlement at 3550 m a.s.l. in the area of the orographic right valley flank of the Imja Drangka (Figure 3, Photo 158) taken facing NE. (■ white) are the lateral-, medial- and end moraine hills in the confluence inset between Imja Drangka and Nangpo Tsangpo; the very large, angular gneiss boulders make clear that rock fall moraine is concerned. (□) are glaciolimnic sands (cf. Figures 65 and 66); above, a solifluction cover from dislocated moraine material is situated. (●) is polymict moraine material from edged and faceted boulders in a clay-containing, heavily clotted matrix of high density (crush resistance: 8 kg/cm²). Analogue photo M. Kuhle, 7/4/2003.



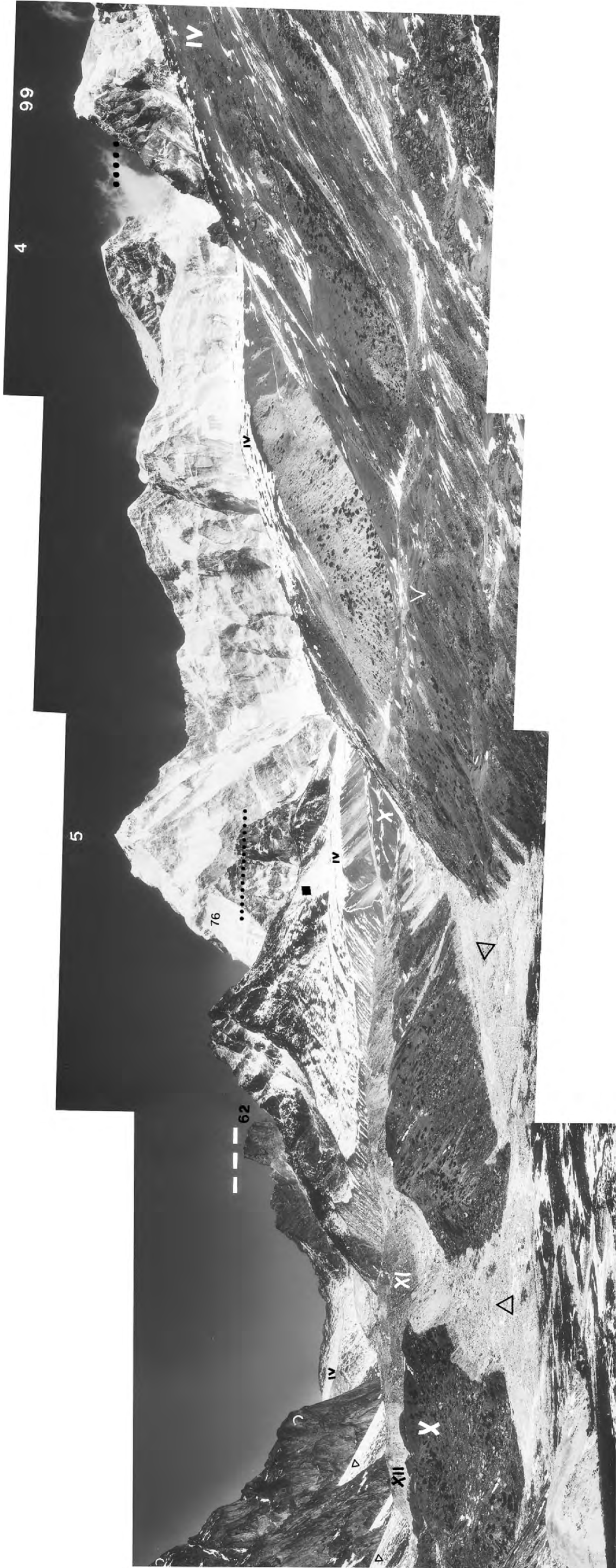
← *Photo 157.* Panorama photo at 3600 m a.s.l. from the orographic right flank of the Imja Drangka NE of the Namche Bazar settlement (Figure 3, Panorama 157) taken from a ground moraine slope (the three large ■ below and in the foreground) from facing NNE (left margin) up the Imja Drangka on to Taboche (No. 40; 6542 m), via facing NE on to Mt. Everest (No. 1, 8848 or 8872 m) and Lhotse (No. 2, 8501 m), via facing ENE on to Ama Dablang (No. 20, 6856 m), via facing E to SE into the orographic left flank of the Imja Drangka and Dudh Koshi Nadi with the summits of Tramskeru (No. 36; 6608 m) and Kusum Kanguru (No. 73; 6369 m), via facing S down the Dudh Koshi Nadi, up to facing WSW to Kongde Ri (No. 60; 6187 m) and into the orographic right flank of the Nangpo Tsangpo Drangka. (II) is a part of an end moraine bend (Figure 3 below Panorama 156 and on the left of Photo 84) up to which the terminal of the Imja glacier has reached during the Late Glacial Taglung-Stage (Table 1). (I) is a terrace of a ground moraine pedestal (Figure 3 on the right above Panorama 159). During the Late Glacial Ghasa-Stage (I: Table 1) it has become a medial moraine between the merging Imja- and Nangpo Tsangpo- (i.e. Bote Koshi-) glaciers and since that time is covered with glacio-lacustrine sands (Figure 59 I). (●) are ground moraines and remnants of ground moraine covers, in part also confirmed by sedimentological laboratory analyses (e.g. ■ in the foreground on the left; Figure 3; 7.4.03/I, i.e. Figures 64 and 37 No. 46). The moraine material at the viewpoint (■ foreground) is composed of polymict boulders up to several metres in size, consisting of dark phyllites, coarse- and fine-grained gneisses, augen-gneisses and granites, which are edged up to at most faceted or scarcely rounded, and which, separated from each other, are embedded into a clay-containing matrix. (◌, ◐) are glaciogenic abrasion roundings following the ground moraine cover in an upward direction. In some places they provide evidence of the High Würmian (Stage 0) trim-lines of the valley glacier (____ and ...). Several of the abrasion roundings, however, have also been developed by local hanging glaciers on the valley flanks (◌ below Nos. 20 and 40). The flank abrasions caused by the High Glacial valley glaciers have been reshaped at a right angle by the Late Glacial cirque- and larger hanging glaciers in a down-slope direction and at the same time destroyed. During the Late Glacial and in part still during the neoglacial period (Stage I to ‘VII) the glaciers concerned have flowed down from the cirques (○) up to below the High Glacial trim-line. The High Würmian level of the Imja-Dudh Koshi glacier has run between 4500 m a.s.l. (____ below No. 20) (Figure 27) and 3500 m a.s.l. (____ on the very right below No. 73) (Figure 53) and that of the Nangpo Tsangpo, i.e. Bote Koshi glacier between 4400 and 4200 m a.s.l. (... from the right margin up to left below No. 60; Figure 36). Analogue photo M. Kuhle, 7/4/2003.



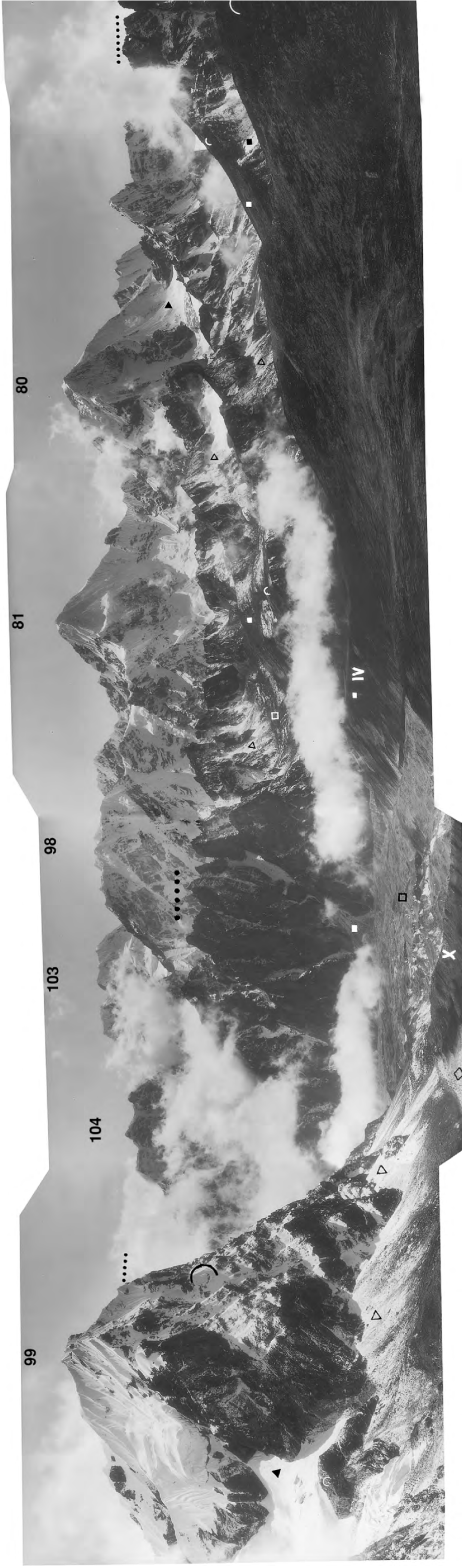
↑ *Photo 159*. Panorama taken at 3520 m a.s.l. from the moraine inset in the confluence area of the Imja Drangka and Nangpo Tsangpo Drangka SE of the Namche Bazar settlement (Figure 3, Panorama 159) from facing SE (left margin) up the Dudh Koshi, via facing S and SW up to approximately W into the orographic right flank of the Nangpo Tsangpo Drangka with the 6187 m-high massif of Kongde Ri (No. 60), via facing NW with the Namche Bazar settlement and to the mountain spur at the exit of the Kyajo Drangka (below the bearded vulture), up to facing N into the direction of Syamwoche. (■) is anthropogenically dislocated moraine material of the terrace of the ground moraine pedestal (Photo 156 f), which during the Ghasa-Stage (Table 1) had ice contact for the last time. It consists of edged, round-edged and facietted to rounded (■ on the right) boulders in size up to at most one metre, made up from different granite- and gneiss varieties. Figures 68 and 37 No. 9 show the glaciogenic condition of the fine material matrix. (▼ on the right) is the sampling locality of Figure 69 and (▼ on the left) of Figure 71. (J) is the ground moraine exposure in Photo 160. (◆) are polished-back truncated spurs between two talwegs, forming glaciogenically triangle-shaped slopes (Figure 3 above and on the right above No. 60; Figure 11 on the left below No. 73). (○, ◐, ◑) are the glaciogenic flank abrasions, reaching up to the marked polish lines (...) and providing evidence of the highest level of the valley glacier. (▽) marks the rock edge of a crumbling which has taken place since deglaciation. (○) is a NE-exposed classic cirque. At the marked spot the current ice margin of a sickle-shaped remaining glacier is situated at 4700–4800 m a.s.l. (... bold) is the Würmian ice level of the Nangpo Tsangpo- i.e. Bote Koshi glacier between 4400 and 4200 m a.s.l. (from ... on the right to left below No. 60; Figure 36) and the Dudh Koshi glacier at 4000 m (... on the very left) (Figure 52) and at ca. 3500 m a.s.l. (Figure 53). Analogue photo M. Kühle, 11/3/2003.



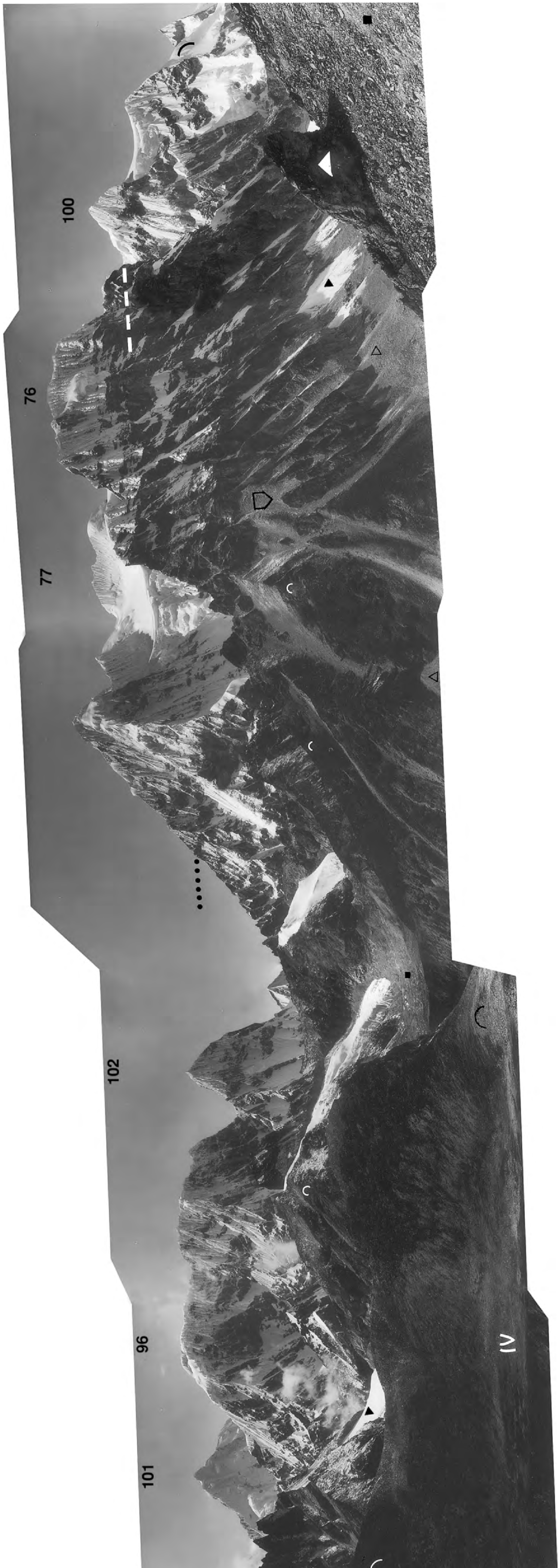
→ *Photo 160*. Four metre-high exposure of ground moraine in the moraine valley of Namche Bazar on the western margin of the settlement at 3520 m a.s.l. in the area of the orographic left valley flank of the Nangpo Tsangpo Drangka (Figure 3, Photo 160; Photo 159 l) taken facing E. The cleaned exposure wall shows tightly pressed ground moraine (■) with a crush resistance of 6–8 kg/cm² even at a moistened matrix. (○) are erratic granite- and tourmaline-granite boulders *in situ*, isolated from each other and up to one metre in size (person with 140 cm-long stick for comparison). They are edged and round-edged. (□) is a 4 m-long angular mica-gneiss boulder on the surface. (▼) is a 110–140 cm-thick cover of solifluction debris with a crush resistance of 3–4 kg/cm². Analogue photo M. Kuhle, 11/3/2003.

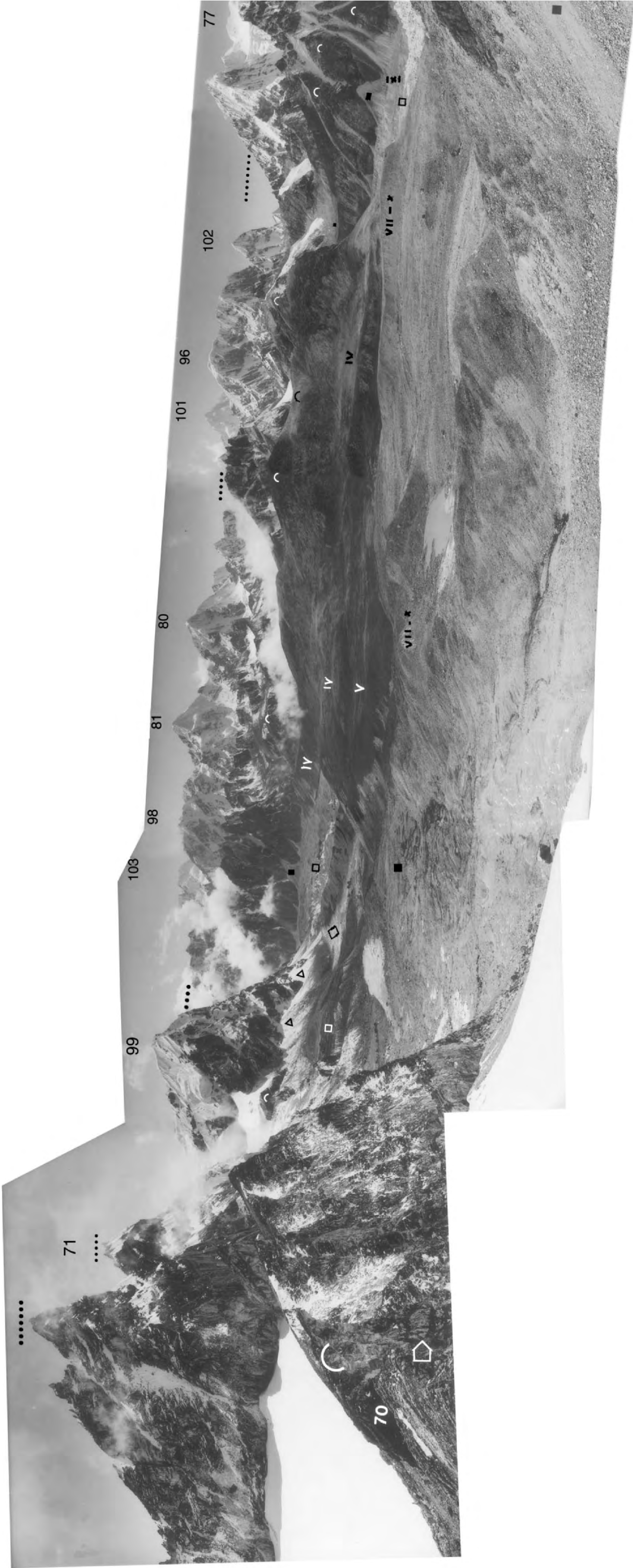


↑ *Photo 163.* Panorama photograph from the orographic left lateral moraine of the Nauri-Stage (V) on the valley floor of the upper Bote Koshi at 4570 m a.s.l., up-valley from the Chhule alpine pasture (Figure 3, Panorama 163) from facing NNW (left margin) in the direction of the 5716 m-high Nangpa La (pass, No. 62; Table 5), via facing N with the main-summit of Nangpai Gosum (No. 5, 7352 m) and in front of it the a good 1000 m lower 6296 m-peak (No. 76), facing NNE with the up to 7296 m-high Nangpai Gosum E-crest (between Nos. 5 and 4) and the 8202 m-high Cho Oyu (No. 4) up to the 5977 m-peak (No. 99). (△ large) are glaciofluvial alluvial debris- and debris flow fans which have been – and still are – heaped up by the meltwater streams of the Nangpa-Lunag glacier (on the left) and Sumna glacier (on the right). (XII and XI) is the active, current front of the Nangpa-Lunag glacier tongue with its light, i.e. current (XII), to darker, i.e. recent (XI), surface moraine to dumped end moraine. (X) are the end moraines of these glaciers built-up during the Little Ice Age 230–80 years ago (cf. Table 1 X). (V) is the orographic left neoglacial (Table 1) lateral moraine ledge of the at that time still connected glacier tongue end of the Nangpa-Lunag (XII and XI) and Sumna glacier (X on the right). (IV) mark the remnants of an originally linked, late Late Glacial ground moraine pedestal. It has heightened the valley glacier network which flowed down ca. 13,500–13,000 years ago. (■) is a ground moraine slope of the same age (Stage IV) reaching up to ca. 5500 m a.s.l. (△ small) are current to Holocene debris cones of crumbly debris from the orographic right valley flank. (○) are immediately adjacent glacial debris preserved on bedrock gneisses (Lower Tibetan gneisses; 6b after Nepal Geological Map 1:125,000 (1985); Sheet No. 721-B). (---) is the High Würmian glacier trim-line in the area of the Nangpa La-transfluence pass from Tibet (No. 62) about 6400–6300 m a.s.l., reconstructed according to the highest upper limits of abrasion. (... below No. 76) shows the synchronous glacier trim-line about 6200–6100 m a.s.l. situated further down-valley; (... below No. 99) is the glacier trim-line about ca. 5900–5800 m a.s.l., still further down-valley. Analogue photo M. Kuhle 31/03/2003.

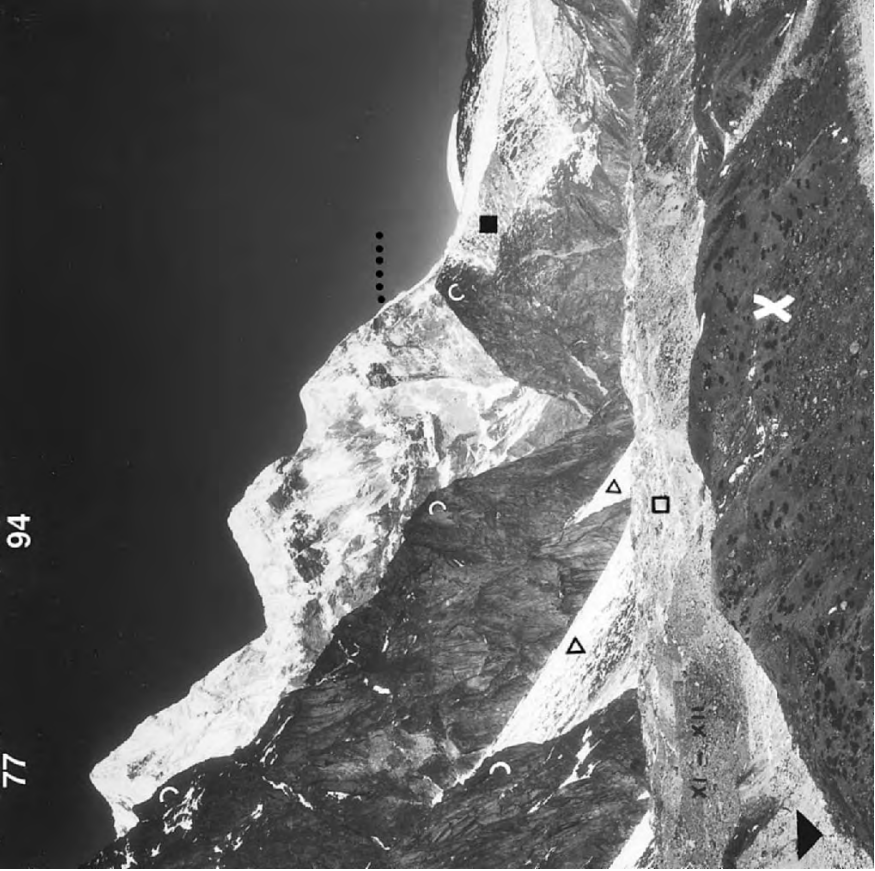


↑ *Photo 161*. Panorama taken at 5640 m a.s.l. from a small plateau ice N above the 5570 m-saddle (No. 70) on the intermediate valley ridge between Ngozumpa- and Sumna Drangka in the upper Bote Koshi (Figure 3, Panorama 161) looking from facing SSW (left margin) with the 5977 m-peak (No. 99) and the 6263 m-peak (No. 104), the Dragkar Go (No. 103, 6793 m) already situated in the Rolwaling Himal, and the 6425 m-peak (No. 98), via facing SW with the 6801 m-high Drag Korob (or Drangnag Ri, No. 81) and the 6705 m-high Kang Korob (No. 80), via facing WSW to Jobo Garu (No. 101), a 7181 m-high main peak in the Rolwaling Himalaya situated 22 km away, via facing W to the 6589 m-peak (No. 96) and the ca. 6000 m-high tower (No. 102), via facing WNW with a 6907 m-high four-summit mountain (No. 77) and the 6296 m-peak (No. 76) between the Sumna- and Nangpa glacier, up to facing NW with the 6477 m-peak (No. 100) and the 5716 m-high Nangpa La (-pass, No. 62) which mediates across the Himalaya into Tibet. (□ black) is the moraine-covered, finely chiselled surface of the Sumna glacier ending on the right side below Peak No. 99, where it pushes against the Nangpa Lunag glacier. Reshaped remnants of ground moraine are adjusted to its right edge (■ white below No. 103). (□ white) is an active rock glacier made up of rock flows which are put in a row. It is fed by debris cones (△ on the right below No. 98) and meltwater of snow. The rest of (▲) mark further debris cones – in part with a thin cover of freshly fallen snow – containing past ground moraines. Their surface consists of the debris of crumbings. (♣) is an exemplary region of gullies, where rock fall deriving from crumbings of glacialic flank abrasions leads to the erosion or out-gouging of these gullies. (▲) are cones of ice avalanches below flank ice and ice balconies. In many places these ice avalanches follow the gullies of the rock falls (△ on the right below No. 76). (▲) is a jagged rock or tor made up of bedrock piercing a past moraine cover (■ on the very right), which at this altitude now is also a current cover of solifluction debris and becomes more and more wasted away by frost weathering. The rest of (■) are ground moraine covers in cirque floors and on the valley flanks. They occur up to altitudes of 5700 m a.s.l. Upwards they have been replaced by triangle-shaped glacialic slopes developed of truncated spurs and by glacialic smoothings of abrasion (○, ◐, ◑). Several of these abrasions have formed roches moutonnées (◐ on the very left and on the left below No. 101). The upper limit of this store of forms provides evidence of a High Glacial (Würmian) glacier trim-line between 6100–6200 m (--- and ... on the right below No. 101) and 5800–5900 m a.s.l. (... below Nos. 99 and 98) (cf. Figure 33). (IV) are ground moraine pedestals upon which the late Late Glacial glacier of the Sirkung Stage was situated (cf. Figure 3). (X) is the orographic left lateral moraine of the Sumna glacier built-up during the Little Ice Age 230–80 years ago (cf. Table 1 X). (◇) are glacio-lacustrine sands of a recent development of a lake in the lateral valley outside of this lateral moraine. Analogue photo M. Kuhle, 28/09/1982.

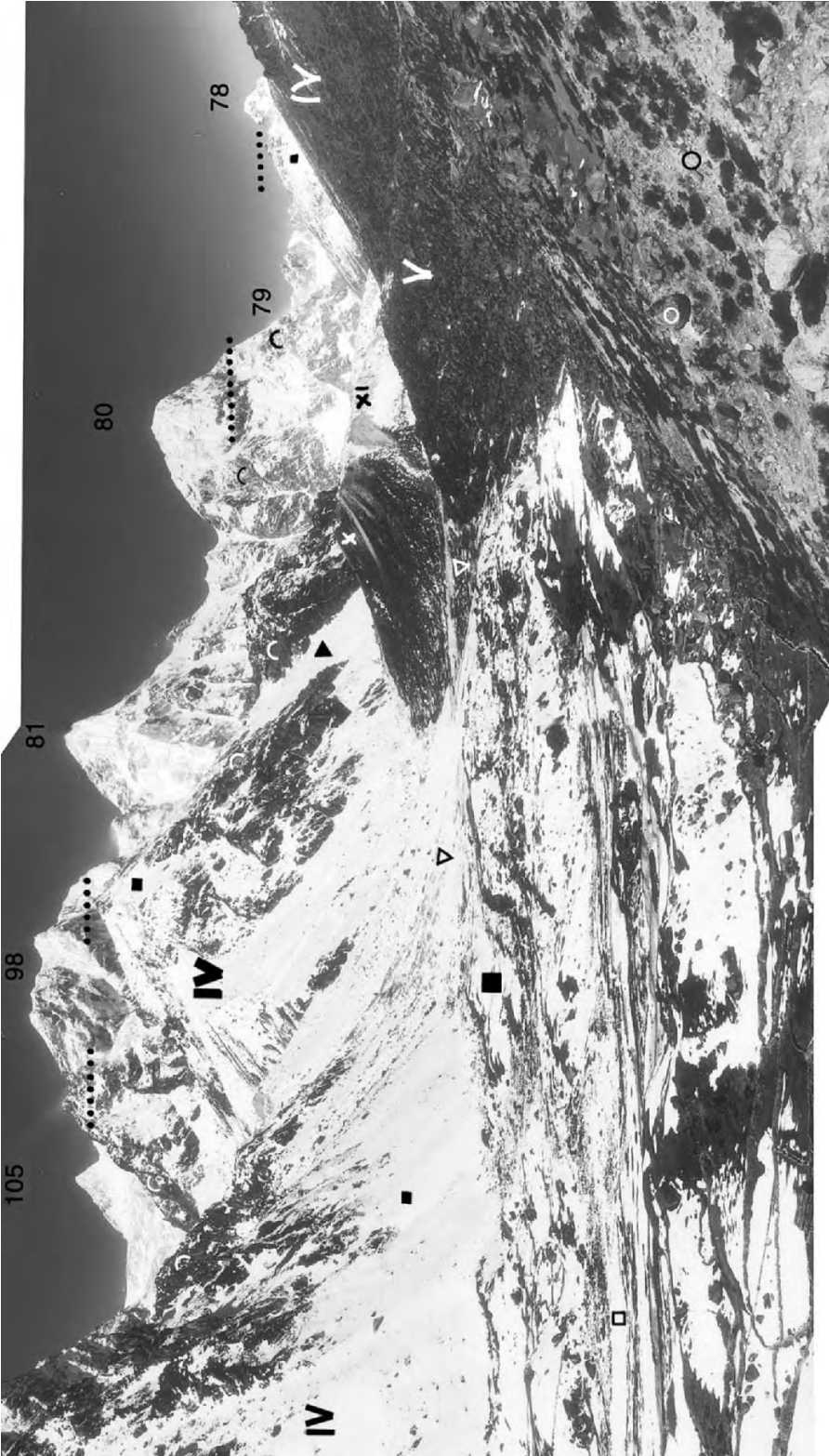




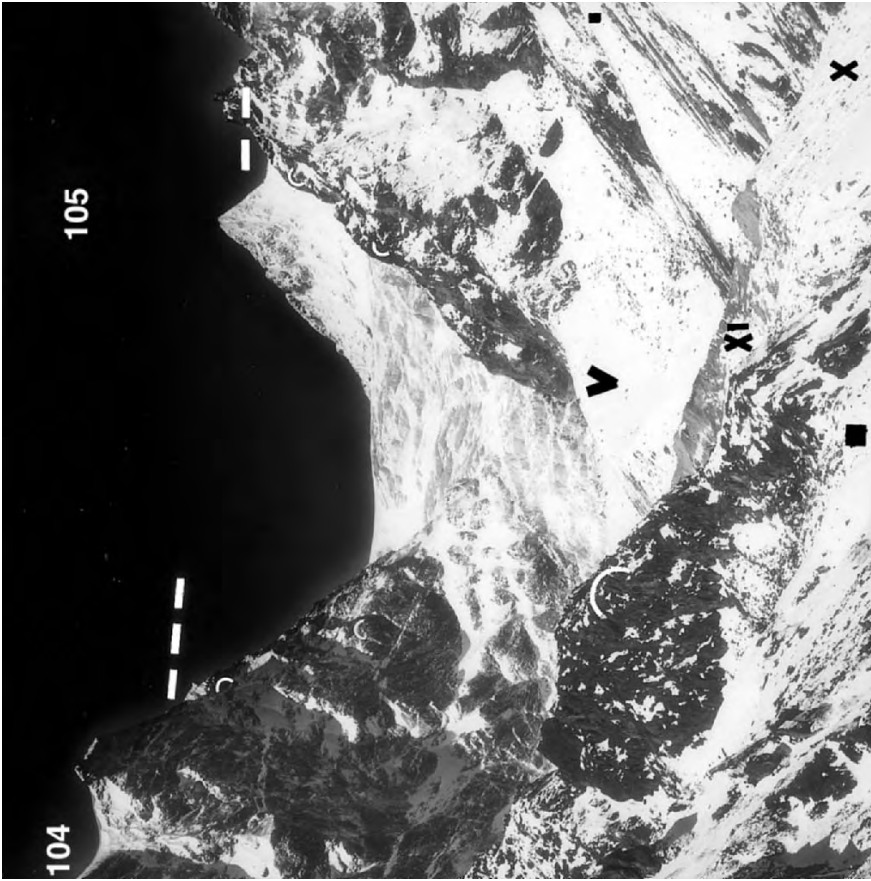
↑ *Photo 162.* Panorama photograph taken at 5640 m a.s.l. from the intermediate valley ridge between Ngozumpa- and Sumna Drangka in the upper Bote Koshi from above the 5570 m-saddle (No. 70) on to the névé field of the Lhabtshan E-glacier, via facing S on to the sharpened summit of the 5927 m-peak (No. 71) and its satellites, via facing SSW with the 5977 m-peak (No. 99) and the 6263 m-peak (No. 104), the Dragkar Go (No. 103, 6793 m), already situated in the Rolwaling Himal, and the 6425 m-peak (No. 98), via facing SW with the 6801 m-high Drag Korob (No. 81) and the 6705 m-high Kang Korob (No. 80), via facing WSW to Jobo Garu, a 7181 m-high main summit in the Rolwaling Himal, situated 22 km away, via facing W on to the 6589 m-peak (No. 96) and the ca. 6000 m-tower (No. 102), via facing WNW with the 6907 m-peak (No. 77) and the 6296 m-peak (No. 76) between Sumna- and Nangpra glacier, via facing NW with the 6477 m-peak (No. 100) and the 7352 m-high Nangprai Gosum main summit (No. 5), up to facing NNW to an E-crest also higher than 7000 m (right margin). (□ black) is the Sumna glacier covered with surface moraine. (□ white) is the WNW-exposed tongue of a hanging glacier wearing a cover of surface moraine, situated between the 5927 m-peak (No. 71) and the 5977 m-peak (No. 99). (◇) are glacio-lacustrine sands in the lateral valley between the lateral moraine of the Sumna glacier (X on the left) and this hanging glacier tongue, which, among others, have been accumulated by its meltwater. (X) are lateral moraines built-up 230–80 years ago (cf. Table 1 X), i.e. the crest of which has been reached by the glacier surface for the last time 230–80 years ago. (VII–X) are lateral- and end moraines of a glacier tongue which during the historical time has branched off from the orographic left source branch of the Sumna glacier (see Table 1 VII–X; cf. Figure 3). In the meantime it has melted away. (IV and V) are remnants of late Late Glacial and neoglacial ground moraine pedestals. (■) are moraine accumulations, which since deglaciation have also been preserved in higher slope positions up to at most 5700 m a.s.l.; in many places they have been reshaped by solifluction (■ on the right totally below), formations of debris cones (△) and ice avalanche cones (▲ black). (○, ∩, ∪) mark glaciogenic abrasion forms and form remnants similar to roches moutonnées (∪ on the left below No. 99, ∩ below No. 81, on the left below No. 101 and on the right below No. 96) on transfluence passes, intermediate valley ridges overflowed with ice (∪ above ⇔ and ∩ on the right below No. 5 and below No. 101) and on valley flanks (∩ below No. 77). The break-off of these abrasions indicates the High Würmian glacier level at 6100–6200 m a.s.l. (... and ---- on the right of No. 102 up to the right margin) up-valley, and at 5800–5900 m a.s.l. (... on the left of No. 101). Peak No. 71, its N-satellite (on the left of No. 71) and Peak No. 102 are glacial horns, which at the time of the early- and late glacial period, when the ice level was lower, have been sharpened due to glaciogenic lateral erosion. (⇒) is the direction of the High Würmian ice transfluence from the Ngozumpa Drangka in the E into the Sumna Drangka and Bote Koshi toward the W, derivable from the flatter, E-exposed lee slope of the 5570 m-high transfluence pass (No. 70). (▲ white) are tors, which during the neoglacial to historical flank glaciation of the slope have been residually exposed by ice denudation, nivation and frost weathering. Analogue photo M. Kuhle, 28/09/1982.



↑ *Photo 164*. Picture taken from the orographic left valley side of the upper Bote Koshi, 0.7 km up-valley from the Chhule alpine pasture from ca. 4700 m a.s.l. (Figure 3, Photo 164) facing NNW across the tongue of the Nangpa-Lunag glacier (□) up the Bote Koshi. No. 77 is the 6907 m-peak with its 6903 m-high N-summit and No. 94 the 1.7 km 6797 m-peak situated 1.7 km further NE. (XI–XII) is the glacier tongue end with its several metres-thick surface moraine cover (□). Since ca. 1950 (cf. Table 1) it is largely stable and active. (X) marks the end moraine dam of this glacier overthrust ca. 230–80 years ago (cf. Table 1 X). It is already overgrown with alpine vegetation, i.e. alpine meadow and some lignified dwarf scrubs (dark patches). In summer yaks are grazing there. (▶) is the position of the glacier outlet of that time (Stage X). In the meantime the meltwater which still discharges here has eroded a small moraine transverse valley through the end moairnes (X). (■) is late Late Glacial ground moraine of Stage IV deposited up to ca. 5450 m a.s.l. (C) marks a rock riegel rounded by glacial abrasion. (○) are glacial rock roundings on the mountain spurs upon bedrock gneisses. (▽) are Late Glacial to neoglacial (Stages III–V) moraine deposits evened out in the indentations of the valley flanks and since deglaciation reworked into the surface form of a debris cone. (...) is the Würmian (Stage 0) glacier trim-line at 6400–6300 m a.s.l. reconstructed according to the flank polishings. Analogue photo M. Kuhle, 1/4/2003.



↑ *Photo 165.* Panorama-photograph taken at 4570 m a.s.l. from the orographic left lateral moraine of the Nauri-Stage (V) on the valley bottom of the upper Bote Koshi up-valley from the Chhule alpine pasture (Figure 3 Panorama 165) from facing WSW (left margin) into the orographic right flank of the Chhule Drangka, and further to the 6508 m-peak (No. 105; Table 5) and the 6425 m-peak (No. 98), via facing W with the 6801 m-high Drag Korob (or Drangnag Ri, No. 81) and the 6705 m-high Kang Korob (No. 80), up to facing WNW to the 5883 m-high Menlung La (pass, No. 79) leading from the Khumbu- to the Rolwaling Himal, and to the 6716 m-high Pangbug Ri (No. 78). (□) is the current gravel floor of the Chhule river and glacier mouth gravel floor, built up by meltwaters of the Pangbug glacier (Figure 3), Dingjung glacier (XI) and Chhule glacier (below No. 105 up to between the two IV, black), (■) large is a neoglacial to historical (Stages V–IX, see Table 1) hilly ablation- and end moraine landscape also continuing on this side of the river, on which the fields of the Chhule alpine pasture are situated (above and below □). These accumulations lie in the tongue basin of the Nauri-Stage (Table 1), the orographic left lateral moraine terrace (V) of which is exposed in the foreground on the right. (○) are far-travelled (up to 10 km), round-edged to rounded gneiss boulders (Lower Tibetan gneisses; 6b after Nepal Geological Map 1:125,000 (1985); Sheet No. 721-B) in this lateral moraine. (∇) present younger fans of alluvial debris and debris flow consisting of dislocated moraine material in the recent glacier forefields, (■ small) are covers of ground moraine extending up to 5400 m a.s.l. (■ on the right below No. 98) and 5600 m a.s.l. (■ on the left below No. 78) up the valley slopes. (IV) are ground moraine covers in the lower areas of the slopes, which for the last time have been covered by glacier ice during the late Late Glacial Sirkung-Stage (Table 1). (▲) is a ground moraine remnant, which since the post-Late Glacial deglaciation has been eroded by slope denudation and re-sedimentated cone-like at the slope foot. (○, ∩, ∪) are glacial rock smoothings and -abrasions, the upper limits of which, situated between altitudes of 6300 (.... on the very right) and 6100 m a.s.l. (... on the very left) render the reconstruction of the High Würmian glacier trim-line possible. (X) is the pedestal moraine of the Dingjung glacier overgrown with fully developed alpine meadow, sedimentated ca. 230–80 years ago (cf. Table 1 X). (XI) marks the front of the surface moraine still underlaid by glacier ice and the ice margin position of this glacier, which has remained in a stable position since ca. 1950. Analogue photo M. Kuhle, 31/03/2003.

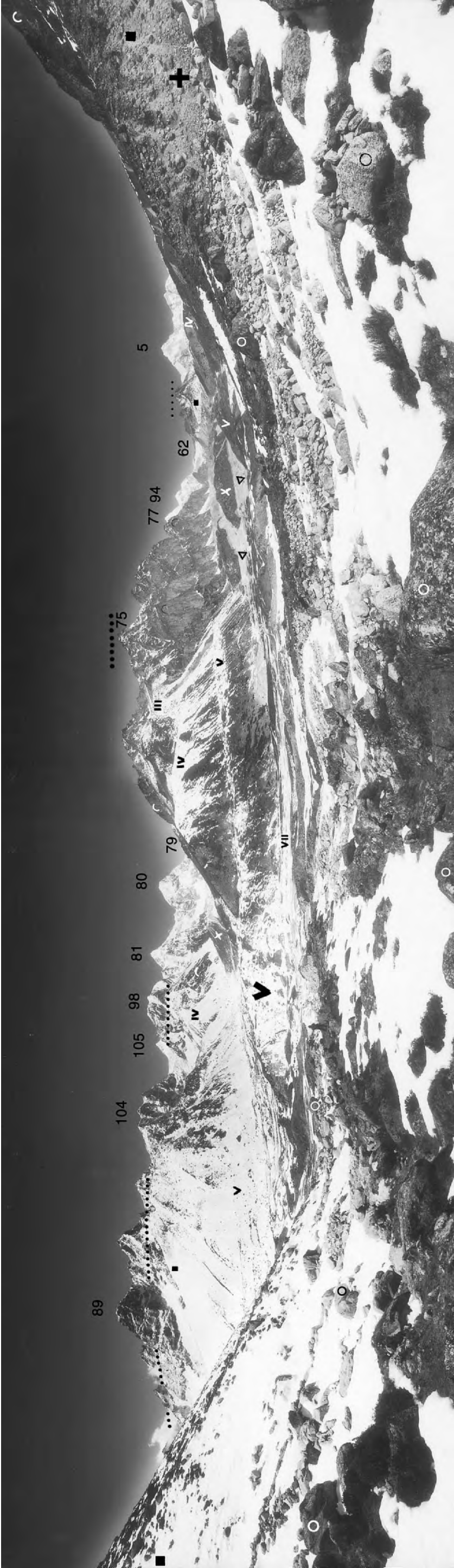


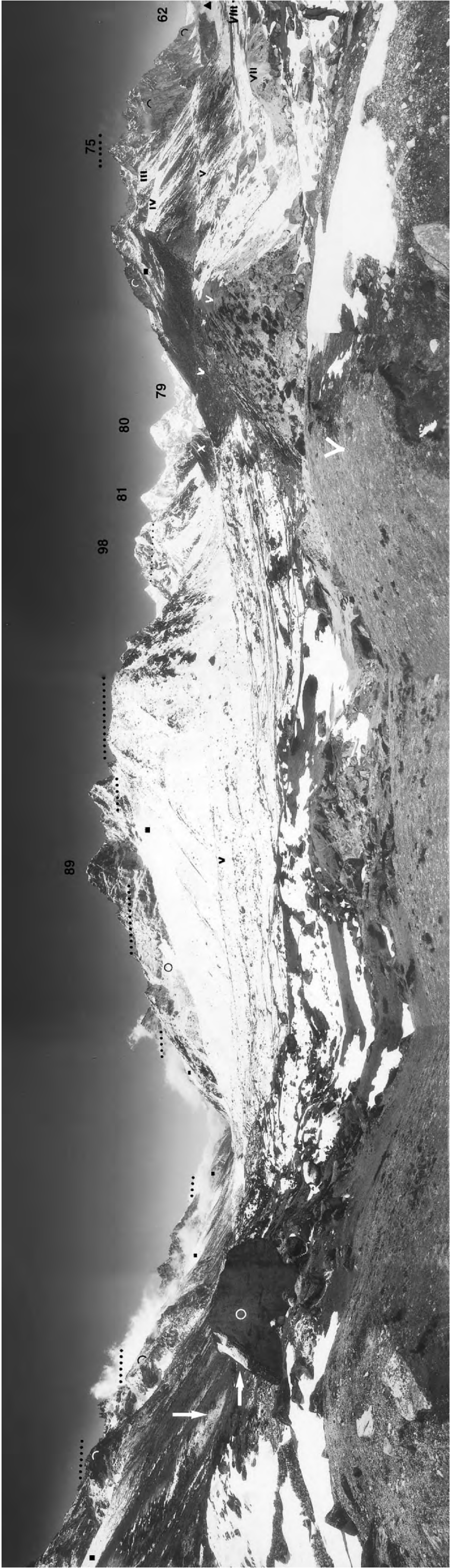
↑ *Photo 166.* Picture taken at 4700 m a.s.l. from the orographic left valley side of the upper Bote Koshi 0.7 km upward of the Chhule alpine pasture (Figure 3 Photo 166) facing WSW toward the Chhule glacier flowing off between the 6263 m-peak (No. 104) and the 6508 m-peak (No. 105) in an NE direction toward the Chhule Drangka. The 4.5 km-long Chhule glacier tongue is an outlet glacier tongue of the upper Drolum Bau glacier which belongs to the Rolwaling Himalaya and first flows down to the S and then to the W toward the Tso Rolpa, where its current ice-level (on the left below No. 105) runs about 5900 m a.s.l. (---) is the High Würmian ice-level about 6000–6100 m a.s.l. Via the Drolum Bau glacier situated in between, the Bote Koshi glacier network of that time was connected with the Rolwaling Drangka glacier network. This Würmian glacier trim-line (---) is verified by the upper limit of the glacialic flank abrasions preserved on the bedrock gneisses (○, ∩, ∪), (■ small) is a ground moraine cover which upward of the contemporary Chhule glacier reaches an altitude of 5400 m a.s.l. (■ large) is the remnant of a corresponding ground moraine cover on the orographic right main valley flank. (XI) shows the historic end moraine of the recent Stage XI (Table 1), to the inner slope of which the current glacier tongue is attached. (X) is the outer slope of the pedestal moraine of Stage X and (V) is the orographic left lateral moraine dam of the oldest neoglacial Stage. Analogue photo M. Kuhle, 1/4/2003.



← *Photo 167*. Picture taken at 4800 m a.s.l. (Figure 3 Photo 167) from the orographic left valley flank of the upper Bote Koshi ESE above the Arye alpine pasture facing WNW looking up the Chhule Drangka. No. 79 is the 5883 m-high Menlung La (pass) which leads into the Rolwaling Himal. No. 78 is the 6716 m-high Pangbu Ri and No. 96 the 6589 m-peak. (□ white) is the front of the Rangbug glacier mantled with front- and pedestal moraine; before it (on the left of □ white) lies the historical (Stage X) pedestal moraine of the Dingjung glacier covered with snow. The three (V) mark the neoglacial (Table 1) lateral moraines of the former Chhule Drangka glacier which has built up a joint tongue of the Rangbug-, Dingjung- and Chhule glacier (Photo 166). (□ black) is the tongue basin of this glacier during Stage V (Nauri-Stage). (IV) mark the late Late Glacial ground moraine cloak of the valley slopes attributable to the Sirkung-Stage and extending up to nearly 5400 m a.s.l. (IV on the left below No. 78). (■) is a slope covered with Late Glacial ground moraine, too. (↘) runs in the direction of a slope gully eroded into the moraine cover since the deglaciation and exposing it up to a depth of ca. 10 m. (○, ○, ○) are glacial flanks in the gneiss bedrock, the upper limits of which are evidence of High Würmian glacier trim-lines (...) at 6400–6200 m a.s.l. Analogue photo M. Kuhle, 29/3/2003.

↓ *Photo 168*. Panorama photograph taken at ca. 4700 m a.s.l. from the orographic left valley side of the upper Bote Koshi, 0.7 km upward of the Chhule alpine pasture (Figure 3 Panorama 168), from facing S (left margin) down the Bote Koshi Drangka, via facing SSW into the orographic right valley flank with the 5967 m-peak (No. 89, Table 5), via facing WSW to the 6263 m-peak (No. 104), to the 6508 m-peak (No. 105) and the 6425 m-peak, via facing W to the 6801 m-high Drag Korob (No. 81), the 6705 m-high Kang Korob (No. 80) and the 5883 m-high Menlung La (pass, No. 79), via facing NNW with the 5719 m-peak (No. 75), via facing NNW with the 6907 m-peak (No. 77) and the 6797 m-peak (No. 94) and further, directly up the Bote Koshi valley, via the 5716 m-high Nangpa La (pass, No. 62) leading into Tibet, via facing N with the 7352 m-high Nangpai Gosum (No. 5) and its ca. 7200 m-high E-crest, up to facing NNE into the orographic left flank of the upper Bote Koshi Drangka (right margin). (+) is the locality of sample 14.03/1 (Figures 72 and 37 No. 37) taken from ground moraine in the orographic right marginal area of a debris fan. (○) are up to 5 m-long (person for scale on the left below V, bold) polymict moraine boulders of gneiss and granite. They are round-edged, i.e. faceted and covered with lichens, if not recently dislocated. It is mainly material of ground moraine recently or currently dislocated in a debris flow fan. (■) shows ground moraine material *in situ* extending on the valley slopes up to 5300 m a.s.l. (■ on the right below No. 89) or even 5500 m a.s.l. (■ on the right of No. 62). (X below No. 81) is the pedestal moraine of Stage X of the Dingjung glacier. (X below No. 94) is the end moraine of the Nangpa glacier (■ on the left) and out of its orographic left lateral valley. (VII) is the remnant of end moraine of the early-historical Stage VII (see Table 1) situated in the tongue basin of Stage V (V on the left below No. 75, on the right below No. 62 and V (bold) below No. 98). (V) (bold) is the medial moraine inset in the former confluence area of the Nangpa- and the Chhule Drangka glacier. (V on the left below No. 104) marks the orographic right margin of the tongue basin of the then Chhule Drangka glacier. (IV) shows terraces of ground moraine pedestals of the Late Glacial Sirkung-Stage (Table 1). (III) is an orographic right, ledge-like remnant of ground moraine of the Dhampu-Stage at 5150 m a.s.l. (○, ○, ○) are glacialic roundings on a rock wall of bedrock gneisses (66: Lower Tibetan gneisses). Their upper limits prove the High Würmian glacier trim-line at ca. 6200 m a.s.l. (...) on the polish notch below No. 98) up to 5500 m a.s.l. (...) on the left below No. 89) (cf. Figure 34). (...) above No. 75 and on the right of No. 62) indicates a High Würmian ice-level about 6600 m a.s.l. (cf. Figure 33) in the upper Bote Koshi Drangka. The rock summits below this level (e.g. No. 75) have been sharpened by the flank polishing at a lower ice-level during the early and late glacial period, i.e. when they have pierced through the glacier surface. Analogue photo M. Kuhle, 1/4/2003.





← *Photo 170.* Taken at ca. 4500 m a.s.l. from the orographic left valley side of the upper Bote Koshi Drangka between the Arye and Chhule alpine pastures (Figure 3 Photo 170) from the bottom of the lateral valley behind the lateral moraine of the Nauri-Stage (V) facing ESE into the orographic left valley flank. (■ black) is moraine material with round-edged to rounded granite- and gneiss boulders (○). For the last time it has been moved by the Bote Koshi glacier during the neoglacial Stage V. The seasonal snow meltwater has superficially flushed the material. (●) are postglacial to contemporary boulders of rock fall, i.e. crumbings of gneiss boulders, which in contrast to the moraine boulders are angular. This debris of crumbling boulders (●) superficially covers the older, late Late Glacial (Stage IV) deposits of ground moraine (■ white) forming the slope. In many places the debris has developed cone forms (▽). The ground moraine cover (■ white) nestles against the gneiss rocks abraded by glacier polishing (○). Analogue photo M. Kuhle, 1/4/2003.





← *Photo 169.* 360°-panorama at 4570 m a.s.l. from the orographic left lateral moraine of the Nauri-Stage (V) on the valley bottom of the upper Bote Koshi up-valley of the Chhule alpine pasture (Figure 3 Panorama 169) taken from facing ENE (left margin) up to ESE looking into the orographic left valley flank of the Bote Koshi Drangka, via facing SSE seen this main valley downward, via facing SSW on to the 5967 m-peak (No. 89) which forms the orographic right flank of the main valley, via facing WSW into the orographic right flank of the Chhule Drangka and further to the 6425 m-peak (No. 98, Table 5), via facing W with the 6801 m-high Drag Korob (or Drangnag Ri, No. 81) and 6705 m-high Kang Korob (No. 80), up to facing WNW to the 5883 m-high Menlung La (pass, No. 79) leading from the Khumbu- to the Rolwaling Himal, via facing NW with the 5719 m-peak (No. 75), via NNW up the Bote Koshi valley to the 5716 m-high Nangpa La (pass, No. 62) leading to Tibet, via facing N with the 7352 m- high Nangpai Gosum (No. 5) and its ca. 7200 m-high E-crest which, facing NNE, extends up to the 8202 m-high Cho Oyu (No. 4) – on the right, 10 km in front of it, stands the 5977 m-peak (No. 99) –, up to facing ENE into the orographic left flank of the upper Bote Koshi Drangka (right margin) with the 5941 m-peak (No. 72). (+) is the locality where sample 31.3.03/1 (Figures 74 and 37 No. 35) has been taken from the lateral moraine (V large in the foreground) of Stage V (see Table 1); (↔) is the sampling locality of sample 31.3.2003/2 (Figures 75 and 37 No. 36) 1 km down- valley on the same lateral moraine; (d) is the locality of sample 1.4.2003/2 (Figures 73 and 37 No. 38) from ground moraine on the valley slope which for the last time was in contact with the glacier during the late Late Glacial (IV), (■) are further High Würmian to Late Glacial covers of ground moraine extending on the slopes up to 550 m (■ below No. 5), 650 m (■ on the right of No. 79, below No. 72 and on the right of No. 99), 750 m (■ below No. 89) and 800 m (second ■ from the left) above the valley bottom. (○, ○, ○) are glaucigenic roundings of the rock wall of gneiss and mica gneisses, the upper limits of which are evidence of the High Würmian glacier level (...); it runs from 6000 m a.s.l. up-valley (... below No. 5 and 75) (Figure 33), via ca. 5900–5700 m (... below No. 72 and on the right of No. 89) and 5500 m (second ... from the left and on the left below No. 89) (Figure 34) up to ca. 5000 m a.s.l. (third ... from the left) (Figure 36) down-valley. (○ black) is a cirque-like form scoured out by a hanging glacier after the Würmian valley glacier had melted. (IV) is a 340 m-high remnant of the ground moraine pedestal of the Sirkung Stage preserved in the confluence area of the two valleys. (III) is a ledge-like remnant of ground moraine of the Dhampu-Stage 230 m upward. (V) mark the neoglacial lateral moraines of the Nauri-Stage (Table 1); (○ white) is a moraine boulder of granite, in size that of a house, transported over a distance of ca. 13 km. (VII; VIII–IX; X) are the remnants of end- and pedestal moraines of the corresponding historical glacier positions (cf. Table 1) in the forefields of the Dingjung glacier (X on the left) and Nangpa glacier (X on the right). (▲) marks the front of the tongue and the outlet of the current Nangpa glacier, the meltwater of which cuts the ca. 230–80 years old (cf. Table 1 X) front moraine (X) of the so-called ‘Little Ice Age’. (Δ) are recent to current debris flow fans. Analogue photo M. Kuhle, 1/4/2003.

↓ *Photo 171.* 330°-panorama photograph taken from the orographic left valley flank of the Bote Koshi Drangka E above the Arye alpine pasture at 4800 m a.s.l. (Figure 3 Panorama 171) from facing SE (left margin) with the 5970 m-peak (No. 91; Table 5), via facing S down the main valley on to the 6187 m-high Kongde Ri (No. 60), via facing WSW and W into the orographic right flank of the Bote Koshi with the 5967 m-peak (No. 89) and the 6263 m-peak (No. 104) towering above the flank, via facing WNW on to the 6705 m-high Kang Korob (No. 80) and up the Chhule Drangka facing NW with the summits of Pangbug Ri (No. 78, 6716 m) and of the 6589 m-peak (No. 96) up to the intermediate valley ridge towards the upper Bote Koshi with the 5719 m-peak (No. 75), up the Bote Koshi on to the 6907 m-peak (No. 77) and facing N across the mountain ridge above the orographic left main valley flank (○), up to facing ENE (right margin) across High- to Late Glacial ground moraine slopes. These ground moraines (■ on the very right and IV on the left) are parts of a pedestal moraine terrace rising here 400 m or even more than 500 m above the valley bottom (near V in the background), (○) is a round-edged moraine boulder below the edge of which sample 29.3.03/1 (Figure 76; Figure 37 No. 33) has been taken. Sample No. 30.3.03/1 (Figure 77; Figure 37 No. 34) has been taken at (■ on the right margin), (■ on the left of ■ on the very right up to ■ below No. 89) are further high-lying remnants of ground moraine at altitudes from 5200 to 5300 m a.s.l. (■ below and on the right of ○, below Nos. 75, 96, 80). (■ below No. 89) is situated at 4850 m a.s.l. and concerns local ground moraine of a hanging glacier. (■ on the right below No. 60) is an only 80 m-high late Late Glacial ground moraine pedestal to which a debris fan (V) is adjusted. (▲) are holocene to current debris cones with Late Glacial cores of ground moraine. (V) marks the lateral moraines of the Bote Koshi glacier accumulated during the neoglacial Nauri-Stage (Table 1); (IV below No. 75) is an inset of pedestal moraine of the Sirkung Stage in the area where the Chhule Drangka glacier joins the Bote Koshi main glacier. (○) is a 5400 m-high mountain ridge rounded by the High Würmian glacier ice, (...) indicates the High Glacial glacier level, running about 6000 m a.s.l. in the upper Bote Koshi (... below No. 75) (Figure 33). Up to the middle Bote Koshi it has dropped to ca. 5500 m (...) on the very right and on the right and left below Nos. 104 and 89) (Figure 34). Analogue photo M. Kuhle, 29/3/2003.

