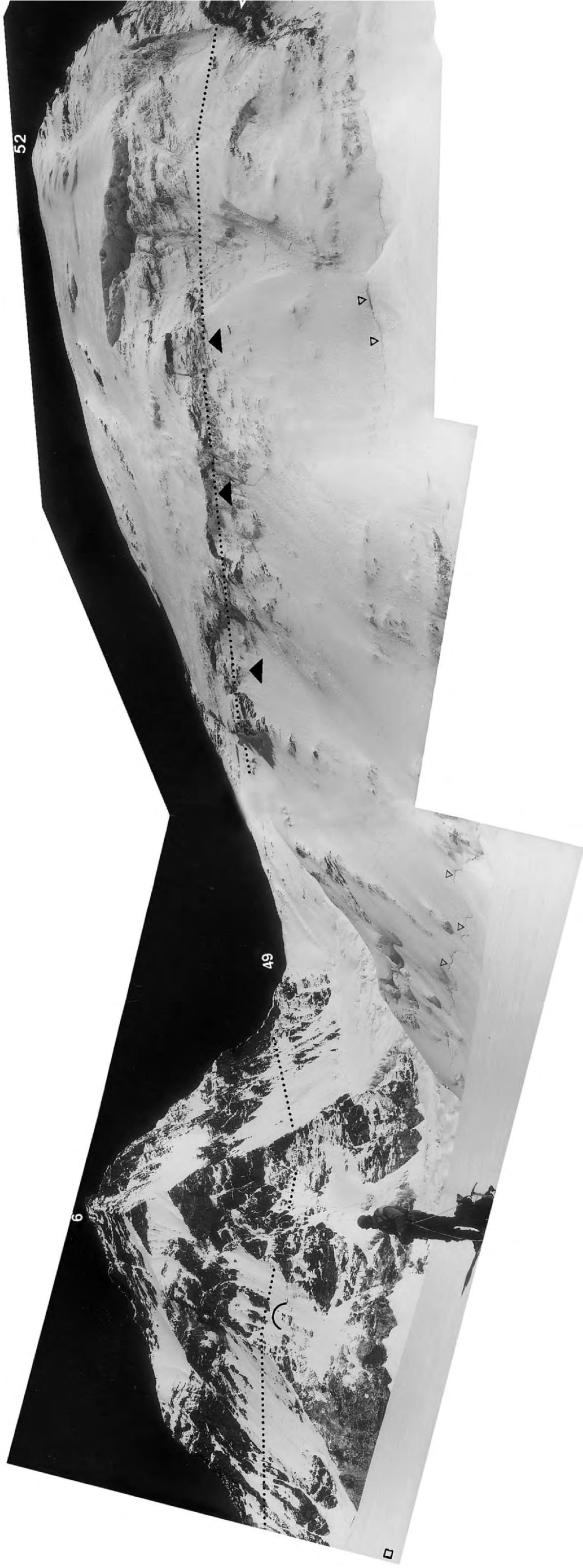
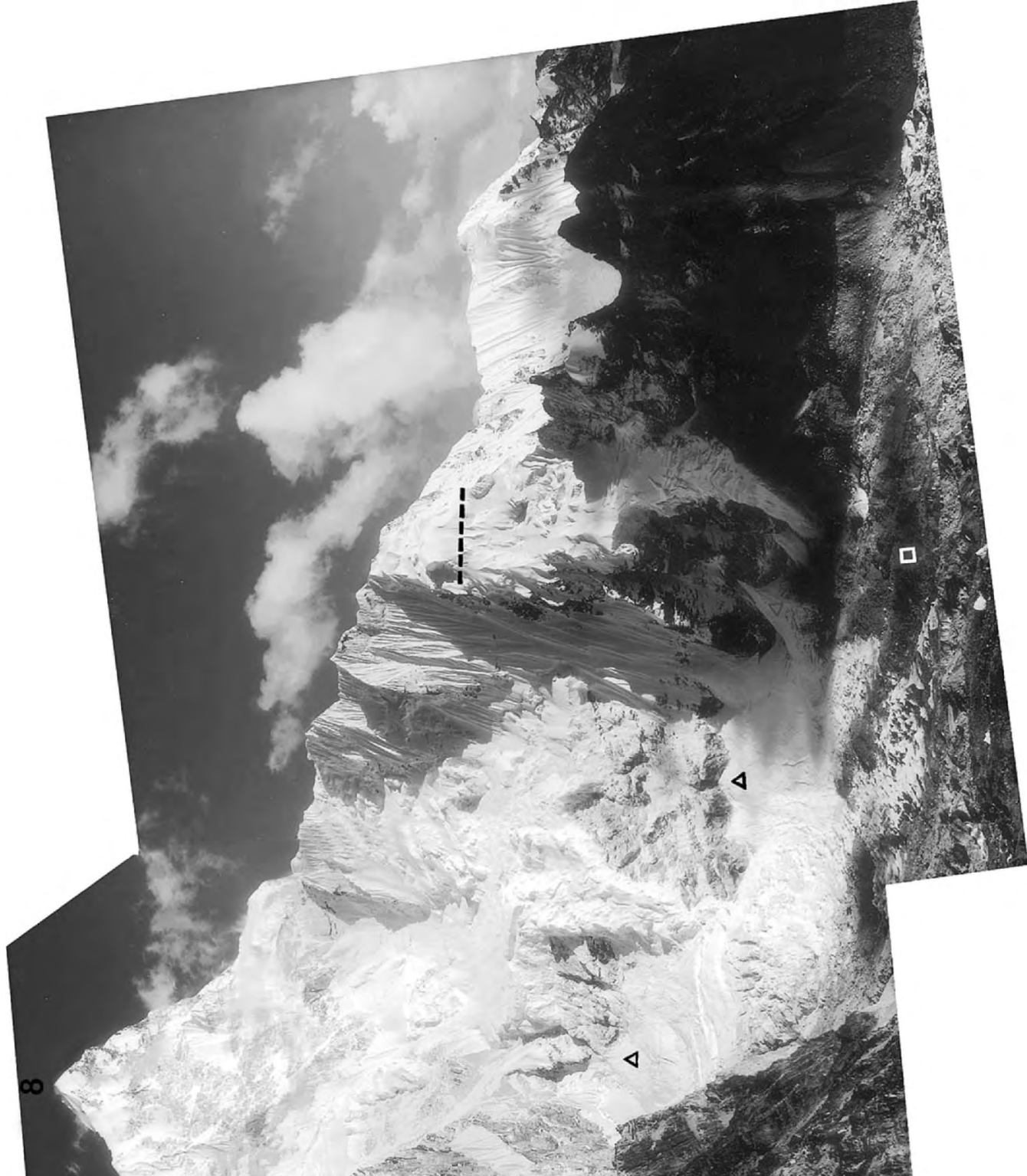






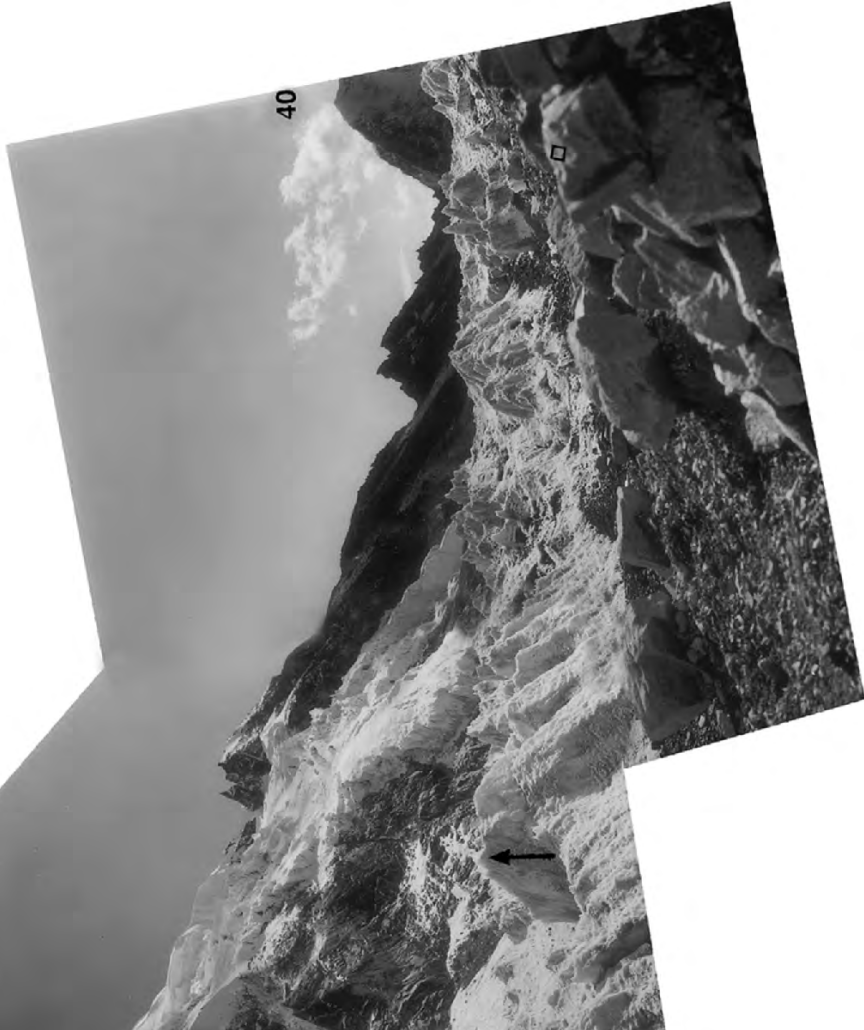
← *Photo 54.* At 6026 m, Panorama from the Lho La (No. 50; Figure 3, Panorama 54; Photo 53) looking from facing NE to the Changtse (Bei Peak, No. 6, 7583 m) and to the Mt. Everest-N-saddle (No. 49, 7066 m), via the Mt. Everest-W-shoulder (No. 52) below the W-ridge in the SE, via the 7879 m-high Nuptse (No. 8) with the Khumbu glacier below in the S, already situated in the Himalaya-S-slope, up to the 6542 m-high Taboche (No. 40) and the 6440 m-high Jobo Lhaptshan (No. 53) in the SW. (□) is the firm area of the central Rongbuk glacier (Rongphu glacier). On the right of No. 50 in the foreground the glacier crevasses of the ice break-off across the steep 600 m-high step of the Lho La transfluence pass down to the Khumbu glacier are to be seen (Photo 56\). (▽) marks the bergschrund between flank ice and Rongbuk glacier. With up to 250 m-long transverse crevasses (▼) of the Khumbu glacier the Khumbu ice fall sets in between 6200 and 5600 m. (...) are the maximum ice levels of the Ice Age. They are situated on the left above the Rongbuk glacier between 7000 m (on the left of No. 49) and 6500 m (on the left below No. 6). Below the Everest-W-shoulder (below No. 52) the trim- line has run about 6400 m and at the exit of the West Cwm, the upper Khumbu glacier valley (--- on the right below No. 8), at 6300 m a.s.l. On the Changtse flank (below No. 6) the ice level is evidenced by rock roundings up to a polish line in the sedimentary series (fine-grained biotite schist: after Heydemann and Kuhle, 1988: 616, 618) via tourmalin granite (tectonically modified two mica granite with rare biotite and dominant muscovite showing re-crystallization indicators; tourmaline is subsidiary: *ibid.*: 616, 619, 623) (○); below the W-shoulder (below No. 52) it is proved by a polish line developed by glacialic undercutting (▲) and at the exit of the W Cwm (on the right below No. 8) also by flank polishings and remnants of rock roundings on outcropping edges of the stratum in the granite (○). (||) are crumbings remoulding the Ice Age flank polishing since the deglaciation up to the present. Analogue photo M. Kuhle 30/9/1984.





← *Photo 55.* At 5550 m from the S-spur of Pumori (Figure 3, Panorama 55) looking from facing NNE (left margin) with the 6749 m-high Lingtren (No. 54), via the 6697 m-high Khumbutse (No. 33) and the Lho La transfluence pass (↷) (6026 m) in front of Changtse (No. 6; 7583 m) in the ENE, already situated in the Tibetan Himalaya N-slope, Mt. Everest (No. 1, 8848 or 8872 m) with its SSW-wall with the W-ridge (No. 52, 7205 or 7309 m) in the W, the 7879 m-high Nuptse (No. 8), up to facing ESE to the 6677 m-high snow-crest (Rim Ri) in the background between Cho Polu and Baruntse. Looking upward, the left half of the panorama shows the a good 4 km-wide, trough-shaped excavation area of the Khumbu valley (Figure 20) with the current Khumbu glacier (□), partly covered by surface moraine, and its tributary glaciers. In the foreground on the left the Pumori-S-hanging glacier (left margin), which presently no longer reaches the main glacier but has still reached it during Stages IX–X (Table 1) (Photo 57 below ○ white, large). Here, its glacialic polishings and their relatively strong rock roughenings due to weathering since the deglaciation at most 200 years ago can be recognized clearly (●). (Δ) are cones of ice avalanches nourished from the steep mountain flanks rising up to 2000 m above the ELA. They are adjusted to the surfaces of parent- and tributary glaciers. The Mt. Everest-SSW-wall (below No. 1) built-up by Cambrian and Ordovician carbonate rocks (quartz-bearing calcite marbles with soda-feldspar, mica (muscovite), chlorite and epidote modified tectonically and metamorphosed), sedimentary series and metamorphic strata (fine-grained biotite mica-schists with hornblende, epidote and apatite) of the Tibetan series (Nepal Geological Map 125.000, 1985, No. 721-B; Heydemann and Kuhle, 1988: 619–623) towers ca. 1300–1400 m above the upper limit of the glacier, so that – in contrast with the similarly steep Nuptse-flank (below No. 8) – no flank glaciation and no ice has been developed, but dark rocks make up the mountain surface (see Kuhle, 1986; 1986j; Kuhle and Jacobsen, 1988). (◁) are ravines in the rock, eroded by rock falls and avalanches since deglaciation. (▼) are debris slopes and -accumulations created by small rock falls, i.e. crumbings. (■) are covers of ground moraine. (○, ◐ and ◑) are glacialic flank abrasions and -roundings more or less roughened by weathering since deglaciation. Due to their protruding positions, the abrasions situated on salients of valley flanks like mountain spurs can only have been brought about by the High Glacial Khumbu parent glacier and not by hanging glaciers. (--- right half) are the highest preserved Last Glacial glacier trim-lines ca. 800 m above the surface of the Khumbu glacier (□) reconstructed according to the uppermost abrasion lines between ca. 6200 and 6000 m. (--- left half) are reconstructed trim-lines between 7000 and 6400 m a.s.l. (Photo 54) beyond and above the Lho La (↷). Analogue photo M. Kuhle, 14/10/1982.

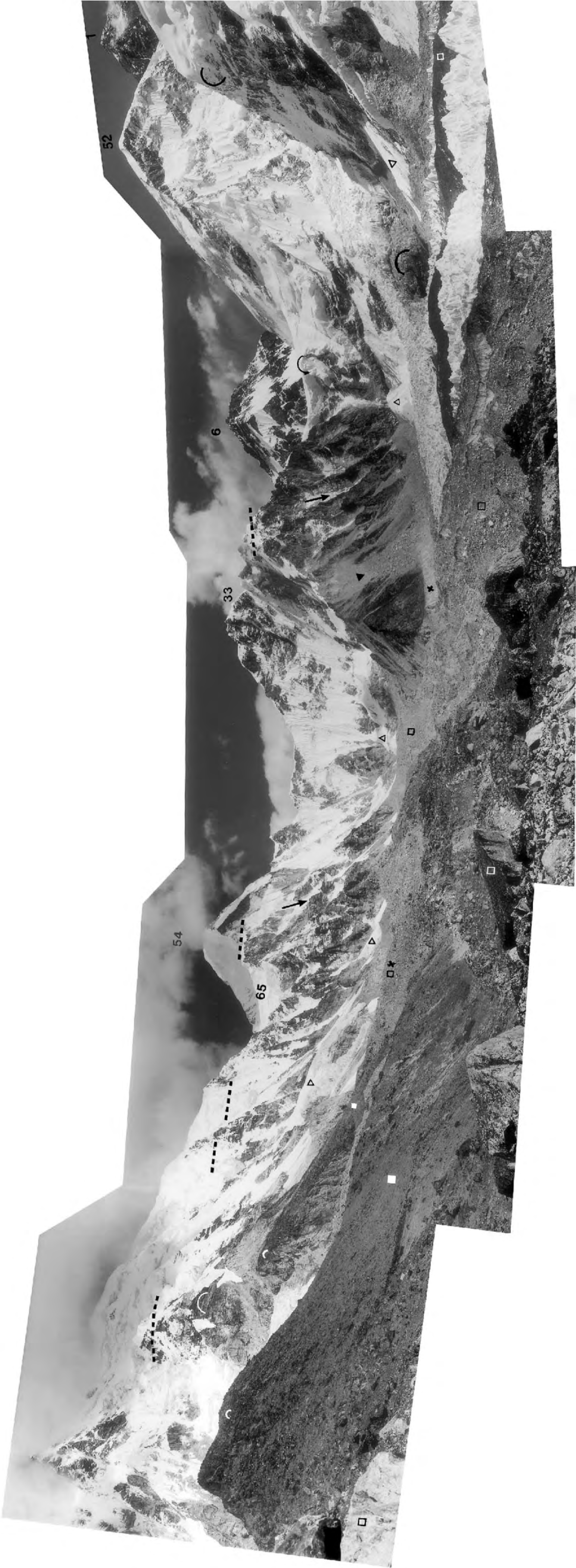




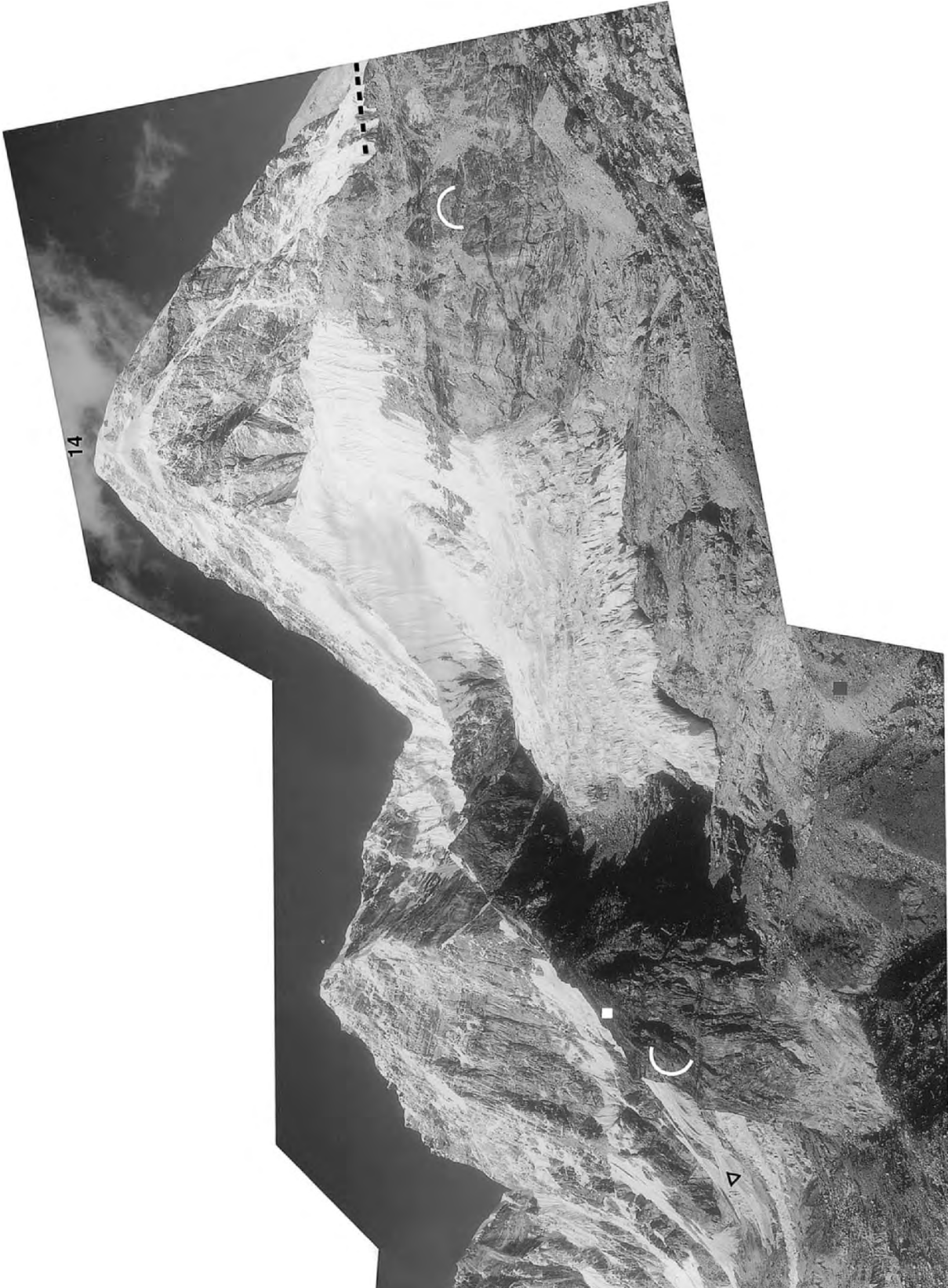
↑ *Photo 61.* At 5195 m a.s.l. from the orographic right half of the Khumbu glacier (Figure 3, Panorama 61) down the glacier a panorama from facing SE to the inflow of the tributary stream of the glacier from the Nuptse-W-flank, via facing SSW to Tramserku (No. 36, 6608 m) and Taboche (No. 40, 6542 m), via SW with Jobe Laptshan (No. 53, 6440 m) and the 6119 m-peak (No. 56) up to facing WSW into the junction of the Changri Nup- and Shangri Shar glaciers and to the 6145 m-peak (No. 55) behind it. (□) is the up to 1 m-thick surface moraine, consisting of mainly angular debris with boulders of light tourmaline granite several metres in length (○ on the right) and dark rock (○ on the left) of the fine-grained biotite schist (Heydemann and Kuhle, 1988: 616, 618) which outcrop in the catchment area of the Khumbu glacier (Photos 53 and 54). (■ white) is a pedestal moraine in an orographic left side valley (Figure 3 on the left of No. 8). (■ black) are High- to Late Glacial remnants of ground moraine. (○, ○, ○) are glacialic flank abrasions preserved up to ca. 5500 m. (▽) are rather large crumbings on these glacialic remnants of ground moraine flanks. They took place after the Late Glacial deglaciation and obtain the dimensions of rock slides and large rock avalanches. (▼) is a contemporary rock fall and moraine slide, which in the lowest section also integrates the historical lateral moraine of the Stages VII-X and contains its debris. (V) is a neoglacial moraine complex of the Nauri-Stage (Table 1). (· · · and —) show the Ice Age glacier trim-line falling away from ca. 6000 m (· · · on the very left and right) to ca. 5500–5400 m a.s.l. (· · · centre) (Figures 21 and 22). Analogue photo M. Kuhle, 13/10/1982.

← *Photo 56.* At 5340 m from the Khumbu glacier W of the Khumbu ice fall (Figure 3, Panorama 56) from facing NE into the S-flank of the 6640 m-high Khumbutse (No. 33), via facing W to the W-ridge of Mt. Everest (No. 52, 7205 m) and the Lhotse summit (No. 2, 8501 m) with the 600 m-high Khumbu ice fall below, flowing down from the West Cwm. The Nuptse lies in the SE (No. 8, 7879 m) and in the SSW, looking down the Khumbu glacier, the 6542 m-high Taboche (No. 40). (↓ and ↘) mark the tracks of ice- and rock avalanches, which have eroded wall gorges. The rock fragment-containing debris of ice forms cones (△), as does the debris of the rock avalanches (▼). The contemporary development of wall gorges takes place so fast, that blackening by lichens is impossible on the rocks of the gorges, but the ribs between the wall gorges are covered with them (below ↓↓ on the left). Whilst the glacialic triangle-shaped face discussed here has been extensively damaged by wall gorges since the Late Glacial deglaciation, the glacialic roundings on the opposite valley flank are relatively well-preserved despite the same outcropping Tertiary tourmaline granites and related rocks (○) (Nepal Geological Map 125,000, 1985, Nos. 721-B and 711-L-D). (---) are locally the highest preserved glacier trim-lines preserved by polish lines: (--- on the left) up to ca. 6400 m and (--- on the right) up to ca. 6300 m a.s.l. (Photo 54 ... on the right). (□) is the cover of surface moraine here thawed out several hundred metres below the local glacier snow-line. (↑) are up to 20 m-high ice pyramids which due to their aerated, especially white, ice with the highest albedo melt down more slowly than their surroundings and thus pierce through the surface moraine (Kuhle and Jacobsen, 1988). Analogue photo M. Kuhle 20/10/1982.

↓ *Photo 57.* At 5230 m from the spur of the medial moraine of the Kala Pattar between Changri Shar- and Khumbu glacier (Figure 3, Panorama 57) from facing N into the S-flank of Pumori (left margin) via NNE and NE to the Lingtren (No. 54, 6749 m) and Khumbutse (No. 33, 6697 m) up the Khumbu trough valley (Figure 20), via ENE across the Lho La (↷) to the Changtse (No. 6, 7583 m), via Mt. Everest (Sagarmatha, No. 1, 8848 m) and its W ridge (No. 52, 7205 or 7309 m) in the E and Nuptse (No. 8, 7879 m) in the ESE, up to facing SSE looking down the Khumbu valley (right margin). (□) is the in part very rough-blocky cover of surface moraine on the current Khumbu glacier and its side glaciers, interrupted by over 20 m-high ice pyramids (below □ white, centre of the Panorama). Below the surface moraine of the Pumori SE-glacier (□ X) is dead ice, which during Stage X, 180–80 years ago (Table 1), was still flowing (living) glacier ice. X is a 30 m-high orographic right lateral moraine of the Khumbu glacier, overthrust during Stage X. (△) are current cones of ice avalanches regenerating into glacier ice which reaches the Khumbu parent glacier in many places (e.g. the four △ from the right). (▼) are debris tali and -cones below fresh crumbplings, which mostly contain moraine cores or have been directly developed in the moraine material (▼■). (↓) are gullies of snow-, ice- and rock-avalanches, i.e. wall gorges in the bedrock. (■) are High- to Late Glacial remnants of ground moraine (Stages 0–IV, Table 1). (V–VIII) on the very right, however, marks neoglacial to historical front moraines of Stages V–VIII below a cirque which is currently nearly free of ice (Figure 3 on the left of No. 8). In some places upward, these ground moraine remnants pass in the shape of a harmoniously steepening curve into a slope polished by flank abrasion (↷ and ↶ small, white, on the left). (↷, ↶, ↷) are more or less small-scale preserved glacialgenic abrasion forms of the past ground- and flank polishing of the bedrock. Its upward interruption marks the Ice Age glacier trim-line (---). This ran down on the orographic left side (on the right of No. 1) from ca. 6300 to 6000 m (--- on the very right) and on the orographic right (--- on the left of No. 6) from ca. 6400 down to 6100 m (--- on the very left). Analogue photo M. Kuhle, 12/10/1982.



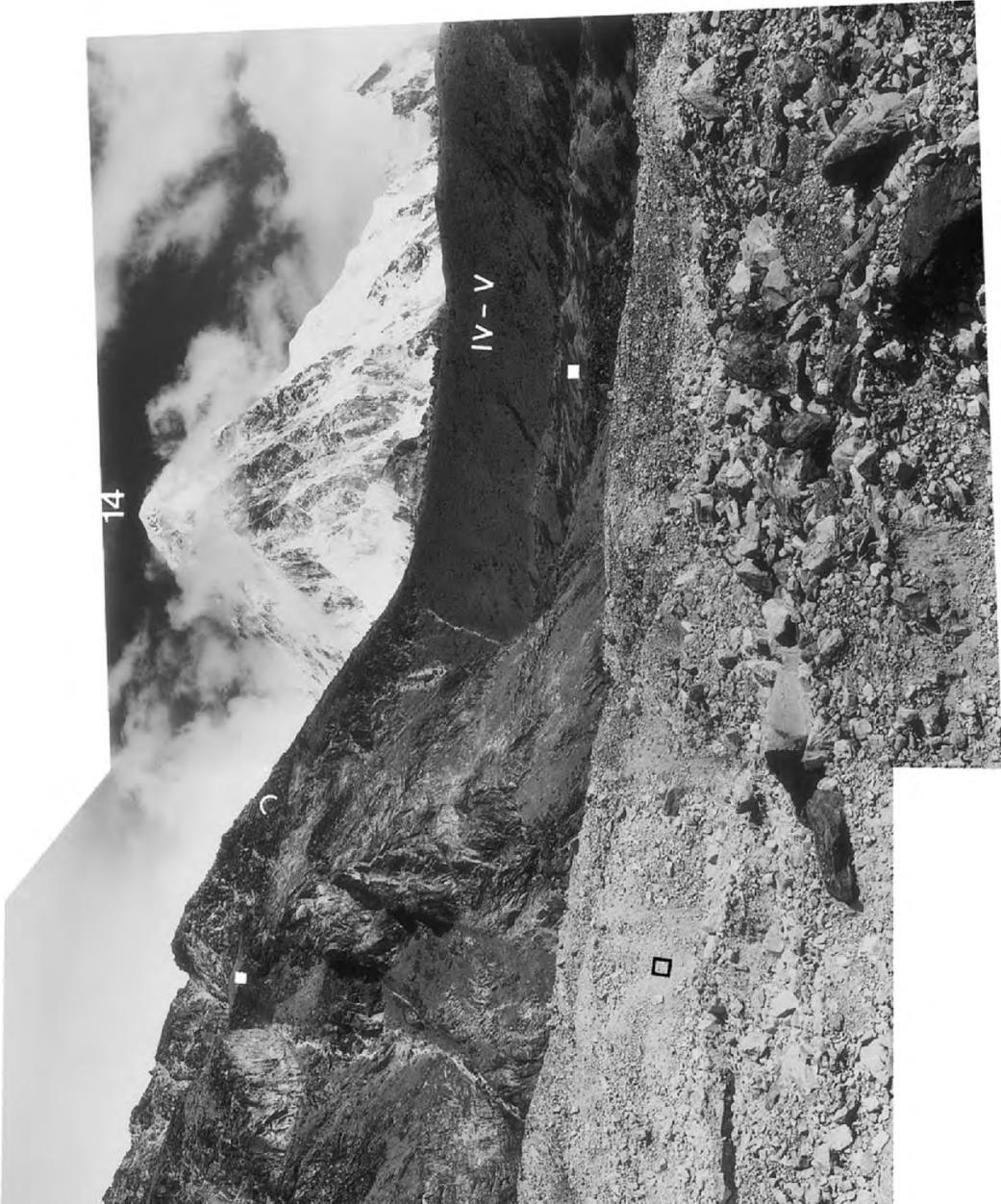




↑ *Photo 60.* At 5270 m a.s.l. looking into an exposure of ground moraine below the Pumori-S-Spur in the orographic right flank of the Khumbu valley (Figure 3, Panorama 60; Photo 59 IV–V on the left) facing SW. It has come into being and still extends through a typical moraine slide. The ground moraine has been glaciogenically modified for the last time during the Late Glacial Stage IV and the Neoglacial Stage V (Table 1). (IV–V) is a kame-like lateral formation been deposited up there during Stage IV. Since the deglaciation reshaping by flushing and solifluction (below ■ an active solifluction tongue) has taken place on the upper slope (above IV–V) ca. 13,500–13,000 YBP ago and on the lower slope (below IV–V) since ca. 5500–4000 YBP. The polygonal frost cracks (which can be recognized very clearly on the margin of the exposure beside the person for scale), also caused by the periglacial climate and desiccation (shrinking due to drying-up, desiccation fissures) are filled with wind-blown sand and loess. The ground moraine consists of polymict boulders – some of them rounded at the edges, which contain edged, local tourmaline granite boulders (○), (...) is the course of the trim-line of the High Glacial glacier on the orographic right above the current Changri Nup- or Phari glacier about 6000 m altitude on the dividing crest toward the Lobuche glacier. Analogue photo M. Kuhle, 14/10/1982.

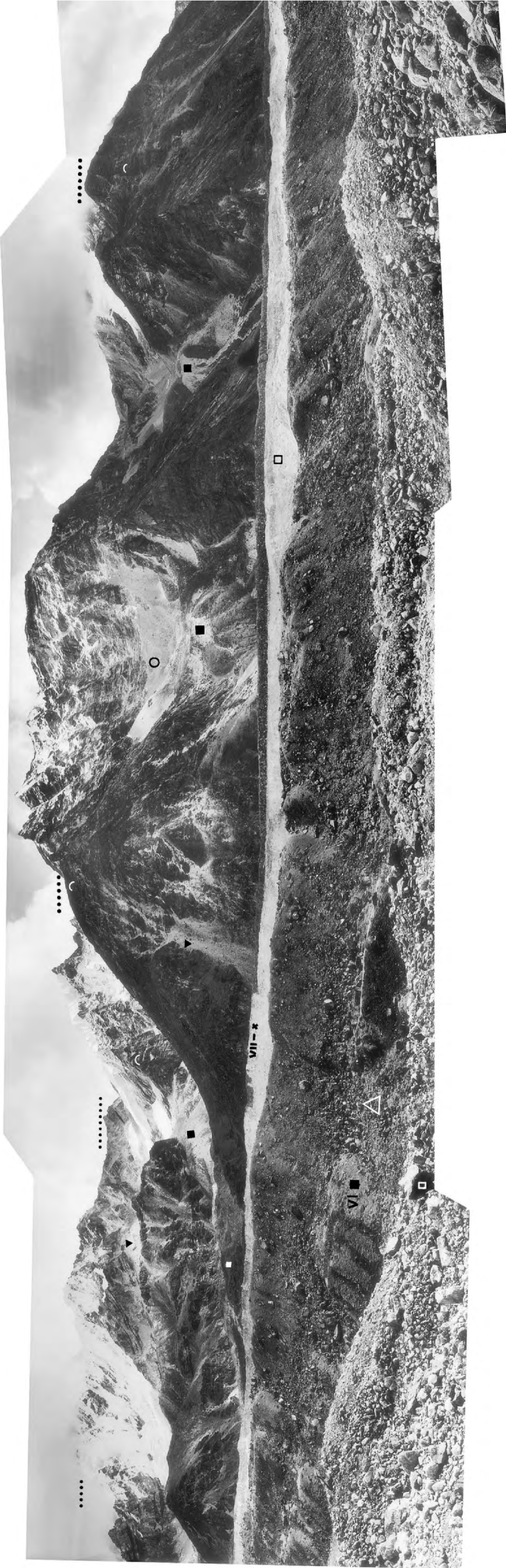


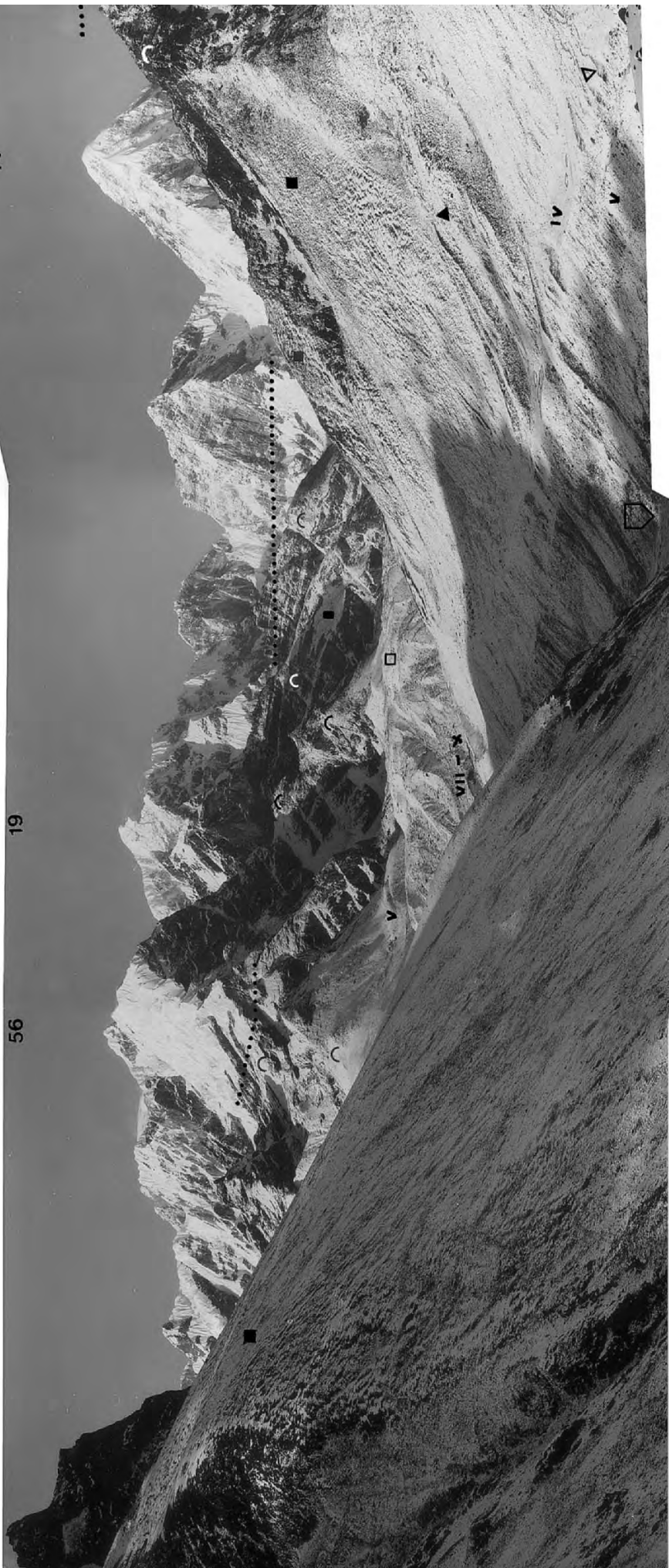
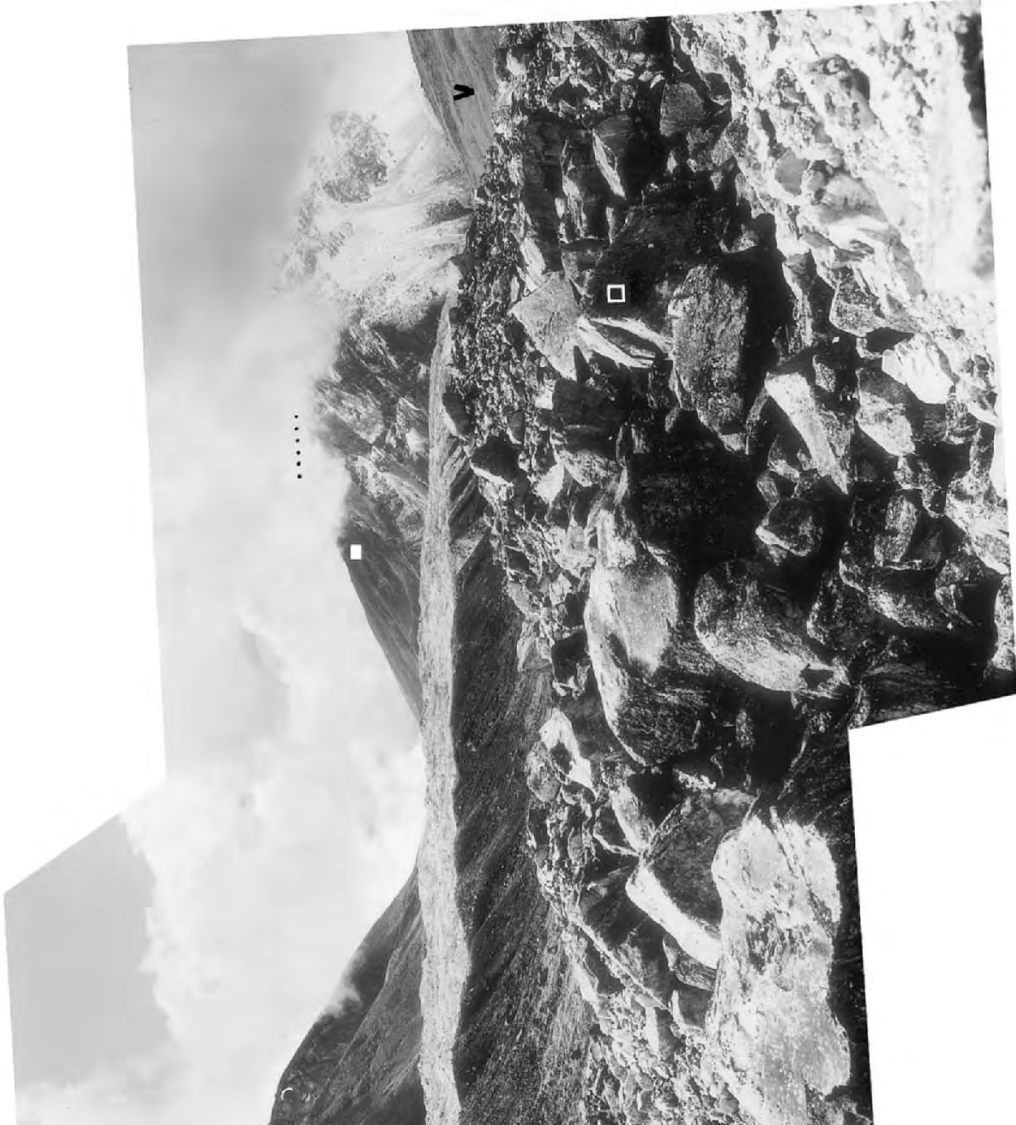




← *Photo 62.* At 5040 m a.s.l. from the dead ice complex below the current Lobuche glacier (Figure 3, Panorama 62) panorama from facing WSW (left margin) with a glaciogenically back-polished mountain spur (C black), via facing WNW looking up the Lobuche glacier valley, up to facing NNE up the Khumbu main valley with Pumori (No. 14, 7145 and 7165 m). In 1955 up to 1963, during Stages XI–XII (Table 1) the contemporary dead ice complex (□) was still connected with the current Lobuche glacier (cf. Khumbu Himal 1:50,000, 1978 Schneider, E.) and attached to the lateral moraine (VII–XII). (□ white) is grey ice with internal moraine and (□ black) debris of surface moraine on top. (▼) is a current block glacier, fed by meltwater from the gully above. The glacier integrates the orographic right lateral moraine material of the historical Lobuche glacier (see above) in its movement. (IV–V) is a remnant of ground moraine of the late Late Glacial to Neoglacial (Table 1) Khumbu glacier. (■) are High- to Late Glacial remnants of ground moraine, part of them on ledges in topographically high positions. (▽) is rough, angular debris of crumbings fallen down on one of these moraine remnants. (C ▽) are glaciogenic flank abrasions in the Lower Tibetan mica gneiss bedrock (Nepal Geological Map 125,000 (1985): Sheet No. 721-B). (...) is the minimum height of the High Glacial glacier trim-line above the rock crest about 5700 m a.s.l. sharpened by glacier abrasion. Analogue photo M. Kuhle, 11/10/1982.

↓ *Photo 63.* At 5050 m a.s.l. from the dead ice complex and its surface moraine (□ white) below the contemporary Lobuche glacier panorama taken from the orographic right lateral valley of the Khumbu glacier (Figure 3, Panorama 63) from facing ENE (left margin) on to the pedestal of Nuptse, via facing ESE into the left flank of the Khumbu valley (centre), up to facing SSW looking down the orographic right lateral valley of the Khumbu glacier (right margin). (□ black) is the Khumbu glacier covered with surface moraine; (VII–X) is its orographic left lateral moraine against which the current glacier surface is 10–20 m lower. Below (VII–X) the corresponding orographic right lateral moraine embankment of this stage is situated, the outer slope of which is visible (middleground); it is overgrown with alpine meadow. This lateral moraine has buried large parts of the neoglacial moraines of the older and middle Dhaulagiri-Stages VI and ‘VII (VI ■), (△) is one of the numerous typical past break-throughs and spillways of meltwater from the Khumbu glacier through the lateral moraine. With the help of the displaced moraine material they have built-up small debris flow- and alluvial fans. (V) is the next-older, neoglacial lateral moraine stage (Table 1). (○) indicates a Late- to Neoglacial cirque. (■ black) are Neoglacial to Historical end moraines of the orographic right hanging- and tributary valleys; the two on the right side show the characteristic features of pedestal moraines. (■ white) are High- to Late Glacial covers of ground moraine reaching 5000 m on the right side. (○) are glaciogenic flank abrasions on polished-back mountain spurs shaped into triangular faces. The abrasion roundings reach up to ca. 5500 m. (▼) are shallow rock crumbles and slides developed since the deglaciation. (...) is the highest Ice Age glacier trim-line which has decreased from 6000 m on the left via 5500 m half-right (Figure 21) down to 5400 m on the very right (Figure 22). Analogue photo M. Kuhle, 12/10/1982.

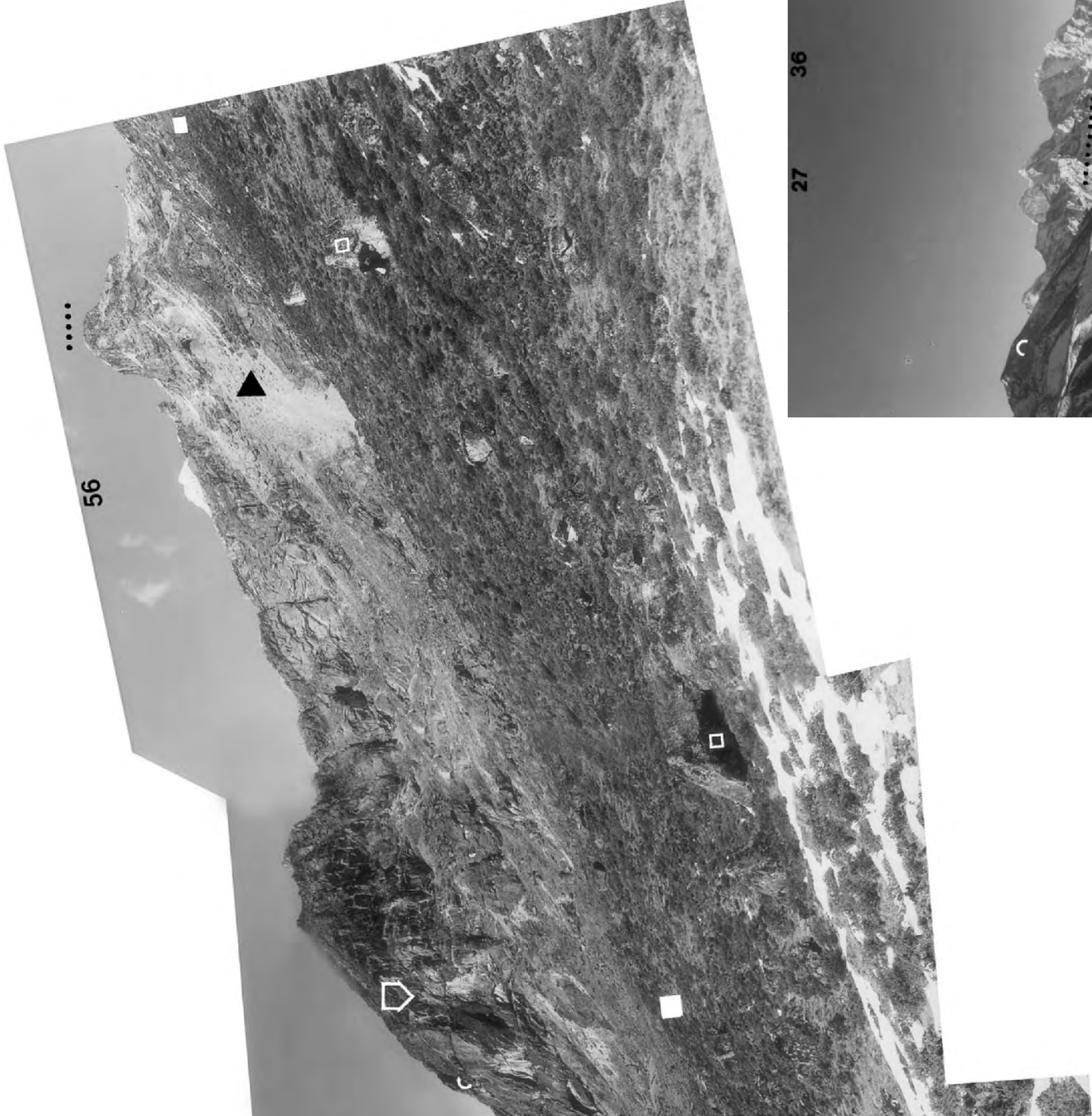




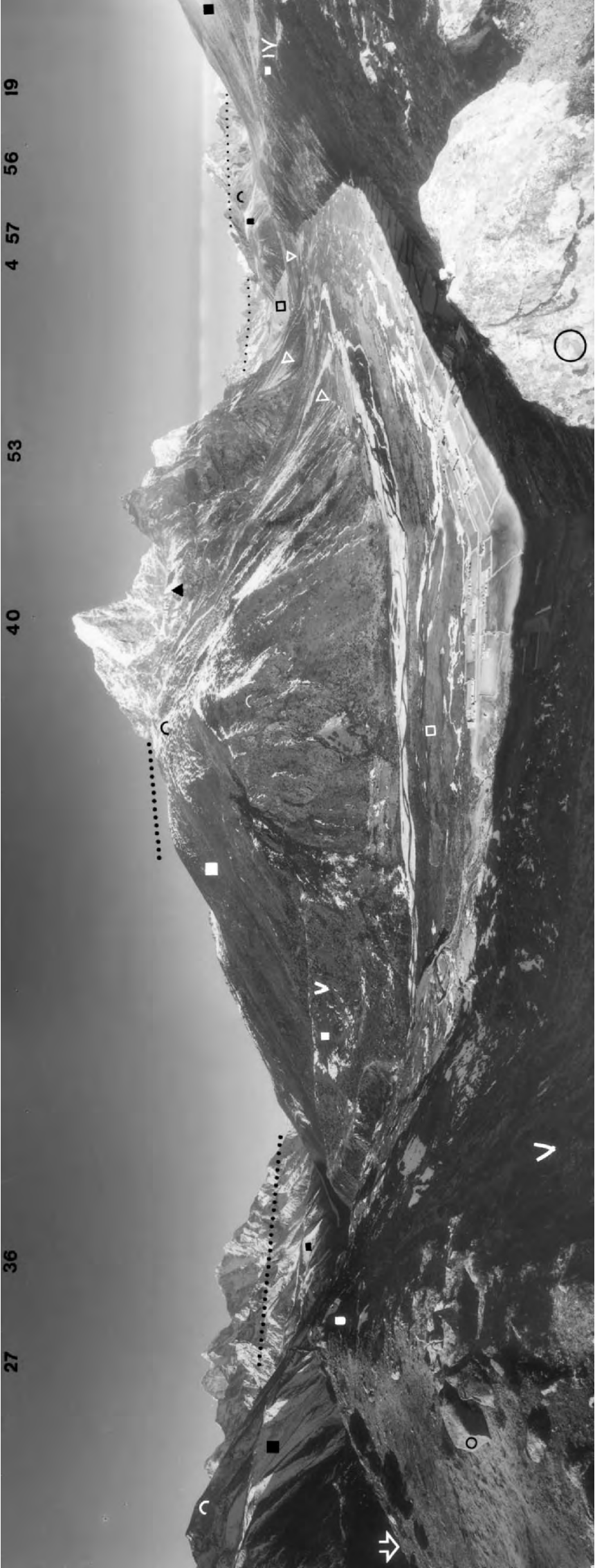
† *Photo 64.* At 4550 m a.s.l. from the Amaï Dablang-W-flank on the orographic left of the Imja Khola (Figure 3, Panorama 64) from facing NNW (left margin) up to facing NNE (right margin) looking up the Imja Khola up to the confluence of the Khumbu valley (on the right) with the Tscholo Khola (on the left). No. 56 is the 6119 m-peak, No. 19 the 6870 m-high Chumbu and No. 14 the 7145 or 7165 m-high Pumori. (□) is the tongue end of the Khumbu glacier with an autumnal cover of fresh snow. (VII–X) is its historical complex of end moraines (cf. Table 1) dissected into rills by the melting dead ice and the cutting by glaciofluvial meltwaters. (V on the left) is an orographic right moraine remnant (Photo 63 V) of the neoglacial Nauri-Stage (Table 1). (IV and V on the right) are two orographic left moraine ledges of the neoglacial Nauri- and late Late Glacial Sirkung-Stage (cf. Table 1); (IV) is a ground moraine incised by the Khumbu meltwater stream (↓). On its terrace surface fans of debris flow (▲ and △) are accumulated. They originate from High- to early Late Glacial (Stages 0 to III, Table 1) moraine material displaced down-slope. It lies on this (the two ■ on the right) and the opposite valley flank (■ on the left) up to somewhat above 5000 m a.s.l. (Photos 66 and 78). (V on the right) indicates an orographic left lateral moraine laid down by the Khumbu glacier in the ground moraine valley cut by the Khumbu river into the late Late Glacial ground moraine (IV). This took place during the Nauri Stage (Table 1, V), i.e. during the glacier's significant neoglacial (holocene) advance. (○) are glacialic flank abrasions in the outcropping Lower Tibetan mica gneiss, quartzite and schist with local attachments and remnants of ground moraine (■ centre). The mountain spurs of the valley flanks are polished-back by abrasions, so that typical glacially triangle-shaped slopes have been developed. The upper limits of these abrasions mark the maximum past and thus High Glacial (Stage 0, Table 1) glacier trim-line (...): it runs between 6000 (... background on the right) and 5500 m (... background on the left) (Figure 21) and also at the exit of the Tscholo Khola; (... middleground on the very right) indicates a glacier trim-line at also 5500 m (Figure 22). Analogue photo M. Kuhle, 24/10/1982.

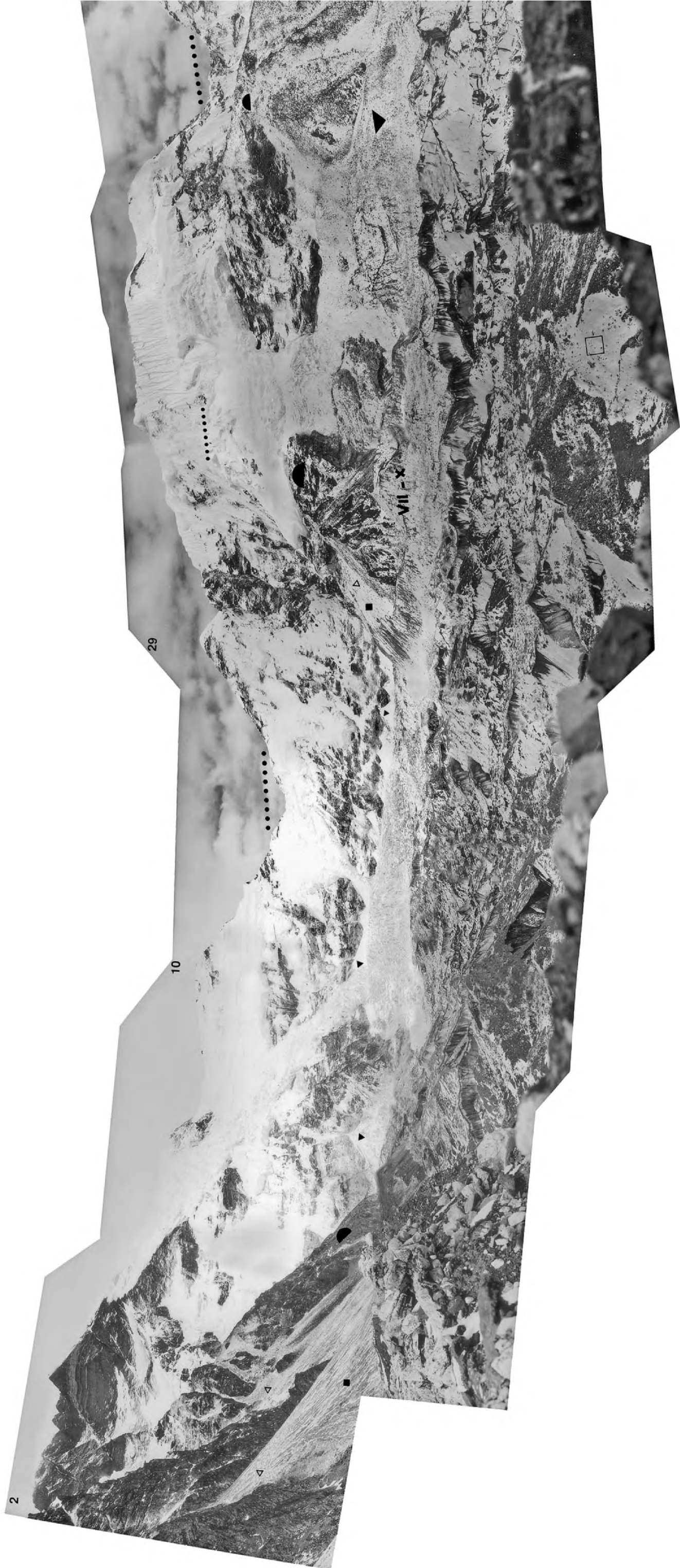


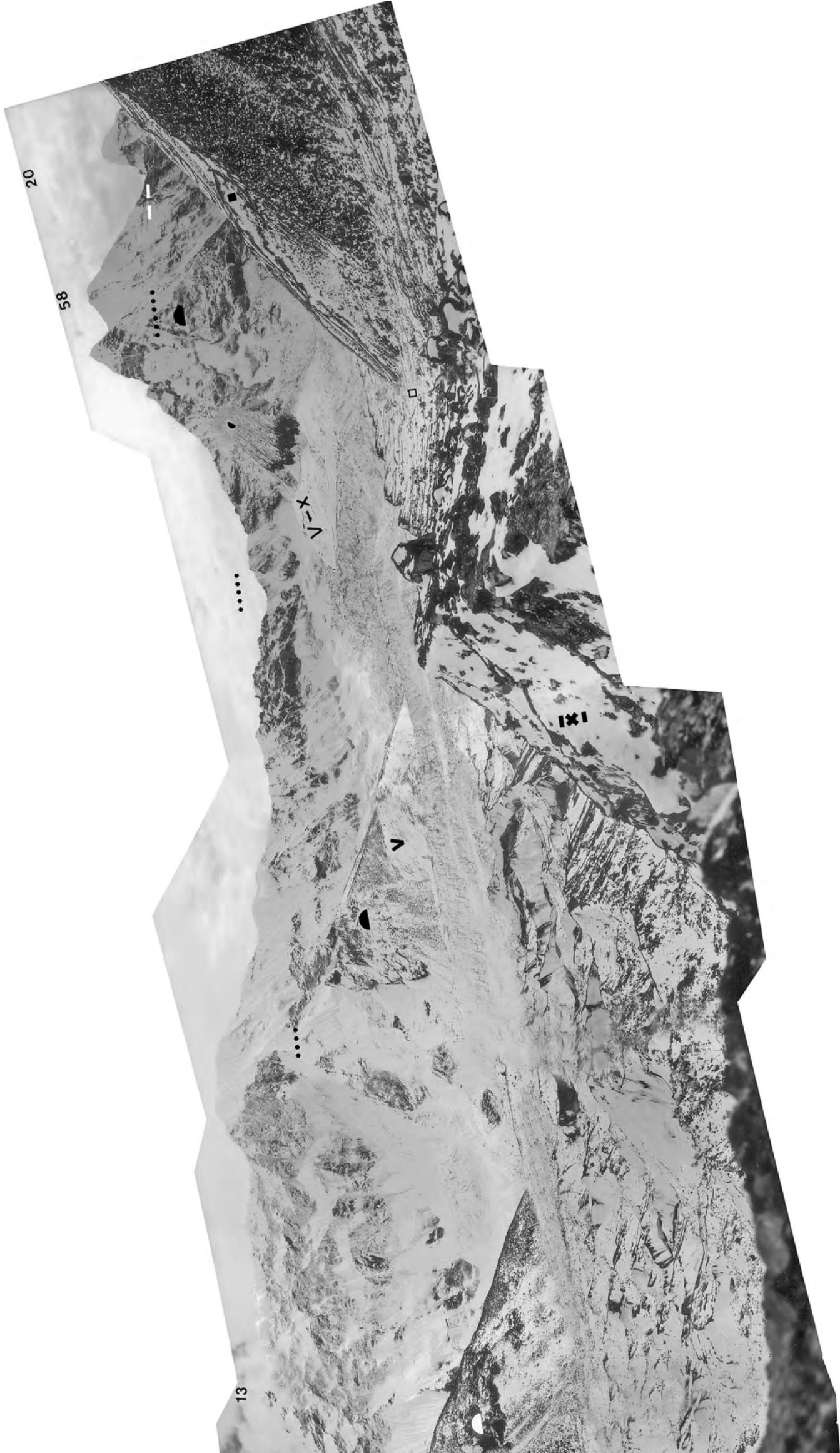
↑ *Photo 65.* Panorama at 4680 m a.s.l. from above the Tsholo alpine pasture in the Tsholo Khola (Figure 3, Panorama 65, on the right of No. 53) from facing WSW (left margin) on to the Jobo Laptshan-NE-flank with the Jobo Laptshan NE-glacier (□ black), via facing NW up-valley with the 6103 m-high Kangchung (No. 57) in the background beyond the valley head, up to facing NNE (right margin) on to the orographic left valley flank; the firn-summit of the 6119 m-peak (No. 56) towers above. (▼) is an active avalanche cone feeding the Jobo Laptshan NE-glacier (□ black); (□ black) is the coarse-blocky surface moraine, which has melted below the ELA. It is slightly covered with fresh autumnal snow. (■ white on the left) is a 160 m-high pedestal of ground moraine beneath the current pedestal- or dam glacier; (||) marks the glacier mouth, the meltwater of which has eroded a gully into the ground moraine pedestal. (●) are two sheer ice glaciers poor in debris. (▽) are active debris cones built-up by rock fall and also debris flow cones; they both cover remnants of Ice Age ground moraine (■ black, on snow) at least in parts. (■ large, black and in the right half of the Panorama) are High- to Late Glacial (Stages 0–IV, Table 1) remnants of ground moraine, dissected by the cutting of the two torrents (↓) and worn down. (○) is one of the moraine boulders up to the size of a hut which has been rounded by the transport; (○ white) are several examples of boulders also lying on the surface which, due to their angular shape, might rather derive from rock fall or they are moraine boulders secondarily broken by falling down. (V) is a remnant of end moraine of the neoglacial Nauri-Stage; (VII–X) are completely preserved historical end moraines of the Tsholo glacier. Today the glacier just exists at the head of the Tsholo valley. (●) is a mountain spur polished-back by glacialic flank polishing; (○, ○, ○) are glacialic abrasions preserved in the mica gneiss bedrock; (○) is a classic roche moutonnée. (B) shows one of the numerous recent crumbings in the rocks rounded in the past. In some places fresh debris slopes (▼) provide evidence of the continuous rock falls and crumbings. (...) is the Ice Age glacier trim-line verified according to upper limits of abrasion, between the minimum heights of 5800 (...) on the left below No. 57), 5600 (...) on the right) and 5700 m a.s.l. (...) on the very left). The highest past glacier trim-line might have run at 6000 m, but it is not preserved. Due to flank polishing at varying ice levels the up to 5939 m-high rock summits (above ---- on the right) have been sharpened into glacial horns. (----) marks a Late Glacial ice level about 5600 m. Probably it has already dropped. Analogue photo M. Kuhle, 5/11/1982.



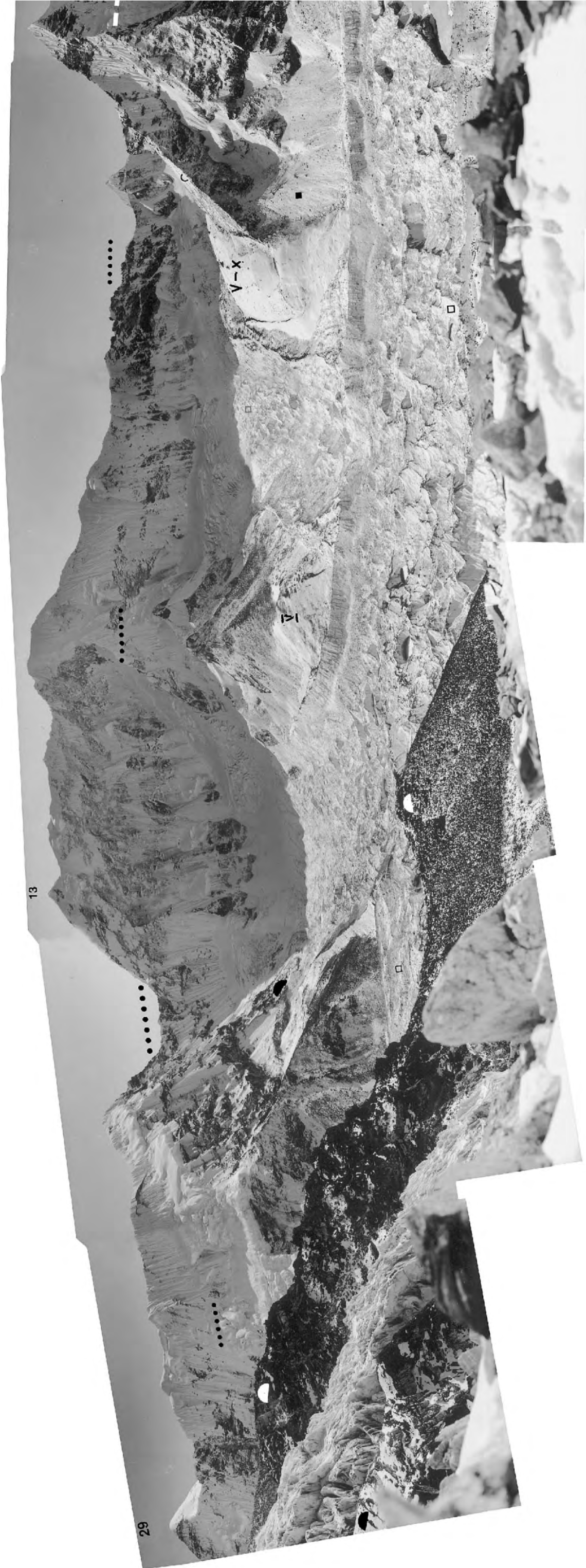
↓ *Photo 66.* Panorama at 4250 m a.s.l. taken above the Pheriche settlement in the Khumbu Khola (Figure 3, Panorama 66) from facing S (left margin) down-valley to the Kang Taiga (No. 27, 6779 m) and Tramskerku (No. 36, 6608 m) via facing W to the Taboche (No. 40, 6542 m), facing WNW to the Jobo Laptshan (No. 53, 6440 m), facing WNW the Tseholo Khola upward and far behind the 8205 m-high Cho Oyu (No. 4), up to facing N via the mountains Kangchung (No. 57, 6103 m), the 6119 m-peak (No. 56) and the Chumbu (No. 19, 6870 m), which are not quite so far away. (□ black) is the valley-damming Tshola pedestal glacier (diam glacier) damming up the 1.4 km-long and 0.7 km-wide Tshola Tsho. (□ white) is the historical to current glaciofluvial gravel floor of the Khumbu valley (Table 1 No. –3 to No. –8). (▲) is the front of the contemporary Taboche glacier at 5100–5200 m. (V) are the ramp-shaped lateral- and end moraines of the Khumbu glacier during the neoglacial Nauri-Stage (Table 1). They contain edged to round-edged granite- and gneiss boulders up to metres in size (○). (■ IV) is a ledge-shaped late Late Glacial (Table 1) remnant of ground moraine (Photo 64). (■ black below Nos. 27 and 36) are High- to Late Glacial complexes of ground moraine. Neoglacial to historical moraines have been deposited on it by the postglacial hanging glaciers. (▽) show current debris flow- and alluvial debris cones. Mainly past moraine material has been – and is still – dislocated down-slope by them. (■ black below Nos. 57 and 19 as well as white on the left below No. 40) are High Glacial ground moraine sheets, covering the slopes up to 5000 m a.s.l. (Photo 78); (∩) are obviously glacial glacial abrasions next to and above the ground moraine sheets, today roughened by crumbings and rills. They prove a minimum High Glacial (Stage 0, Table 1) trim-line (...) at 5800 m (... below No. 4), 5500 m (... below No. 56) (Figure 21) and at 5450 m (... below No. 40) (Figure 22). This trim-line drops to ca. 5200–4500 m a.s.l. in the WNW-flank of the Kang Taiga and Tramskerku (... below Nos. 27 and 36) (Figures 26 and 27). Analogue photo M. Kuhle, 18/03/2003.

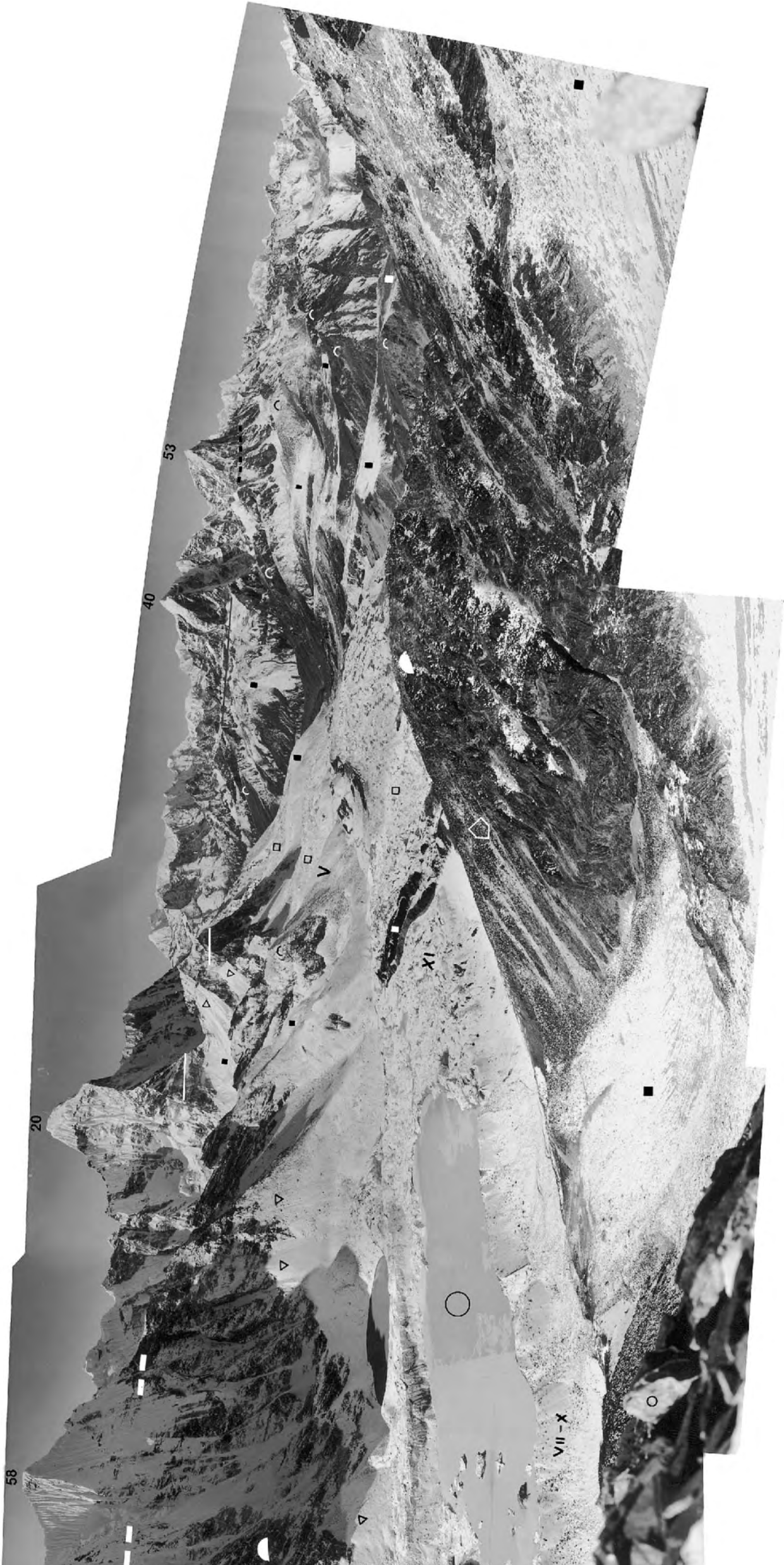




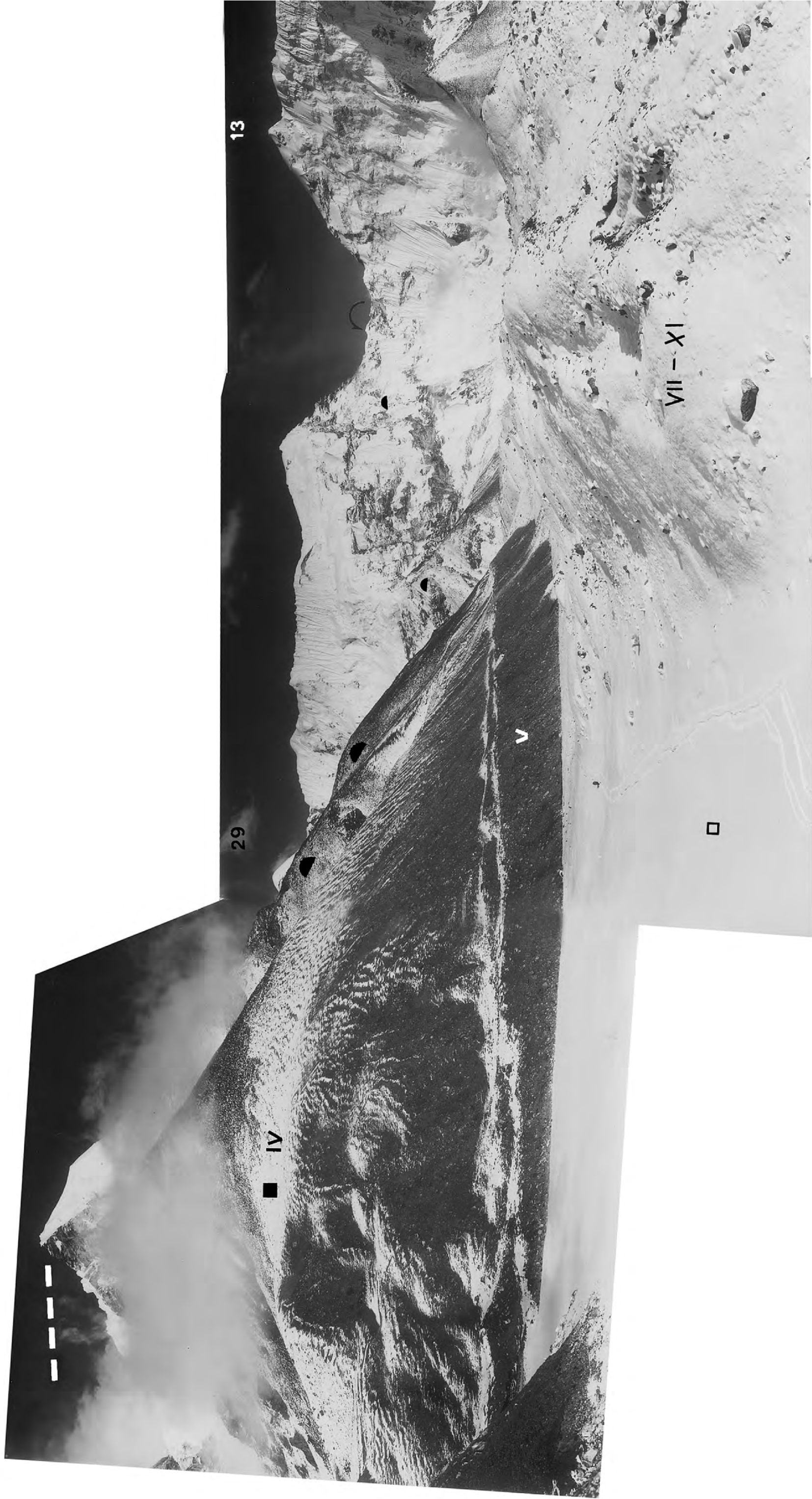


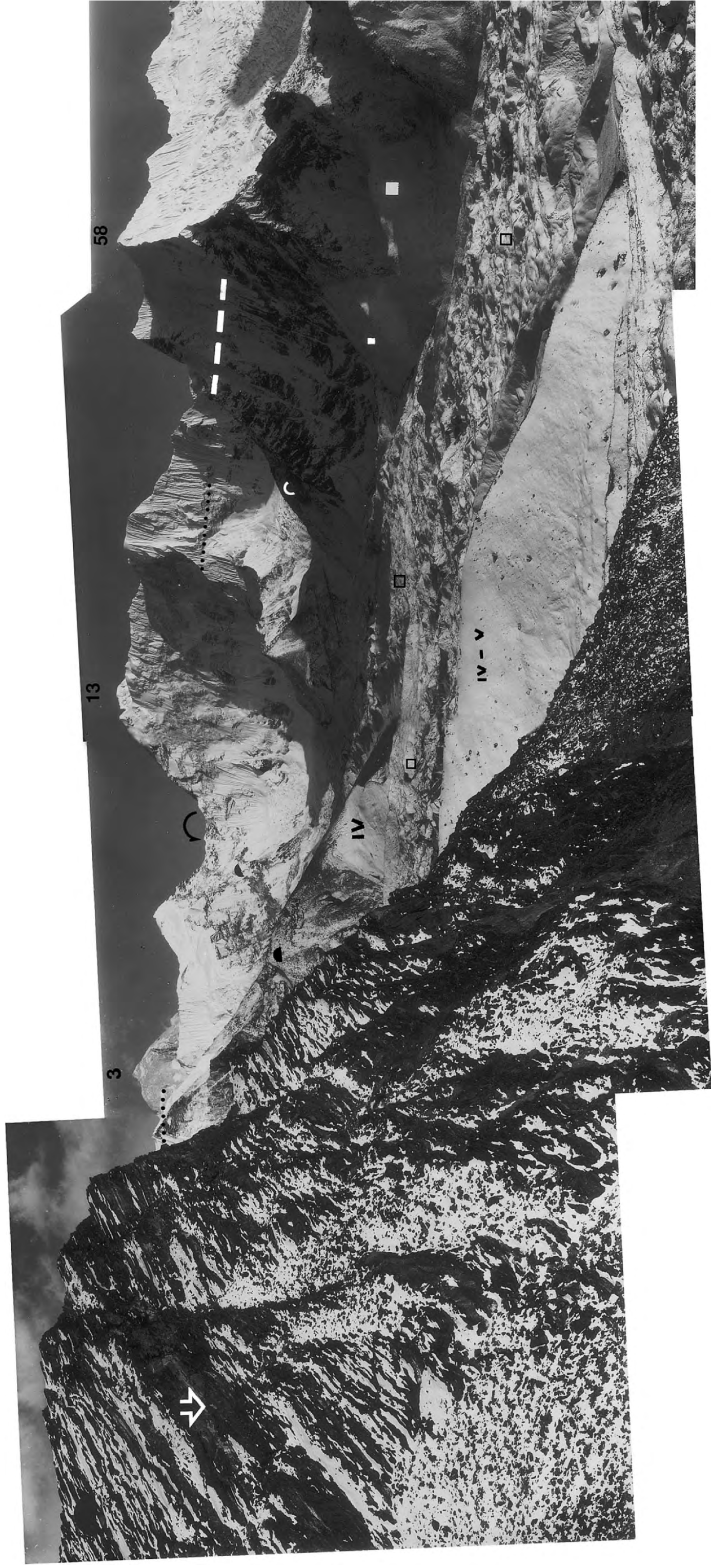
↑ *Photo 67*. Picture taken at 5260 m a.s.l. from the orographic right lateral valley (□ small) of the Lhotse Shar glacier (Figure 3, Panorama 67) from facing NNW (left margin) with the 8501 m-high Lhotse (No. 2) and its 8383 m-high E-satellites, the Lhotse Shar (black rock-triangle on the right of No. 2) directly in the N, via facing NE to the 7502 m-high Shar Tse, the 6734 m-high Cho Polu (No. 29) in the ENE and the 7220 m-high Baruntse (No. 13) in the SE, via facing SW to the 6238 m-peak (No. 58), up to the 6856 m-high Ama Dablang (No. 20) in the WSW. The true Lhotse Shar valley glacier is situated below the ELA, so that it is covered by surface moraine (□ large) with an overlay of fresh snow over large parts. The Lhotse Shar glacier is nourished from its valley head by the ice streams flowing steeply down from the S-flanks of Lhotse Shar (see above) and Shar Tse (No. 10). (▼) are avalanche cones below the valley head with its steep flanks which contribute to the glacier's feeding. The Lhotse Shar glacier flows into the Imja glacier (on the right below No. 13) which the Amphu glacier joins from the opposite side, from the S (on the left below No. 58). Ice streams from the Baruntse N- and NW-flank, i.e. from the source basin below the Amphu Labtsa-saddle (behind V-X), but also avalanches from the wall areas participate in the feeding of these two glaciers. (▼) is a further glacier inflow from the orographic left valley flank reaching the Lhotse Shar main glacier 200–300 m below the snow-line. This can be recognized by the cover of surface moraine on its tongue. (X right half) and (VII-X) are the striking historical lateral moraines on both sides of the Lhotse Shar glacier, 40–60 m above its surface. They are built-up from white tourmaline-granite boulders up to some metres in size and very dark metamorphic sedimentary rocks as they outcrop in horizontal layers e.g. at the Lhotse Shar peak (on the right of No. 2). This is the weathered substratum of local Lower Tibetan gneisses of many varieties and the Tertiary series (6b and 9 in the Nepal Geological Map 125 000 (1985): Sheet No. 721-B) of this valley cauldron. (V-X) are significantly older forms of ground- and lateral moraine towering up to 240 m above the current glacier surface and developed during the neoglacial Nauri-Stage (Table 1). They have been flattened by solifluction and are covered with alpine meadow. (■) are still older, i.e. Ice Age to Late Glacial (Stages 0–IV, Table 1) deposits of ground moraine reshaped on the surface, i.e. somewhat removed down-slope. They then have been buried in the form of cones (▽) by debris of rock fall – deriving from bedrock as well as from still higher moraine debris displaced by rock fall. (□) is a lateral sander. There, the moraine material has been and is still washed out, flushed and rounded by a stream in the lateral valley and then re-sedimentated as a gravel band. (●●●) are glacialogenic flank abrasions. Independent of the rock their roundings decrease with respect to the quality from below to above. They have created glacially triangle-shaped slopes by polishing back of the mountain spurs. The highest Ice Age glacier level (...) and (---) can be recognized by the polish cavetto, i.e. the glacialogenic rounding of the lower parts of the slope and the undercutting of the upper steep walls indicated by a concave bend of the profile (on the right below Nos. 29 and 13). It runs from ca. 6300 m (...) on the very left) down to ca. 6000 m (--- below No. 58) (Figure 23). Corresponding transfluences have existed across the three notches between Nos. 10 and 58 at 6220, 6190 and 5780 m a.s.l. Analogue photo M. Kuhle, 28/10/1982.

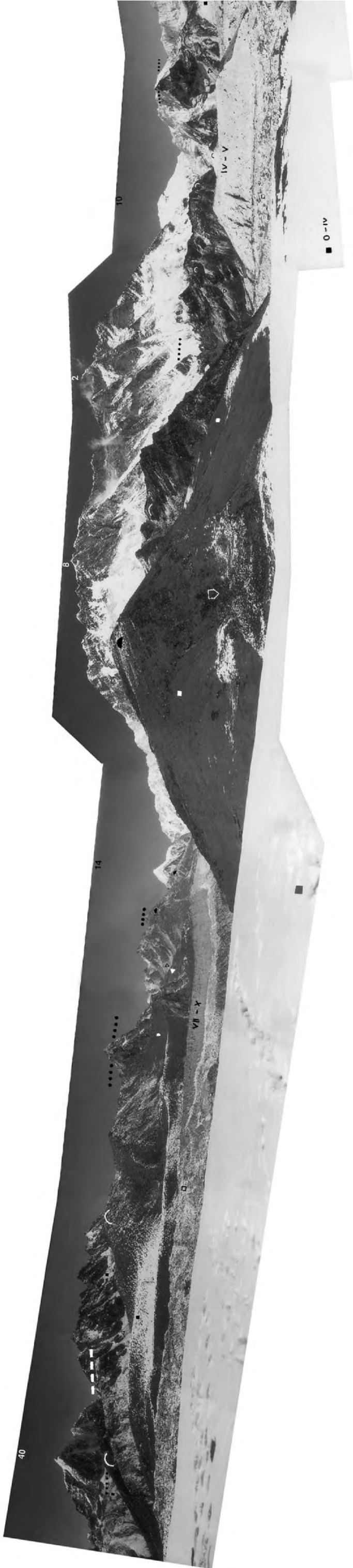


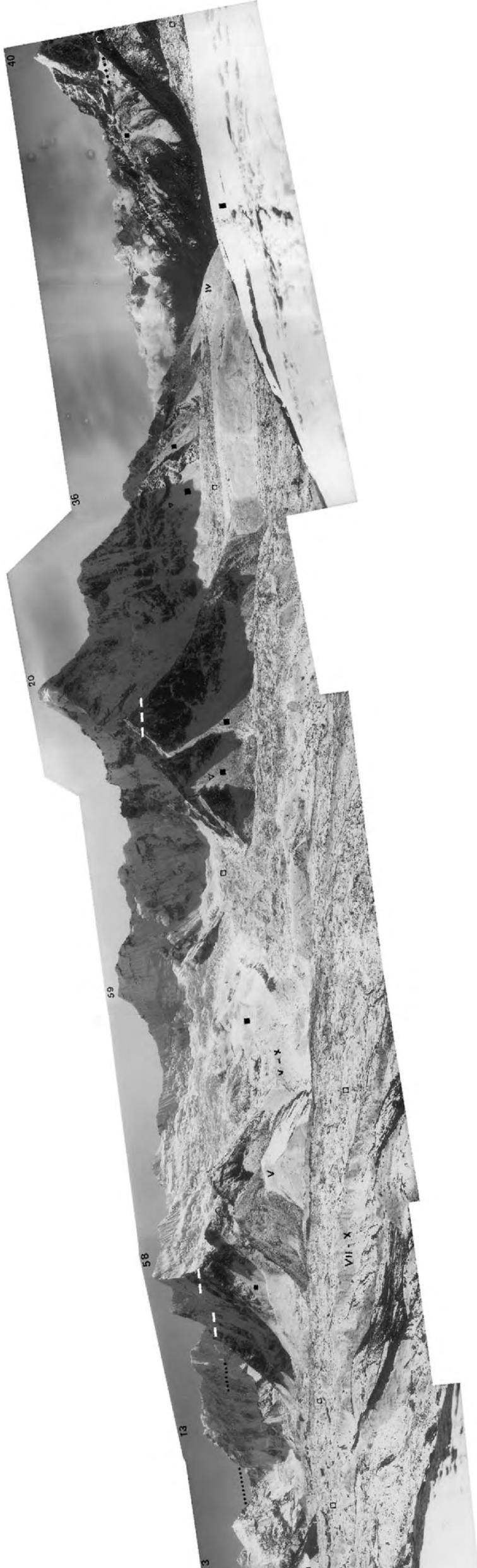


† *Photo 68.* Picture taken at 5760 m a.s.l. from the orographic right flank of the Imjia Khola SW of the 6173 m-high Imjatse-peak (Figure 3, Panorama 68) from facing E to Cho Polu (No. 29, 6734 m) via facing SE to Baruntse (No. 13, 7220 m), via SSW to the 6238 m-peak (No. 58) and WSW to Amaï Dablang (No. 20, 6856 m) and Taboche (No. 40, 6542 m), via facing W to Jobo Laptshan (No. 53, 6440 m) up to WNW (right margin). Between Nos. 20 and 40 down to the SW the confluence of the Khumbu- and Imjia Khola is situated. Between No. 20 and the right margin the high summits of the Rolwaling Himal, with an altitude somewhat below and above 7000 m up to the 7352 m-high Nangpai Gosum SW of Cho Oyu, form the skyline. (□) mark the surface-moraine-covered glacier areas of the (from left to right) Lhotse Shar- and Amphu glacier which both join the Imjia glacier. (□ on the right below) is the Lhotse glacier, (□ above) the Amaï Dablang glacier and again above the Duwo glacier (□ on the right totally above), (V), (V–X), (VII–X) and (XII) mark the geomorphologically dated neoglacial and historical moraines according to Table 1. Stage XI is documented by the mapping of E. Schneider in the years 1955–1963 (1978) which is the base of Figure 3. At that time (about 1950) the Imjia glacier has nearly reached the Lhotse glacier and thrust a frontal moraine against it (■ white on the right above XI). (○ large) is a lake on the Imjia glacier at 5020 m a.s.l. developed in the meantime (1963–1982, since Stage XI). Probably (XI) is dead ice. A further young frontal moraine is marked by (■ on the right below V–X). The rest of the (■) are ground- and pedestal moraines, (■ below and on the right below No. 53 and also on the right somewhat above the right V) are remnants of a connected pedestal of ground moraine which was a good 300 m-thick and on which the High- to Late Glacial Imjia glacier has flowed down (Figures 24 and 25). (■ on the left below No. 40) is the erratic-bearing ground moraine on the right slope of the Khumbu- and Imjia Khola confluence (Figure 78), (■ below and on the right margin) is ground moraine of a late Late Glacial to neoglacial side glacier from the W Imjatse-S-flank. Below No. 29 in the middle ground the eastern Imjatse-S-glacier is situated, torn by transverse crevasses. (○ small) are coarse light tourmaline-granite boulders lying here on a rib of dark, thinly stratified phyllite bedrock; accordingly, they are erratic. (▽) are postglacial debris cones and -tali which at least superficially are built-up from debris of rock fall, i.e. crumbings. Partly they have an older, i.e. High- to Late Glacial ground moraine core. (●, ▲, ○ and ○) are glaeigenic abrasions, which become manifested by back-polishing, smoothing and rounding of the bedrock valley flanks, their projecting ribs and mountain spurs and the cavetto-shaped undercutting of the steep walls. (...) on the very left and right below No. 13) are undercuttings of this sort; (___ white) are polished back spurs. (... , ---, ---, ---) are the highest glacier trim-lines verified and interpolated by the transfluence passes, which therefore are classified as belonging to Stage 0 (Table 1). They run from 6300 m (...) on the very left) via 6100 m (...) and --- on the left below No. 58) (Figure 23) up to ca. 5400–4500 m (___ black) (Figures 24, 25, 22, 26, 27). (___ white) establish them at a limit of glacier polishing, i.e. the break-off of the rock smoothing toward above, whilst the truncated spurs still reach up to nearly 6000 m (above ___ white on the left) and 5600 m (above ___ white on the right). Owing to this (___ white) have to be classified as belonging to the already lowered glacier level of the Late Glacial (Stages I–IV). Analogue photo M. Kuhle, 30/10/1982.



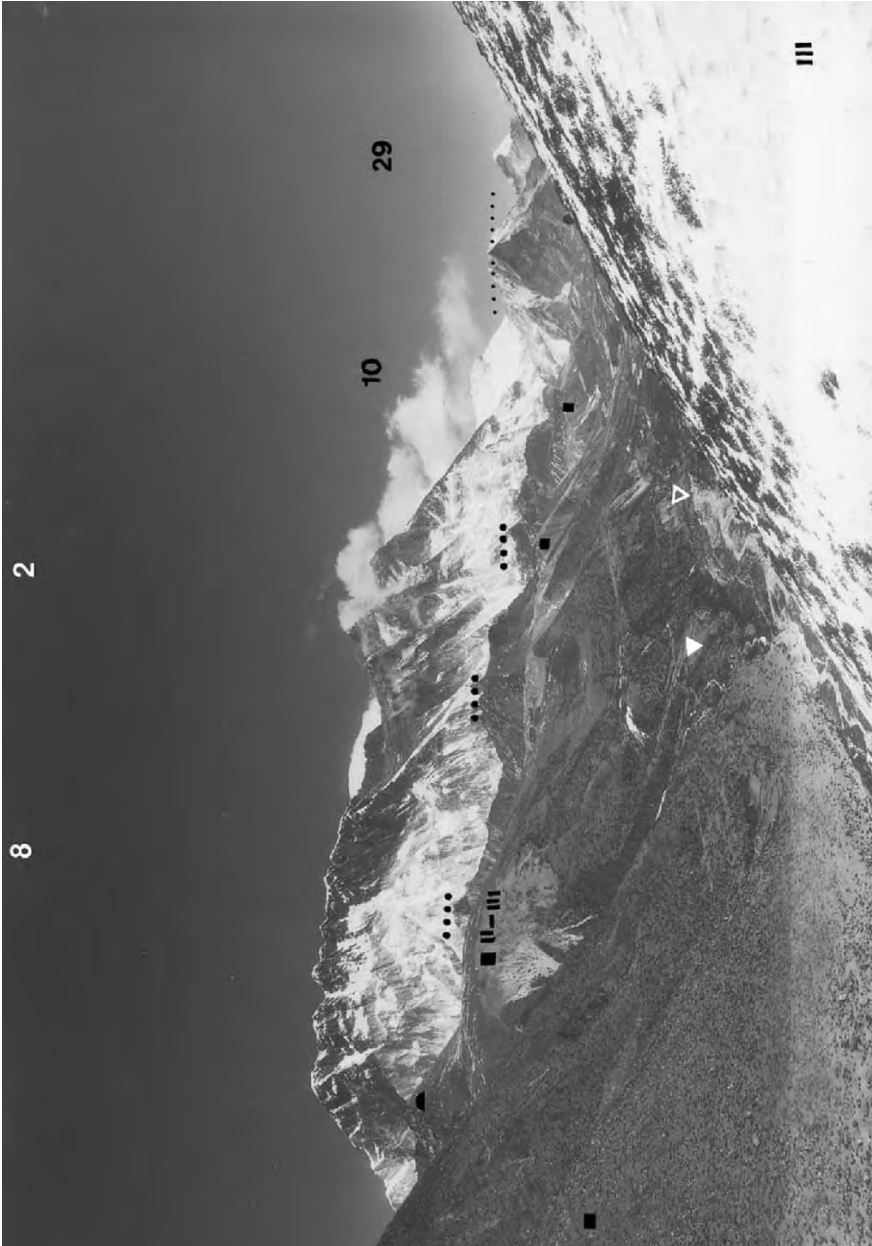




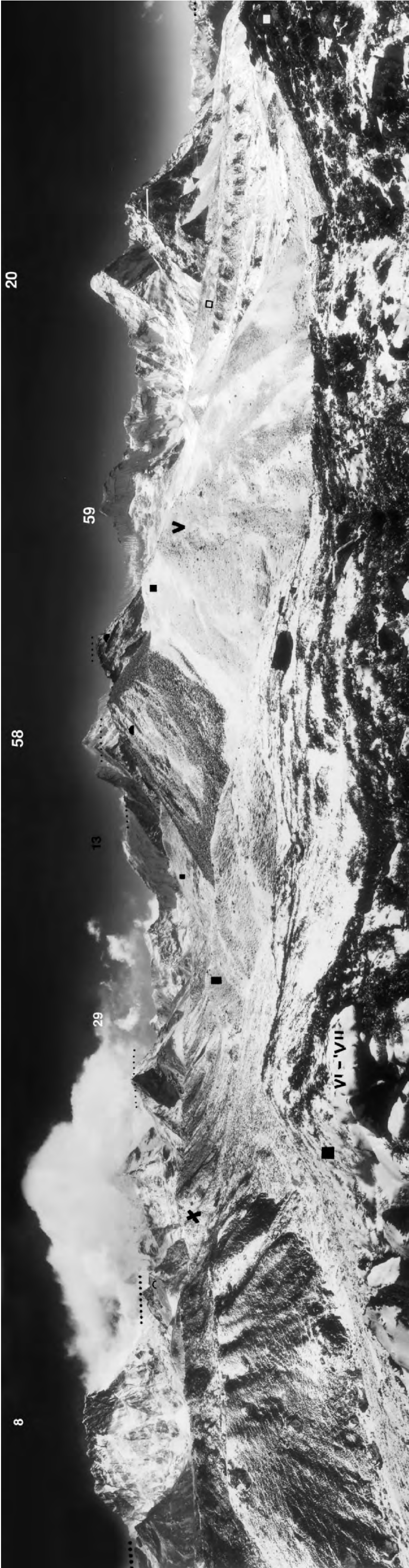


↑ *Photo 72.* 360°-panorama at 5050 m a.s.l. from the orographic right side of the Imja Khola or Drangka, from the ground moraine terrace between Lhotse Nup- and Nuptse glacier (Figure 3 Panorama 72) N of the Chhukhung alpine pasture from facing WSW (left margin) to Taboche (No. 40, 6542 m) via facing NNW with Pumori (No. 14, 7145 or 7165 m), facing NNE to Nuptse (No. 8, 7879 m), facing NE to Lhotse (No. 2, 8501 m), facing ENE to Sha Tse (No. 10, 7502 m), facing Makalu (No. 3, 8475 or 8481 m) beyond the valley head of the Imja Drangka, facing ENE to Baruntse (No. 13, 7220 m), facing SE to the 6238 m-peak (No. 58), facing SSE to the 6430 m-peak (No. 59), via facing SSW to Amaï Dablang (No. 20, 6856 m) up to facing SW to Tramserku (No. 36, 6608 m) and further down the Imja Drangka once more to Taboche (see above). (□) are the more less snowy surface moraines of the (from left to right) Nuptse glacier, the Lhotse Nup glacier, the Lhotse glacier (three times □), the Amaï Dablang glacier and the Duwo glacier; (□) on the very right is again the tongue of the Nuptse glacier. The Chhukhung glacier (on the right below Nos. 58 and 59) is an a good 3 km-long hanging glacier without surface moraine. (VII–X) are the immediately attached lateral moraines of the Nuptse- and Lhotse glacier. (V–X) are end moraines of the Chhukhung glacier, gradually accumulated and modified during these stages (cf. Table 1). The same applies to (IV–V). (■) in the foreground on the left and right) and (0–IV) is a 310 m- high ground moraine terrace; the second (■) from the left is its down-valley continuation at the same level, even 540 m above the Imja Khola valley bottom. (■ on the left of ♠) is also High- to Late Glacial (Stages 0–IV) ground moraine, which above the ground moraine terrace nestles against the slope. (♠) is a slide in this ground moraine cover exposing its thickness of several metres and the round-edged boulders it contains. (■) are further occurrences of ground moraine, in places overlain by the debris of crumblings (▽), (▼) is a rock glacier also consisting of past dumped moraines of a sheer ice glacier. (●, ◆, ◇, ○ and ◎) are glacialenic polish- and abrasion forms which testify to the High- to Late Glacial glacier trim-line during the last glacial period (..., ---). It runs (... on the right below No. 3) about 6300 m, (... between Nos. 13 and 58 at 6150–6000 m) (Figure 23), (---) below No. 20 at 5500 m, (...) below No. 40 at ca. 5400 m (Figure 22), (...) between Nos. 3 and 2 at 6000 m (Figure 23) and (... between Nos. 14 and 40 from 5700 down to 5500 m (Figures 25, 21 and 22). Analogue photo M. Kuhle, 3/11/1982.

← *Photo 71.* Picture taken at 5000 m a.s.l. from the orographic right side of the Imja Khola or Drangka from the modern frontal moraine of the Lhotse Nup glacier (Figure 3 Panorama 71) from facing NNW (left margin) to the 5546 m-high intermediate valley ridge between Lhotse Nup- and Nuptse glacier, via facing N up the Lhotse Nup glacier to Nuptse (No. 8, 7879 m), via facing NE to Lhotse (No. 2, 8501 m) with the dark metamorphic rock triangle of the 8383 m-high summit of Lhotse Shar on the right beside it, facing ENE to Shar Tse (No. 10, 7502 m) up to facing E up the Imja Khola or Drangka (right margin) with the 6186 m-high Imjatse. (□ white) is the surface moraine cover of the Lhotse Nup glacier reaching a maximum of over 1 m in thickness. Its debris cover is supported by the avalanche nourishing of the glacier from the 2300 m-high Nuptse-S-wall. (▼ on the left) marks the central avalanche cone below the ice avalanche gorge and the steep cirque glacier in the line of dip of the summit (below No. 8). (X) is the orographic right lateral moraine which for the last time has been reworked ca. 230–80 years ago, i.e. during the Little Ice Age. (▼ on the right) is a further ice avalanche cone which from the Imjatse-W-wall joins in the feeding of the Lhotse glacier. (□ black) is the orographic right lateral valley of the Lhotse glacier with its lateral sander of the Stages Nos. – 3 to – 8 (see Table 1). (▽) shows an active debris talus of crumblings, i.e. a debris cone, caused by historical glacial undercutting. (■) are High- to Late Glacial (Stages 0–IV) deposits of ground moraine which since the deglaciation have been reshaped into many forms, also by neoglacial glacier advances. (●) is a mountain spur polished back by glacial flank abrasion in the late Late Glacial (IV) and Neoglacial. It has been roughened by syngenetic and postgenetic crumblings and the corresponding rock fall. (○) are further High- to Late Glacial (Stages 0–IV) flank polishings (○ black) and roche-moutonnée-like rock roundings (○ white) due to transfluence. (---) is the Ice Age glacier trim-line above the Nuptse glacier at ca. 5800 m (Figure 24); (·: centre) at ca. 6000 m in the Nuptse-Lhotse S-wall and at ca. 6100 m a.s.l. at the Imjatse-summit (... on the right) (Figure 23). Analogue photo M. Kuhle, 21/03/2003.



← *Photo 75.* Picture taken at 4660 m a.s.l. from the orographic left flank of the Imja Khola or Drangka close to the confluence with the Khumbu valley from the slope of the ground moraine pedestal NW of the Duwo glacier (Figure 3, Photo 75) facing NE to the Nuptse-Lhotse group (No. 8, 7879 m; No. 2, 8501 m). In the background the 7502 m-high Shar Tse (No. 10) and the 6734 m-high Cho Polu (No. 29) are visible. (■) is the large pedestal of ground moraine preserved as moraine terraces gradually built-up by the High- to Late Glacial (Stages 0, II or III, Table 1) Imja Drangka glacier (also III in the foreground). The height of these ground moraine terraces increasing down-valley from 120 m (■ below No. 10) via 310 m (■ below No. 2) to 540 m (■ II–III) indicates the characteristic increase in thickness of ground moraines down to the dam- or pedestal moraines typical of the Himalaya. (▼) is a holocene alluvial debris- and debris flow fan accumulated from moraine material dislocated down-slope since the postglacial deglaciation. In the meantime, it has again been cut by the talweg of the side valley by which it was built-up. The reason for this is the continuous cutting process of the main valley talweg of the Imja Drangka (▽). (●) is a mountain spur glacially abraded up to 5400 m, showing a typically glacial triangular slope. (...) is the High Glacial glacier trim-line which has run between 6100 and 6000 m on the Imjatse summit (...) between Nos. 10 and 29) and at the wall foot of Lhotse and Nuptse (...) below Nos. 2 and 8). Analogue photo M. Kuhle, 18/3/2003.



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