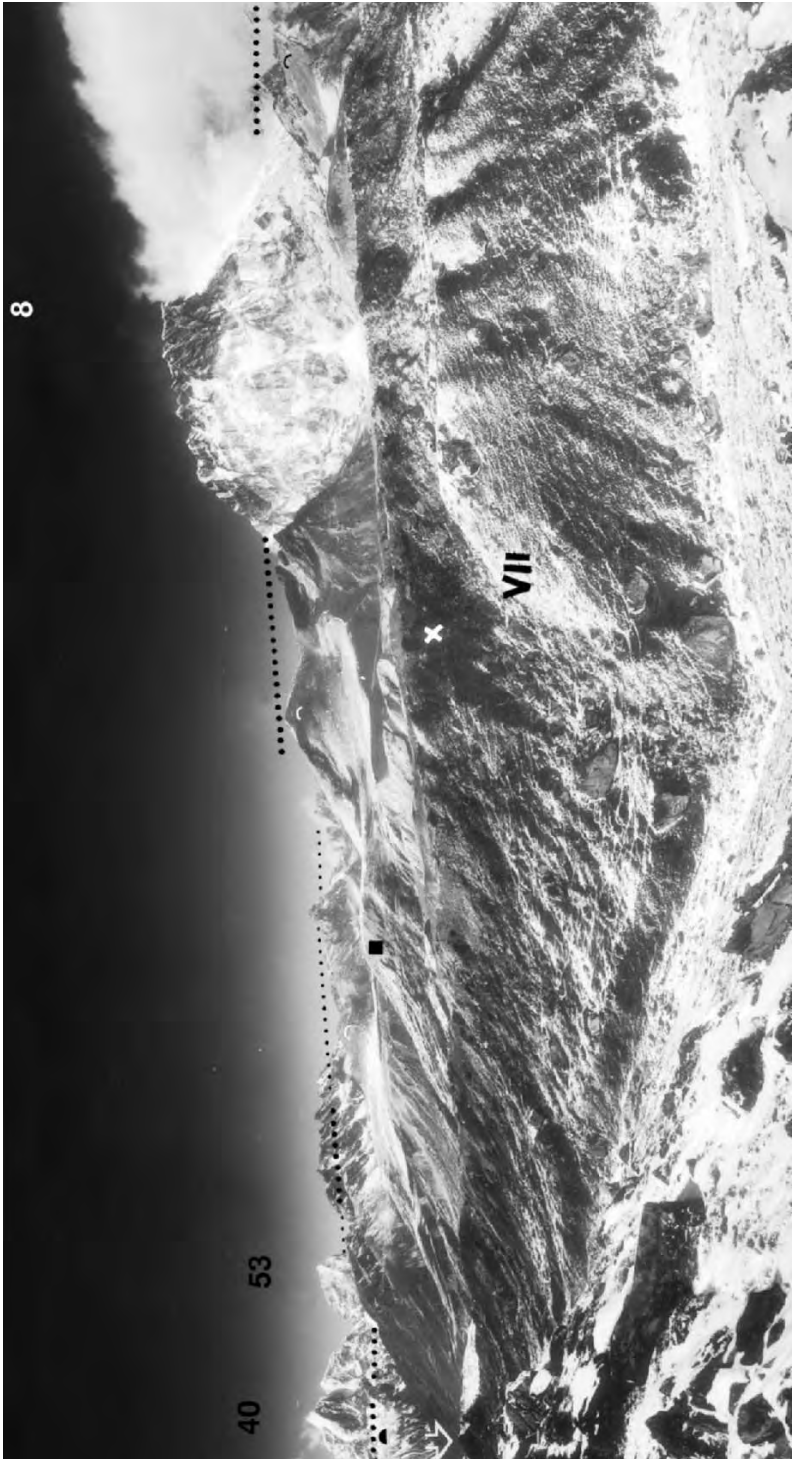
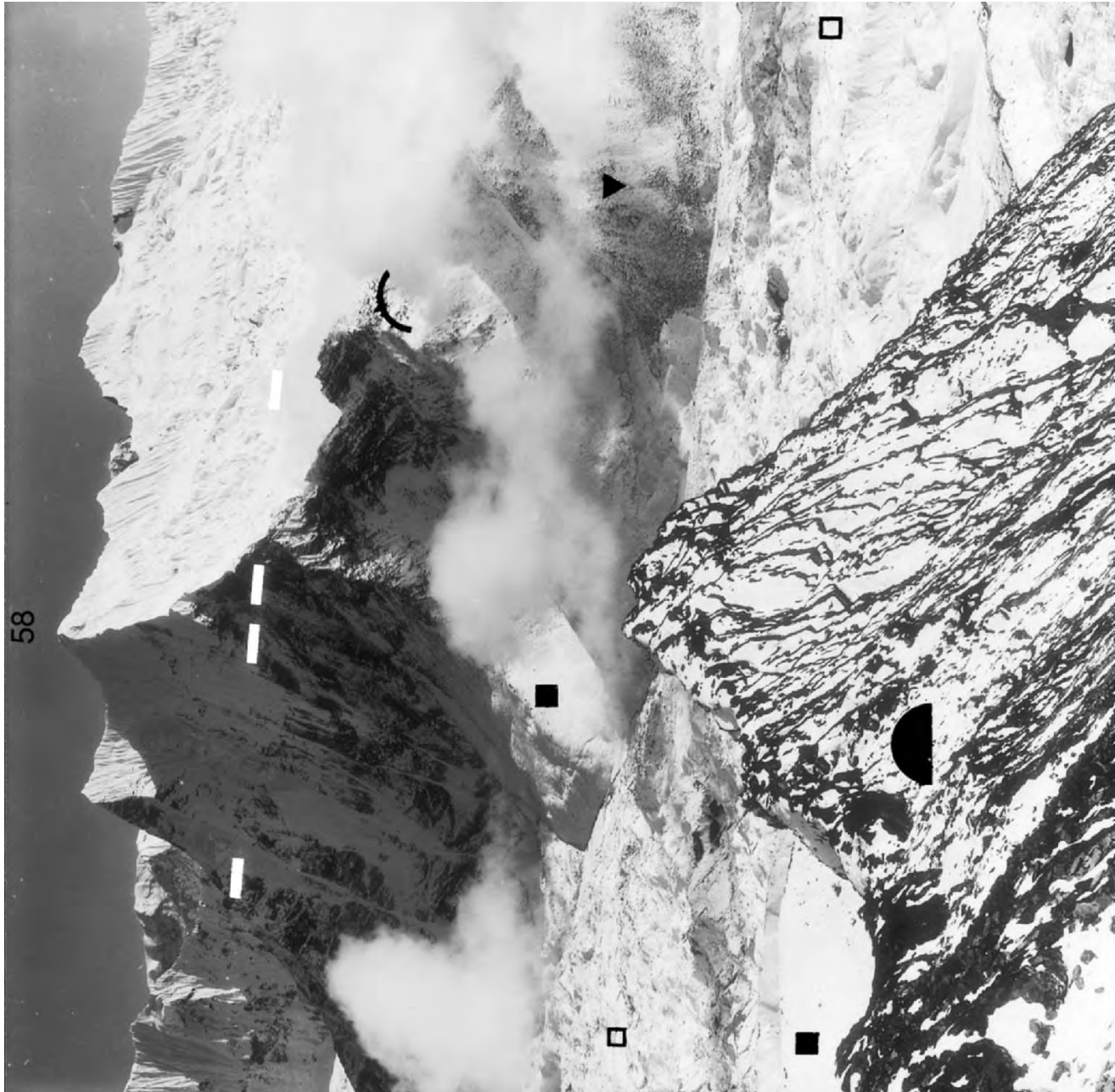
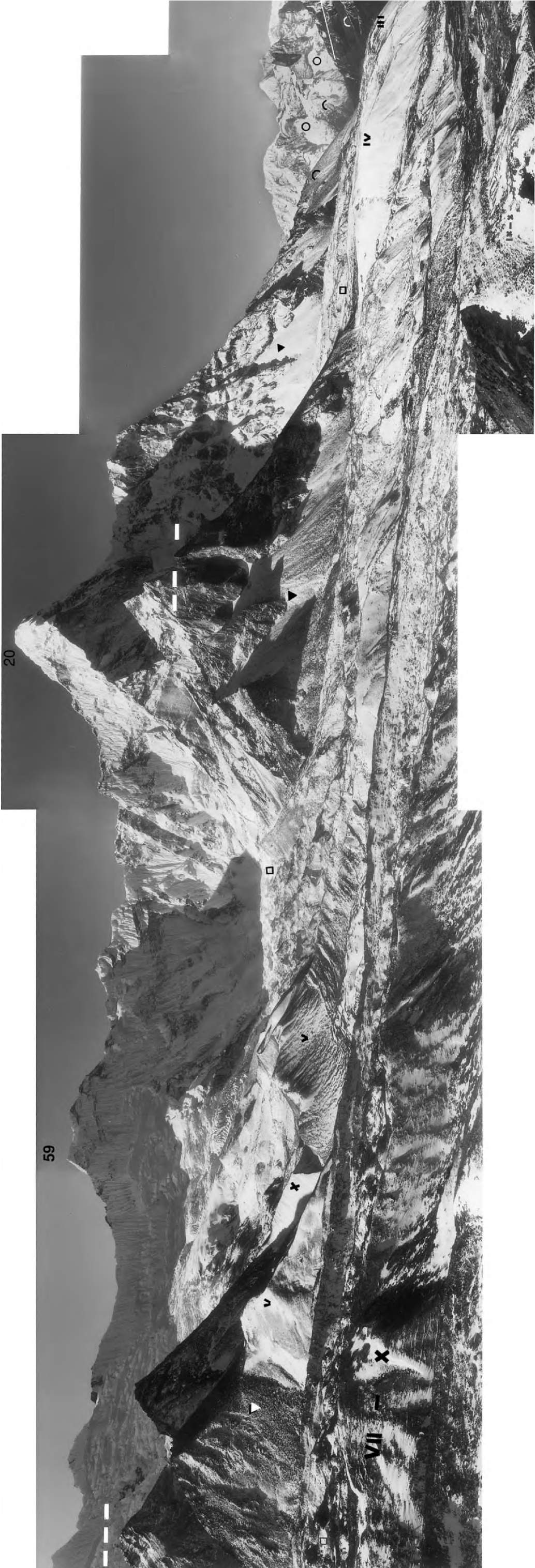


→ *Photo 73.* Picture taken from the orographic right side of the Imja Khola or Drangka, from the 5546 m-spur between Lhotse Nup- and Nuptse glacier (Figure 3, Photo 73) N of the Chhukhung alpine pasture facing SE across the Imja Khola to the 6238 m-peak (No. 58) and the 6193 m-peak towering left from it. (□) are the snowy surface moraines of the Imja glacier (on the left) and the Lhotse glacier (on the right). (■) are remnants of High- to Late Glacial (Stages 0–IV) pedestals of ground moraine. (▼) show movements by slide- and solifluction in the ground moraine cover on the slope. (● and ○) are glacialenic flank abrasions: (●) is a crest polished on two sides and sharpened by the adjacent Lhotse Nup- and Nuptse glaciers which flow parallel to it; (○) is a polished-back spur, i.e. glacially triangle-shaped spur. (---) is the glacier trim-line of the last glacial period (Stages 0–I; Table 1) (Figure 23). Analogue photo M. Kuhle, 3/11/1982.



← *Photo 74.* 360°-panorama from the orographic left side of the Imja Khola or Drangka, from the highest point of a lateral moraine crest of Stages VI–VII taken from the left bank of the Lhotse glacier at 5000 m a.s.l. (Figure 3 Panorama 74); from facing NNW (left margin) to Nuptse (No. 8, 7879 m) via facing ENE and ESE with Cho Polu (No. 29, 6734 m) and Baruntse (No. 13, 7220 m) up-valley, via SSE with the 6238 m-peak (No. 58), via S up to facing SW with the 6430 m-peak (No. 59) and Amai Dablang (No. 20, 6856 m) and via WSW down the Imja Drangka up to facing W to Taboche (No. 40, 6542 m) and Jobo Lapishan (No. 53, 6440 m) and again to Nuptse (see above) in the N. In this overall topographic connection seen up-valley and down-valley, the positions and their geomorphological arrangements of the historical (X, VII, ■ VI–VII, ■ white, V) remnants of lateral- and ground moraines are recognizable in their decreasing completeness and the increasing distance to the current glaciers. (□) is the Amai Dablang glacier covered with surface moraine. (■ black) are secondarily reshaped remnants of ground moraine, i.e. a ground moraine terrace rising from 310 to 540 m above the valley bottom (■ on the right) on which the Imja Khola parent glacier flowed down during the Stages 0–IV (Table 1). (▼) are debris tali and -cones deriving from postglacial crumbplings which in these positions regularly show a core of glacial ground moraine material. (●) are key forms of glacialenic flank abrasions in the course of which polished-back mountain spurs have been developed. On the resulting triangle-shaped slopes remnants of ground moraine mixed with debris of crumbplings due to flushing, slides and solifluction are to be observed. (○) are similar flank abrasions the ground moraine covers of which do not contain any or nearly any debris of crumbplings, but they show solifluction and moraine slides. The glacier trim-lines during Stage 0 (last glacial period) evidenced by upper abrasion limits (...) run at 6100 m a.s.l. at the valley head (... on the left below No. 29 and 58 and below and on the right below No. 58) (Figure 23); at the right valley flank down-valley from 6000 m (...) on both sides below No. 8) (Figure 24) via 5700 and 5500 m (...) on the right of No. 53) (Figures 25, 21, 22) down to 5400 m (below No. 40)(Figure 22). Analogue photo M. Kuhle, 20/3/2003.

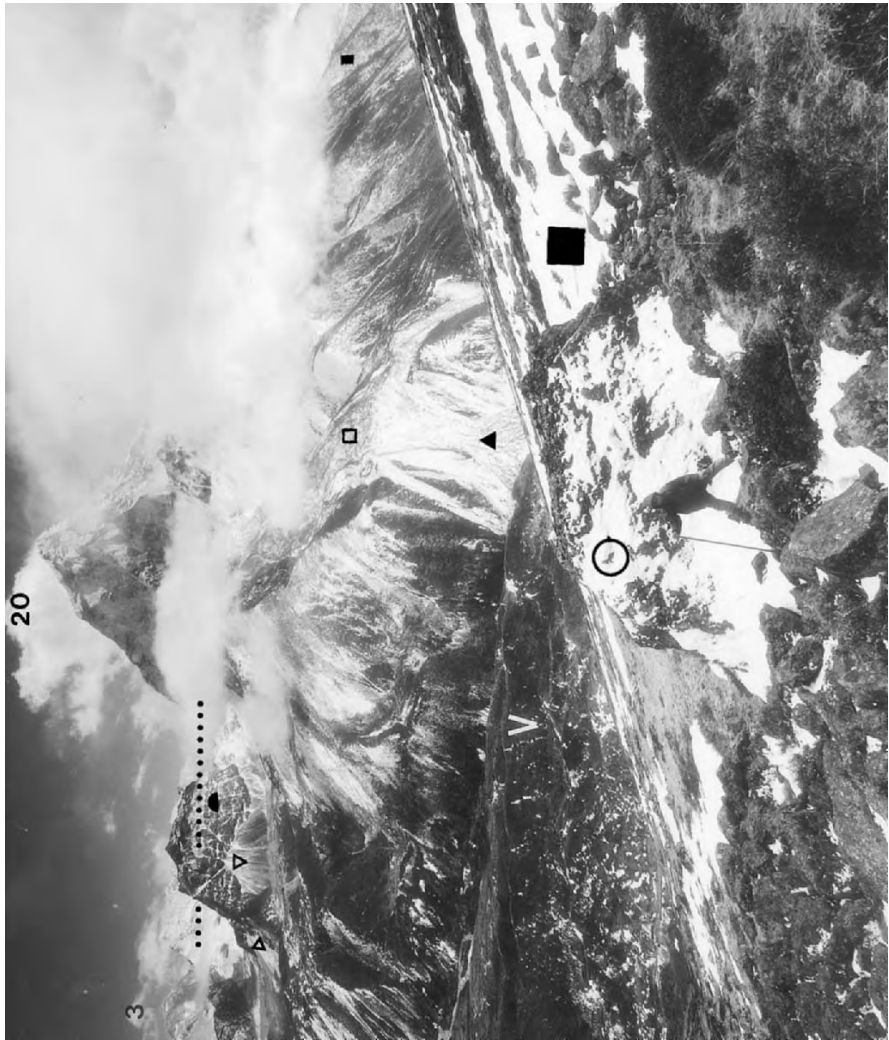


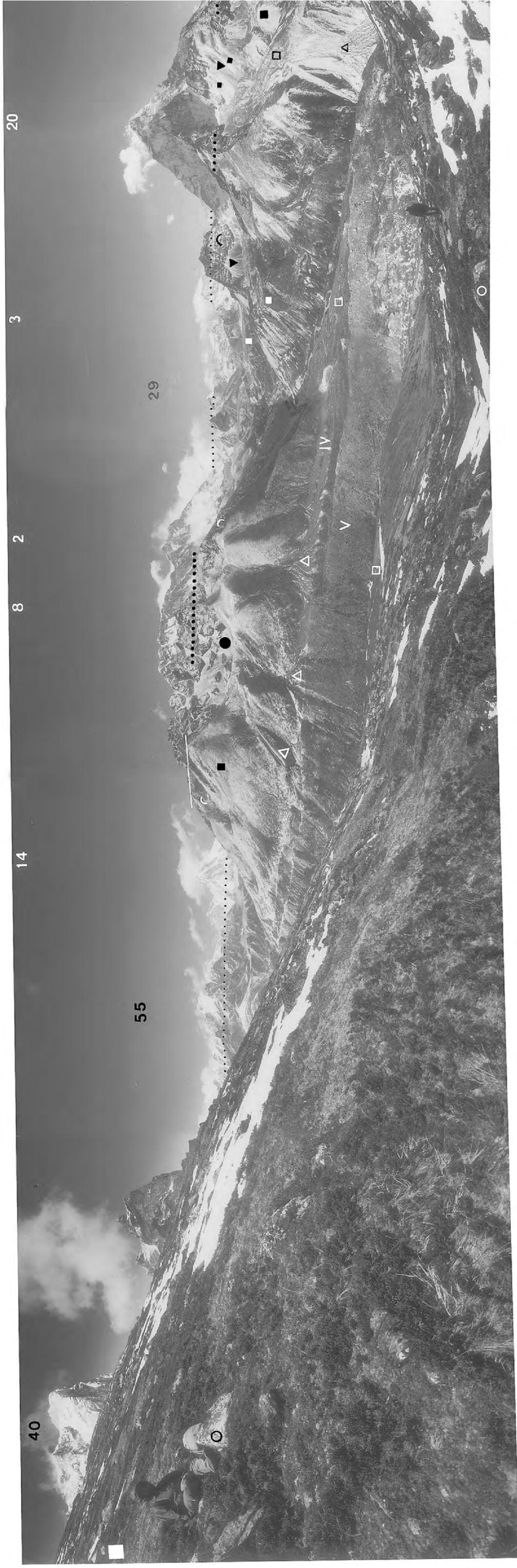
† *Photo 76.* Taken at 5000 m a.s.l. from the orographic right side of the Imja Khola or Drangka from the current front moraine of the Lhotse Nup glacier (■ X) (Figure 3 Panorama 76) from facing SE (left margin) via facing SSE to the 6430 m-peak (No. 59) and SSW to Amaï Dablang (No. 20, 6856 m), down the Imja Drangka (on the left below No. 40) facing WSW up to W to Taboche (No. 40, 6542 m) and Jobo Laptshan (No. 53, 6440 m) up to facing WNW (right margin). (□) are the surface moraines of the (from left to right) Lhotse glacier, the Amaï Dablang glacier, the Duwo glacier and the Lhotse Nup glacier. (VII-X), (IX-X), (X) and (■ X), (V), (IV) and (III) are remnants of lateral- and end moraines as well as ground moraine remnants, which can be classified as belonging to past to sub-recent and recent glacier stages (see Table 1), (■) are High- to Late Glacial ground moraines of the Stages 0–III showing a blanket character, i.e. they are only several metres-thick (■ white on the left below No. 40), up to dam- or ground moraine pedestal character with thicknesses of decametres up to over 100 m (the first three ■ from the right). The exposed pedestal moraine (■ on the very right) (cf. Photo 75) contains polymictic boulders of metamorphic sedimentary rocks (phyllites) and tourmaline granite which are edged and rounded at the edges, i.e. glaciogenically faceted. (■ black below No. 40) is the youngest ground moraine pedestal the substrate of which for the last time has been reshaped and exposed by the historical end of the Nutse glacier. (▼) are holocene debris tali of crumbings since the deglaciation. (●, ∩, ∪ and ∘) are glaciogenic flank abrasions, glacially triangular-shaped slopes and round-polished mountain ridges; ---, ... and ___ are High Glacial polish lines (Stage 0) between 6000 m a.s.l. (--- on the very left), 5600 m (--- on the right) and 5400 m (... below No. 40) down to 4600–4500 m a.s.l. (Figure 27). (--- below No. 20) is a Late Glacial ice level (Stage I) at ca. 5400 m. (○) are two cirques in the NE-flank of Kongde Ri (No. 60, 6187 m). Analogue photo M. Kuhle, 21/3/2003.

→ *Photo 80*. Picture taken at 4850 m a.s.l. from the orographic right flank of the confluence area of Khumbu- and Imja Khola W above Pheriche (Figure 3, Photo 80) from nearly the same position as in Photo 78, facing SE looking into the opposite valley flank with Amai Dablang (No. 20, 6856 m); the ice-free summit of Makalu is visible in the E (No. 3, 8475 m). (□) is the Tsuru glacier covered with surface moraine. It is adjusted to a High- to Late Glacial (Stages 0–III) ground moraine pedestal (■ small) of the main valley. Its contemporary front moraine has been dislocated by moraine slides and debris flows triggered by its meltwater – during the past and still today – and re-sedimentated on a very active debris flow cone (▲). (▽) are debris tali containing High- to Late Glacial moraine material. (V) is the front moraine of the Khumbu glacier during the neoglacial Nauri Stage at 4200 m a.s.l. (■) are ground moraine covers extending along the two valley slopes up to an altitude of 5000 m. On the orographic right side (■ large) they consist of edged and round-edged polymict boulders of gneiss- and tourmaline granite which float in the fine matrix. They show extensions (○) at a maximum the length of 7.5 m, a 4.1 m-wide base and a height of 3.9 m (person with 1.6 m-long surveyor’s rod) (Photo 79). Slides and rock falls as mechanisms of transport are to be ruled out on this merely 30°-steep slope which with height flattens convexly (cf. Photos 78 and 83). (●) are comparably freshly preserved glacialenic flank abrasions verifying the Ice Age, probably Late Glacial glacier level (...) about 5400–5500 m. Analogue photo M. Kuhle, 17/3/2003.



→ *Photo 79*. Picture taken at 4850 m a.s.l. from the orographic right flank of the confluence area of the Khumbu- and Imja Khola W above Pheriche (Figure 3, Photo 79) from approximately the same position as in Photo 78, facing NNE looking onto the valley bottom of the lower Khumbu valley. (V) is the orographic left inner slope of the lateral moraine of the neoglacial moraine of the Nauri Stage, (VI) is the ground moraine terrace of the next-older late Late Glacial Sirkung Stage. (■ small on the left) is the sub-recent outer slope of the front moraine of the Khumbu glacier. (■ small on the right and large) are the Ice Age ground moraine overlays reaching an altitude up to 5000 m on both valley flanks (Photo 78). (○) is a 7.5 m-long, on its base 4.1 m-wide and 3.9 m-high moraine boulder (persons for scale) of gneiss (Photo 80). The boulder belongs to a polymict scatter of erratic tourmaline granite and Lower Tibetan mica gneiss. Schist, phyllites, gneisses of many varieties and some marble outcrop in the underground (Nepal Geological Map 1:125,000 (1985); Sheet No. 721-B), tourmaline granite is lacking. Analogue photo M. Kuhle, 17/3/2003.





↑ **Photo 78.** 360°-panorama at 4840 m a.s.l. from the orographic right flank of the confluence area of Khumbu- and Imja Khola W above Pheriche (Figure 3 Panorama 78) from facing W (left margin) up-slope via the summit of Taboche (No. 40, 6542 m), via facing N to the 6145 m-peak (No. 55), facing NNE to Pumori (No. 14, 7165 or 7145 m), via facing NE to Nuptse (No. 8, 7879 m) and Lhotse (No. 2, 8501 m), facing E up the Imja Khola up to Cho Polu (No. 29, 6734 m) and beyond the valley head to Makalu (No. 3, 8475 or 8481 m), facing ESE into the orographic left flank of the Imja Khola to Ama Dablang (No. 20, 6856 or 6828 m), via facing S to Kang Taiga (No. 20, 6779 m) and up-slope again facing W to Taboche. (□ white) are neoglacial to historical glacier mouth gravel field terraces (sander terraces) of Stages Nos. – 1 to – 2 (on the right) and – 1 to – 8 (on the left) corresponding to the glacier Stages VI–XII (Table 1). (□ black) is the Tsuru glacier covered with surface moraine. It is adjusted to a High- to Late Glacial (Stages 0–III) ground moraine pedestal of the main valley. Its contemporary front moraine has been dislocated by moraine slides and debris flows, which have been and are still triggered by the glacier's meltwater. It has been re-sedimentated on a very active debris flow cone (△ black). (△ white) are active debris flow cones consisting of dislocated High- to Late Glacial (Stages 0–III) ground moraine. They are adjusted to the Late Glacial ground moraine terrace (IV) of the Sirkung Stage. (V) is the orographic left lateral moraine of the neoglacial Nauri Stage (Table 1). (■) are High- to Late Glacial deposits of ground moraine, at some places covered by debris cones and -tali (▼). (○) are erratic, light boulders of tourmaline granite up to metres in size (persons for scale) on the surface of a metre-thick cover of ground moraine. (●) is a Late Glacial cirque (Stages III–IV), the glacier of which was adjusted to the Khumbu glacier surface which has dropped during the Late Glacial. (C, ●, ∩) are preserved glacial trim-lines during the last glacial period (Stage 0) at 6200 m (... below No. 14) (Figure 20) to 5500 m (... below No. 55) (Figure 21), about 5450 m (... below No. 8), at 6300–6000 m at the valley head of the Imja Khola (... below No. 29) (Figure 23) and at ca. 5500 m (... below No. 3) up to 5200–5050 m a.s.l. (... below and on the right below No. 20). The last two trim-lines might also belong to the early Late Glacial (Stage I). Analogue photo M. Kuhle, 17/3/2003.

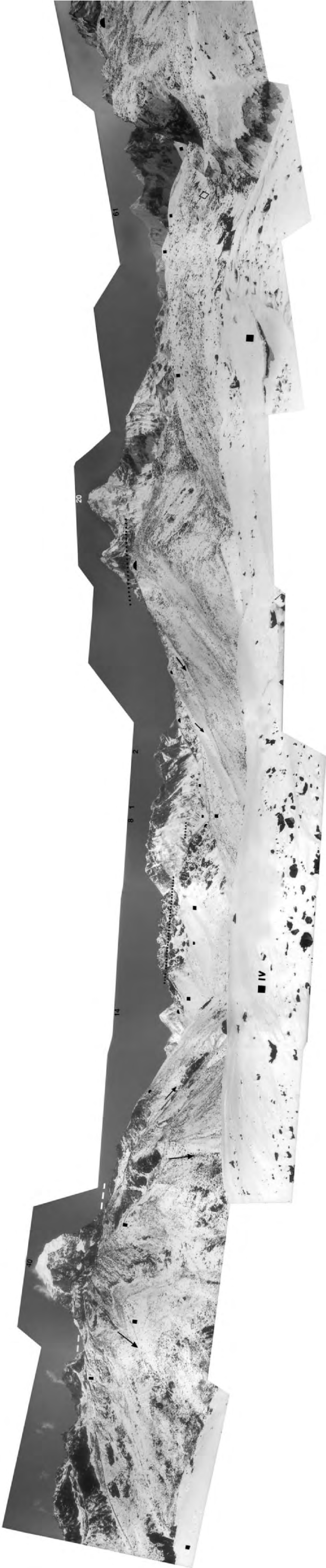
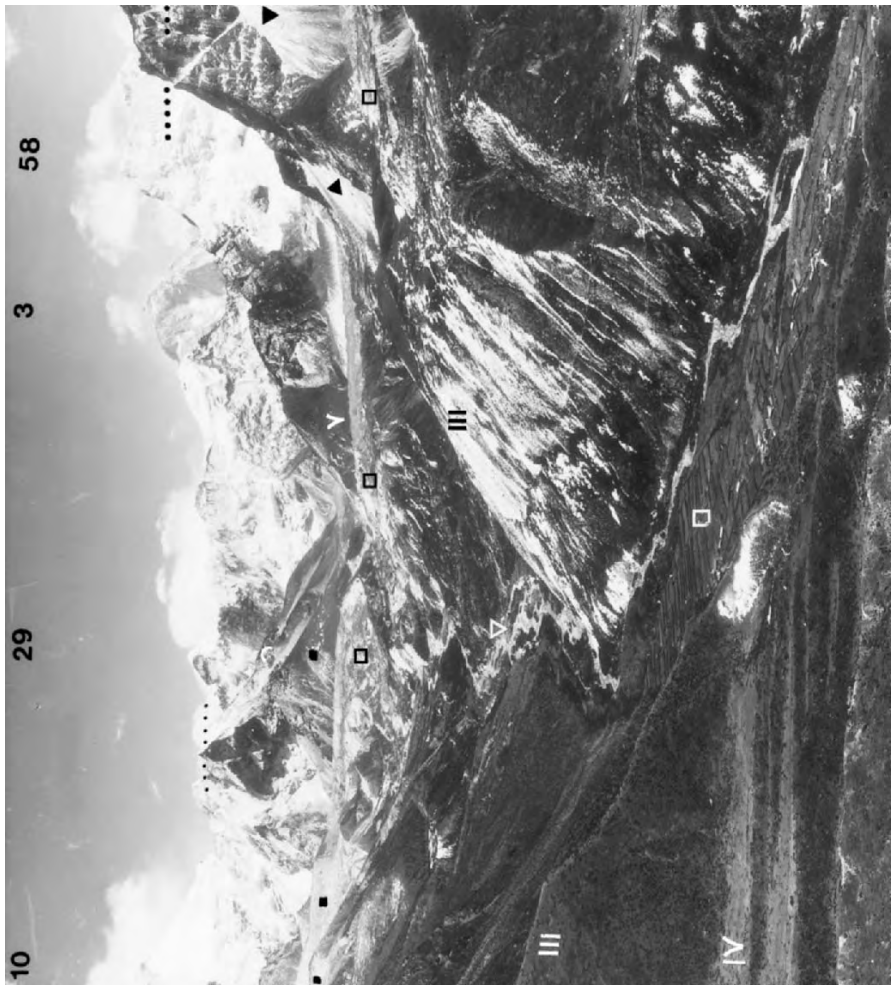


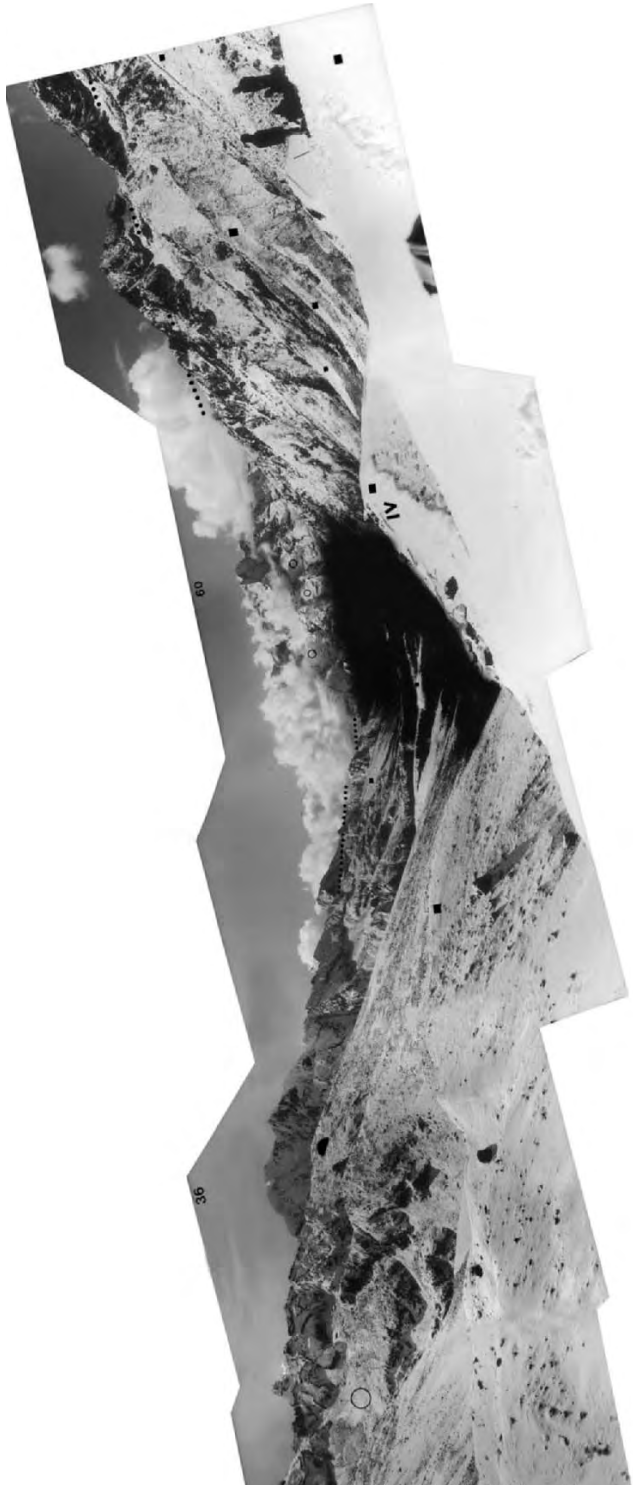
← *Photo 77.* Taken at 4570 m a.s.l. from the orographic right flank of the Imja Khola or Drangka NE above Dingboche (Figure 3 Panorama 77) from facing ENE up the Imja Drangka (left margin) via facing SSE to the 6856 m-high Amaï Dablang (No. 20) up to facing WSW (right margin) via the Dingboche hamlet down the Imja Drangka. (IV) is material of lateral moraine of the late Late Glacial Stage IV: (IV black) has been attached as an orographic left lateral moraine to the remnant of the ground moraine pedestal of the next-older Late Glacial Stage (III) (Table 1). (IV white) is the spur of the medial moraine between the Imja- and Khumbu glaciers which have flowed together during Stage IV. The Duwo glacier tongue (below No. 20, not visible from here) is adjusted to the ground moraine pedestal (III). (■) are more or less heavily reshaped remnants of ground moraine older than Stage IV. In places they have been covered by the debris of crumbings (V). (○) are angular (○ white) and rounded (○ black) moraine boulders. (◌) is a rock head polished into a roche-moutonnée-like form. (↗) is the current Imja Drangka river undercutting the Late Glacial ground- and lateral moraines at some outer slopes. There, slides of moraines occur afterwards. (-1- -2) is the glaciofluvial gravel floor (sander) Nos. -1 to -2, i.e. of the neoglacial glacier positions VI-'VII (Table 1). (... on the left) is the Late Glacial glacier trim-line (Stage I) at 5400-5500 m, proved by the freshly preserved flank polishing and its upper limit. (... on the right) is the High Glacial (Stage 0) glacier level at 5300 (Figure 26) to 5000 m. Analogue photo M. Kuhle, 18/3/2003.



← *Photo 81.* Picture taken at 4150 m a.s.l. in the confluence area of the Khumbu- and Imja river, 1.5 km to the S down-valley from Pheriche (Figure 3, Photo 81) facing NW looking at an exposure of ground moraine. (■) is the very densely packed (over 4.5 kg/cm² crush resistance of the matrix), multi-layered ground moraine below the end moraine of the Khumbu glacier during the neoglacial Stage V (Photo 80 (V)). The typical composition of mainly edged and several round-edged components at a large portion of matrix is evident. (○) are 2-3 m-long erratic boulders of tourmaline granite; (○ white) is dark due to a cover of lichens; (○ black) has been cleared of lichens by fluvial reworking in the stream bed. It is light and increasingly rounded at the edges. Analogue photo M. Kuhle, 21/3/2003.

→ *Photo 82.* Taken at 4840 m a.s.l. from the orographic right flank of the confluence area of the Khumbu- and Imja Khola (or Drangka) W above Pheriche (Figure 3, Photo 82) facing E (from left to right) to Shar Tse (No. 10, 7502 m) and Cho Polu (No. 29, 6734 m) at the valley head of the Imja Khola. In the Barun Khola, beyond the valley head, is Makalu (No. 3, 8475 m) and in the orographic left flank of the Imja Khola the 6238 m-peak (No. 58). (□ black) are the glacier tongues of (from left to right) Lhotse-, Amaï Dablang- and Duwo glacier covered with surface moraine; the last one is adjusted to the remnant of the ground moraine pedestal of the Late Glacial Dhampu Stage (III black). (III white) is a corresponding ground moraine remnant in the triangular section of the confluence between Khumbu- and Imja Khola. (IV) and (V) are the next-younger remnants of ground moraine of the Sirkung- and Nauri Stage (Table I). (■) are further remnants of ground- and lateral moraines. The Imja river (▽) has cut into the neoglacial glacier mouth gravel floor (□ white) Nos. – 1 to – 2 (Figure 3; Table I), so that a ca. 10-20 m-high terrace has been developed on which the Dingpoche settlement is situated. (▼) are debris cones and -tali developed since the Late Glacial deglaciation. (○) is glacialic flank abrasion on the Imjatse-S-flank up to an abrasion limit at ca. 6100 m. Accordingly, the High Glacial glacier trim-line (... on the left) has run there. Between (▼) and (... on the right) polishings have remained on the rock walls. Only above 5400 m (... on the right) do they pass into coarser roughenings so that one can recognize the early Late Glacial (Ghasa Stage I) glacier trim-line about 5400 m altitude. Analogue photo M. Kuhle, 17/3/2003.





↑ *Photo 84.* Long-distance photo at 3530 m a.s.l. from the medial moraine ridge E of Namche Bazar on the orographic right side in the Imja Drangka (Figure 3, Photo 84) facing NE up the Imja Drangka up to the valley head of the upper Imja Drangka (Khola) with Lhotse (No. 2, 8501 m), Mt. Everest (No. 1, 8848 m) towers directly behind Nuptse; the middle Imja Drangka is flanked by Amaï Dablang on the orographic left side (No. 20, 6856 m). The perspective of the long-distance photo illustrates the wide trough valley profile of the Imja Drangka (Figures 26, 27, 32), its mantling by ground moraine (■) and the glaciogenic flank abrasions (∩, ∪) on the outcropping edges of the strata of gneiss, schist and similar metamorphites (crystalline schist, phyllite) of the Lower Tibetan Formation (6b after Nepal Geological Map 1985: Sheet No. 721-B) situated in between. (○) is a cirque-bottom-like form polished out by the ground scouring of the neoglacial Tramserku NW-glacier tongue below the High Glacial Imja Drangka valley glacier level. (...) is the maximum Imja Drangka glacier level of the last glacial period (Stage 0; Table 1), fallen away from 5300 m a.s.l. (... centre), via 4550 m (... on the left; Figure 27) up to 4300 m (... on the right; Figure 32). (III) is the reshaped end moraine ridge of Tengpoche, to which the Imja Drangka glacier tongue has flowed down during the Late Glacial Stage III up to ca. 3300 m a.s.l. Analogue photo M. Kuhle, 2/9/1982.

← *Photo 83.* 360°-panorama at 4295 m a.s.l. from the Lhabarma alpine pasture in the Imja Drangka (Figure 3 Panorama 83) from facing W (left margin) into the right flank of the valley, via facing NW to Taboche (No. 40, 6542 m), facing N up-valley to Pumori (No. 14, 7145 m), via facing NE to Nuptse (No. 8, 7879 m), Mt. Everest (No. 1, 8848 m) and Lhotse (No. 2, 8501 m), facing E to Amaï Dablang (No. 20, 6856 m), facing SE up the Nare Drangka to the 6571 m-peak (No. 61), facing S to Tramserku (No. 36, 6608 m) up to facing SW down the Imja Drangka to Kongde Ri (No. 60, 6187 m) and again westward into the orographic right flank of the valley (right margin). Despite a 30 cm-thick cover of fresh snow the High- to Late Glacial moraine landscape is readily recognizable (■). (■ below No. 40 and on the right below No. 14) are ground moraine covers reaching up to 5000 m up the slopes (Figures 26 and 21). (■ below Nos. 8–2) are the 310–540 m-high ground moraine pedestals in the upper Imja Drangka (Figures 24 and 25); (■ in the background on the left and on the right below No. 60 up to the right margin of the panorama) are High- to Late Glacial moraine overlays on faces of flank polishing on both valley slopes of the lower Imja Drangka up to ca. 4500 m (Figure 27). (■ everywhere in the foreground and on the left below No. 61) are Late Glacial to early neoglacial moraines (Stages I–V, Table 1) overlying the corresponding older to High Glacial pedestal moraines. (◇) is a recent to sub-recent meltwater incision of the Nare river cut into the ground moraine, (↓) are slope ravines dissecting the ground moraines since the deglaciation up to the present. (♥, ◆, ●) are truncated spurs and the typical roundings on glaciogenically triangular-shaped slopes, the upper limit of which verifies the past glacier trim-line (--- and ...). It runs (from left to right) (---) at 5250 m, (...) below 5500 m, (...) below No. 8) about 6000 m, (...) below No. 20) about 5100 m and (...) on the right below No. 36 up to right of No. 60) between 4500 and 5000 m a.s.l. (○) are cirques increasingly polished out during the Late Glacial ablation process. Analogue photo M. Kuhle, 24/10/1982.



← *Photo 85.* Taken from the orographic right valley flank at 3930 m a.s.l. facing SW (Figure 3, Photo 85) looking down the Imja Drangka on to a roche moutonnée (○) in the massive-crystalline gneiss bedrock. (■) is very thick material of ground- and end moraines of the Omoga tributary glacier (Figure 3), deposited during the Late Glacial Stage IV and covered by birches (*betula utilis*). (▽ above) is moraine material removed by actual debris flows. Today it is undercut by the Imja river (flows between ▽ above and △ below). (△ below) is moraine material on the orographic right side, also cut and dislocated by flushing and debris flows. Analogue photo M. Kuhle, 15/03/03.

→ *Photo 86.* From the orographic right valley flank at 3800 m a.s.l. facing SW (Figure 3, Photo 86) seen down-valley into the orographic right flank onto a roche moutonnée (○ small and ∩ white) and a glaciogenic polish plain in the massive-crystalline bedrock gneiss lying in front of it. (↓) is a subglacial meltwater gully in the bedrock which currently has fallen dry, i.e. it is situated away from actual water courses. Several potholes are lined up along it. This meltwater- and pothole gully has been worked into the middle of the roche moutonnée, i.e. it separates it. The left side of the roche moutonnée (left of ∩ small) has been undercut by the Imja river. (■) is a several metres-thick cover of ground moraine material on the valley slope. Analogue photo M. Kuhle, 15/03/03.

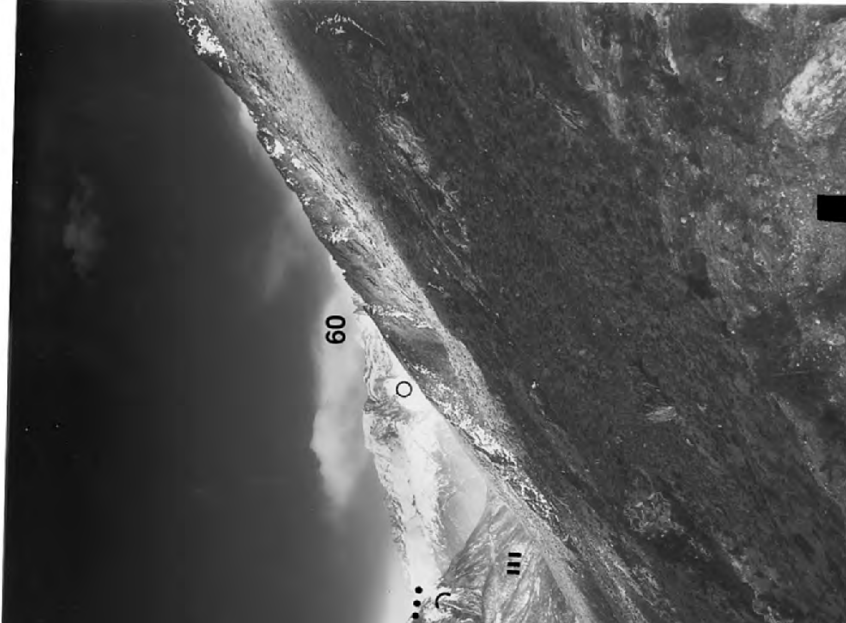




← *Photo 88*. From the orographic right valley flank of the Imjja Drangka W of Pangpoche (in the middleground on the right) at 4040 m a.s.l. (Figure 3, Photo 88) facing NE looking up the Imjja Drangka toward Lhotse (No. 2, 8501 m) and Mt. Everest (No. 1, 8848 m), visible behind Nuptse. Amai Dablang (No. 20, 6856 m) forms the orographic left Imjja Drangka valley flank. (■) is an orographic right ground moraine cover from which exemplary samples have been taken. In addition to different sorts of phyllites and gneisses, erratic round-edged, i.e. faceted tourmaline-granite boulders (○) up to 1.5 m in length are contained. They have been transported over a distance of 6 km; phyllite- and gneiss bedrock occurs in the underground. (IV) is the dumped end moraine of the Late Glacial Nare glacier incised by the current and subrecent Nare river, which during the Sirkung Stage IV has been deposited at the exit of the side valley. (...) is the High Glacial (Stage 0; Table 1) glacier trim-line at 5300 m a.s.l. Analogue photo M. Kuhle, 22/03/2003.



→ *Photo 89*. Taken from the orographic right valley flank of the Imja Drangka W of Pangpoche at 4060 m a.s.l. (Figure 3, Photo 89) facing NE up the Imja Drangka looking on to Lhotse (No. 2, 8501 m); (■ white) is an orographic right cover of ground moraine; (■ black) is exposed ground moraine with the sampling locality in Figures 48 and 37, No. 26. (○) are polymictic boulders; they consist of schists, different phyllites, gneisses and erratic tourmaline-granite boulders, transported over a distance of 6 km. Phyllites and gneisses outcrop in the underground. (IV) is the dumped end moraine of the Late Glacial Nare glacier incised by the contemporary and subrecent Nare river. During the Sirkung Stage IV, it has been deposited at the orographic left side valley exit. (...) is the High Glacial (Stage 0; Table 1) glacier trim-line at 5300 m a.s.l. Analogue photo M. Kuhle, 22/03/2003.

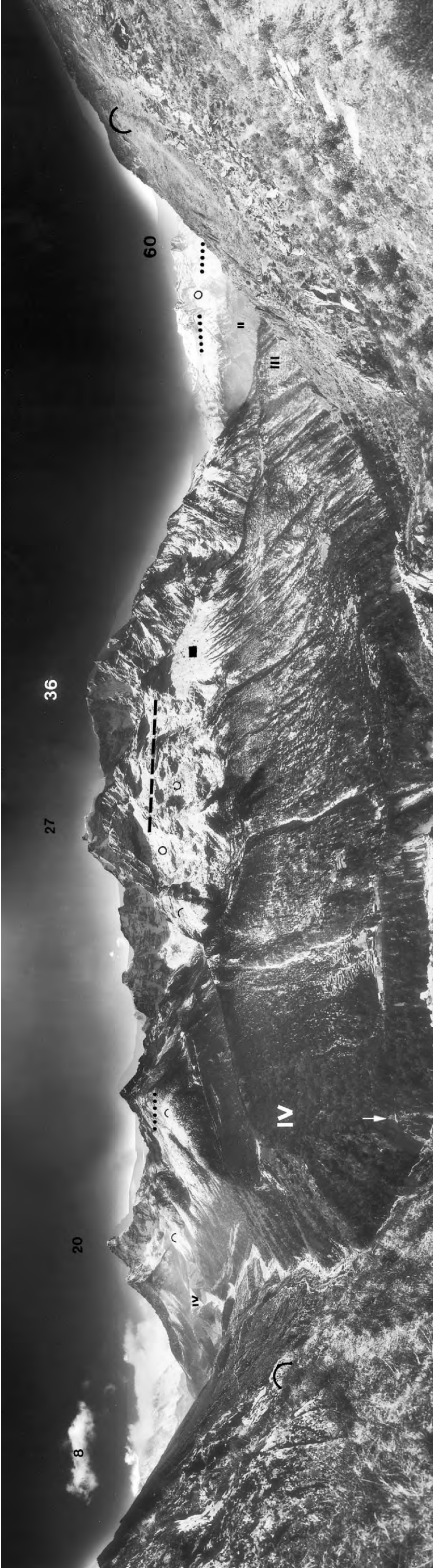


← *Photo 87*. Panorama from the orographic right valley flank of the Imjia Drangka N above Pangpoche at 4450 m a.s.l. (Figure 3; Panorama 87) from facing NNW (left margin) up the Imjia Drangka, into the orographic right valley flank on to Taboche (No. 40, 6542 m), via facing NE to Lhotse (No. 2, behind the clouds) and via the orographic left valley flank from facing W with Ama Dablang (No. 20, 6856 m) (in the foreground on the lower margin lies the Taboche alpine pasture) up to facing S to Tramserku (No. 36, 6608 m) with the summits of the 6571 m-peak (No. 61) at the valley head of the Nare Drangka and Kang Taiga (No. 27, 6779 m) situated in between; toward WSW below the main valley where Kongde Ri (No. 60, 6187 m) stands; up to facing W with the valley slope covered with ground moraine (right margin). Below Taboche (No. 40) is the currently ice-free, hose-formed cirque, the High- to Late Glacial (Stages 0-II or III; Table 1) glacier of which has been adjusted to the Imjia glacier. (IV white and black) mark the Late Glacial complexes of end moraines of the Sirkung Stage of the two orographic left side valley glaciers, the Nare glacier and the Omoga glacier (Figure 3 between Photo 89 and Panorama 83). The two end moraine complexes bear the characteristics of dumped end moraines, especially (IV white) and (IV black) are the corresponding gravel floor terraces and terrace remnants of the Stages No. 1 and younger (perhaps up to – 8). On one of them fields and houses of the lower part of the Pangpoche settlement (fences below No. 27) are situated. During the Late Glacial Dhampu-Stage (Table 1) the Imjia glacier terminal has reached up to (III); there we can find the corresponding remnants of end moraines. (○) are Late Glacial cirques and cirque niches. (■) are the ground moraines from which samples have been taken. They lie on the valley flanks between 5200 and 4500 m (Figures 26 and 27). Locally they are interrupted by glaciogenic flank abrasions (∩, ∪, ∘) reaching higher up. The highest glacier trim-line of the last glacial period runs between 5300 m (... on the right below No. 2), 5200 m (... on the right below No. 40) and 4500–4400 m (... on the right below No. 36). (...) on the right below No. 61) is an already decreased, early Late Glacial glacier level of the Ghasa (I)- or Taglung Stage (II; see Table 1). During the High Glacial (Stage 0) the Imjia glacier has completely overflowed the mountain spur concerned. Analogue photo M. Kuhle, 16/03/2003.



← *Photo 90.* From the orographic right valley flank of the Imja Drangka ca. 1 km W of Pangpoche at 4070 m a.s.l. (Figure 3, Photo 90) facing SW looking down the Imja Drangka. Kang Taiga (No. 27, 6779 m) and Tramserku (No. 36, 6608 m) stand in the area of the orographic left flank. From the first the Omoga Drangka leads down, at the exit of which the end moraine complex of the Late Glacial Sirkung Stage (IV) is situated. (■) is the orographic left cover of ground moraine reaching up to 4500 m. Since deglaciation up to the present, it has been incised by ravines and gullies. On the main valley slope this orographic left ground moraine cover is interrupted by a Late Glacial bed of a hanging glacier, emerging from a cirque (○). (●) are erratic tourmaline-granite boulders (the climbing-stick is 145 cm-long) transported by the High- to Late Glacial Imja Drangka glacier along the main valley. They lie 200 m above the talweg and at least 7 km away from their source area; phyllites and gneisses outcrop in the underground. (○) are glacialic flank abrasions at 4350 m a.s.l. (cf. Figure 27); (...) is the synchronous down-valley glacier trim-line at 4400 m. (III) indicates the Late Glacial end moraine of the Imja parent glacier at the time of the Dhampu Stage (Table 1). Analogue photo M. Kuhle, 22/03/2003.

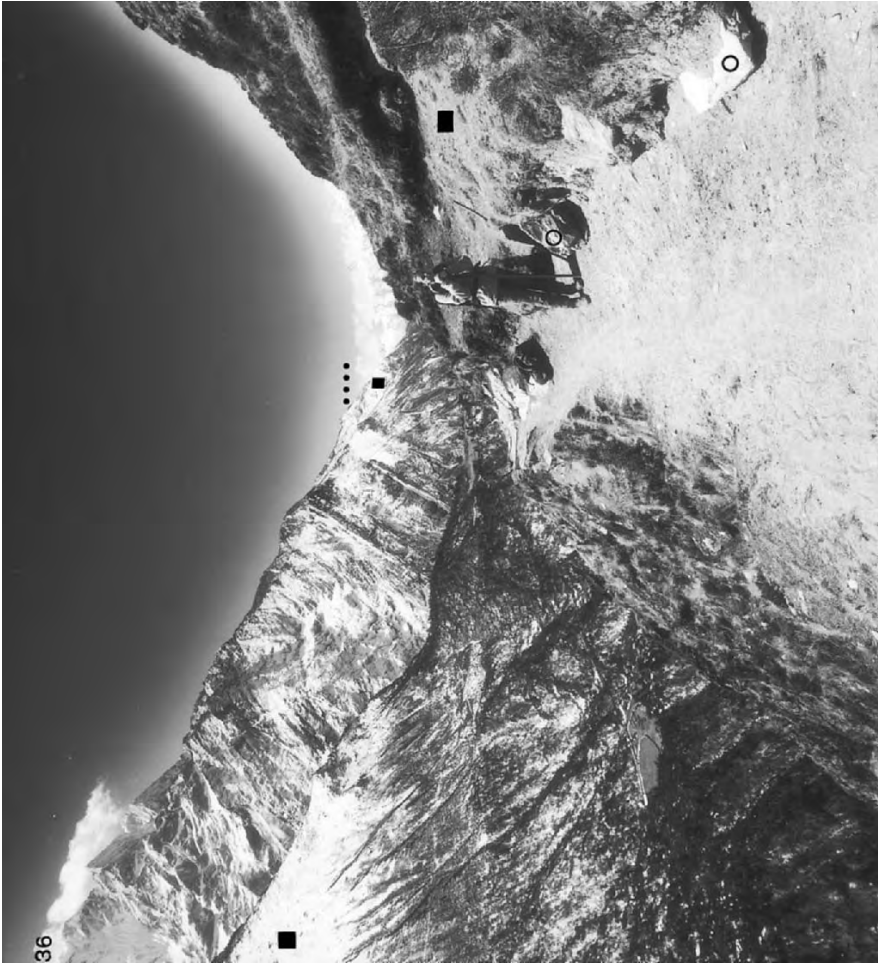
↓ *Photo 91.* Panorama from the orographic right valley flank of the Imja Drangka, 1.7 km SW of Pangpoche at 4200 m a.s.l. (Figure 3, Panorama 91) from facing NE (left margin) up the Imja Drangka toward its valley head with Nuptse (No. 8, 7879 m) and into the orographic left valley flank of Ama i Dablang (No. 20, 6856 m) in the ENE via facing SE with Kang Taiga (No. 27, 6779 m), up to facing SSE to Tramserku (No. 36, 6608 m) and then down the Imja Drangka facing SW with Kongde Ri (No. 60, 6187 m), into the right main valley flank in a WSW direction (right margin). (↓) is the sampling locality of the ground moraine in Figure 50 (see also Figure 37, No. 16). From the exit of the Nare Drangka (IV black) and also from the exit of the Omoga Khola (IV white), the Late Glacial end moraine complexes of the Sirkung Stage have been pushed by the tributary glaciers of the same name into the – there ice-free – main valley. (III) and (II) mark further Late Glacial areas of end moraines and ice margin positions, this time of the Imja parent glacier during the Dhampu Stage (III) near the Tengpoche monastery and during the Taglung Stage (II) near the Namche Bazar (Nauche) settlement. On the orographic left side the ground moraine cover reaches up to ca. 4500 m up the slope (Figure 27). (○, ○, ○) mark localities with well-preserved glacialic abrasions, situated at polished-back mountain spurs (truncated spurs) and glacialic triangle-shaped faces. They can be recognized by roundings. The corresponding highest limits of abrasion lie at least 4700–4500 m (---). (...) on the left) is an already decreased, early-Late Glacial glacier level of the Ghasa (I)- or Taglung Stage (II; see Table 1). During the High Glacial (Stage 0), the Imja glacier has flowed across the entire mountain spur. (...) on the right) are the highest polish lines in the confluence of the Imja Drangka with the Bote Koshi about 4100 m (Figure 52) up to 4200 m. These High Glacial upper limits of abrasion are interrupted by Late Glacial cirque bottoms (○). Analogue photo M. Kuhle, 22/03/2003.

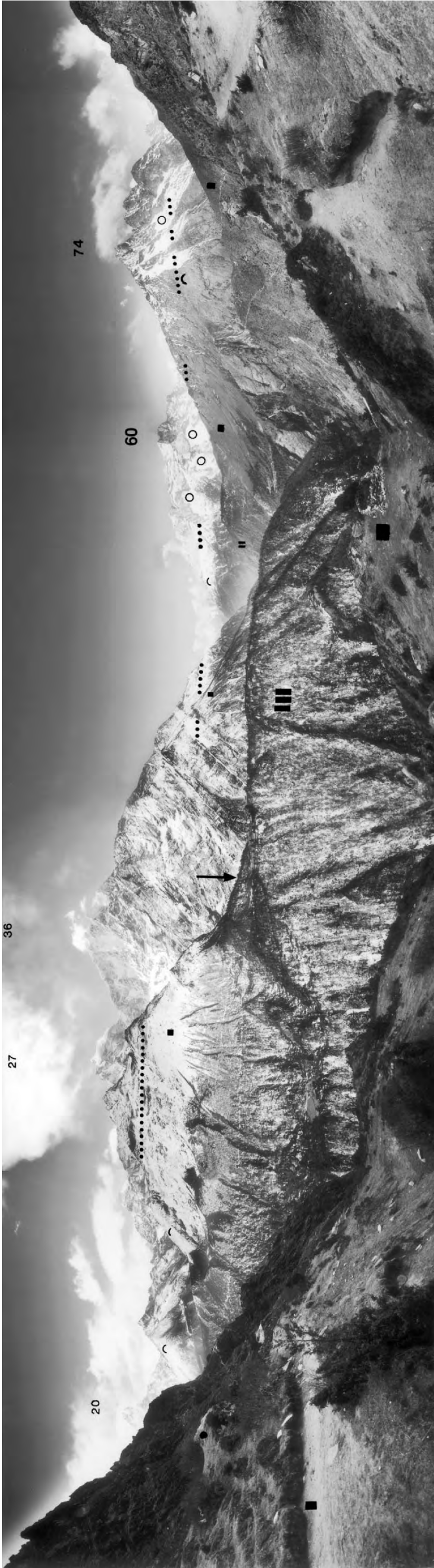
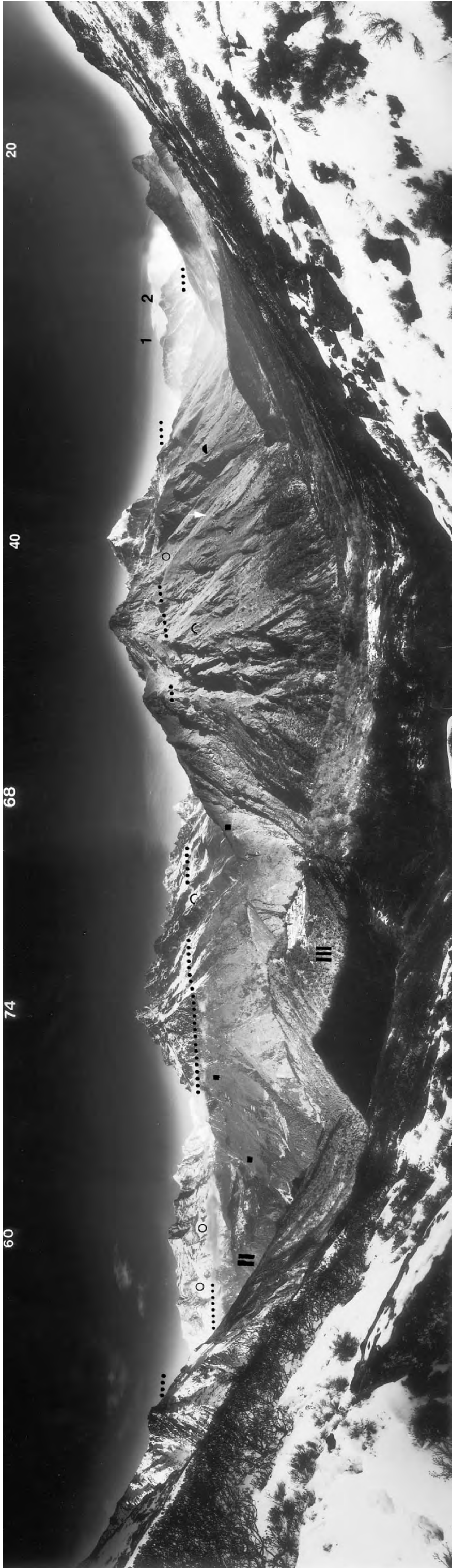


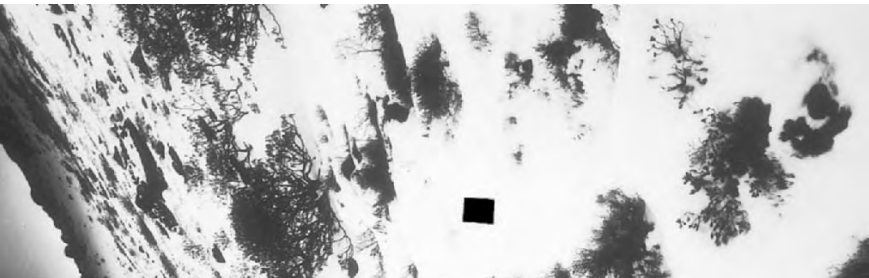


← *Photo 92.* From the orographic right valley flank of the Imja Drangka ca. 2.5 km WSW of Pangpoche at 4100 m a.s.l. (Figure 3, Photo 92) up the Imja Drangka facing ENE looking to Amai Dablang (No. 20, 6856 m). (IV) is the end moraine complex of the Late Glacial Sirkung Stage (Table 1) at the exit of the Omoga Drangka. (○, ●) are glacialic flank abrasions on the edges of the banking structures of gneiss bedrock. Naturally, they have been reshaped by crumbings and weathering-dependent secondary roughenings. (■) is the orographic right cover of ground moraine reaching up to 4200 m. Since the deglaciation up to the present it has been incised by gullies. It consists of polymictic, faceted and round-edged boulders (●) up to over 1 m in length ‘swimming’ in a clayey matrix. These are phyllite- and gneiss boulders of different varieties, partly outcropping on the slope a small distance off (● near to the climbing stick), (● on the right and left of the person) are erratic tourmaline-granite boulders which the Imja glacier has transported at least 8 km down-valley. Analogue photo M. Kuhle, 22/03/2003.

→ *Photo 93.* From the orographic right valley flank of the Imja Drangka ca. 2.6 km WSW of Pangpoche at 4100 m a.s.l. (Figure 3, Photo 93) facing SSW looking down the Imja Drangka; the summit of Tramserku (No. 36; 6608 m) lies toward SSE. (■ on the left) is the orographic left ground moraine cover reaching up to 4500 m and incised by ravines and gullies since deglaciation up to the present. (■ centre) are deposits of ground moraine preserved on slope flattenings as e.g. slope depressions or niches on a glacialic triangle-shaped slope. They reach up to 4150 m, i.e. 150 m lower than the related High Glacial (Stage 0) glacier trim-line (. . .). (■ on the right) is orographic right, solifluidally dislocated ground moraine mixed with slope debris. Polymictic up to 1.10 m-long angular boulders (○) ‘swim’ in the clayey matrix. It concerns phyllite- and gneiss boulders of different sorts, which partly outcrop on the slope at only a small distance and also above (○ near to the person), (○ in the foreground) is an erratic tourmaline-granite boulder which the Imja glacier has transported over an 8 km-distance down the valley. Due to the steepness, this cover of loose material is only a few metres-thick; gneiss rock already outcrops on the left side of the person. Analogue photo M. Kuhle, 22/03/2003.

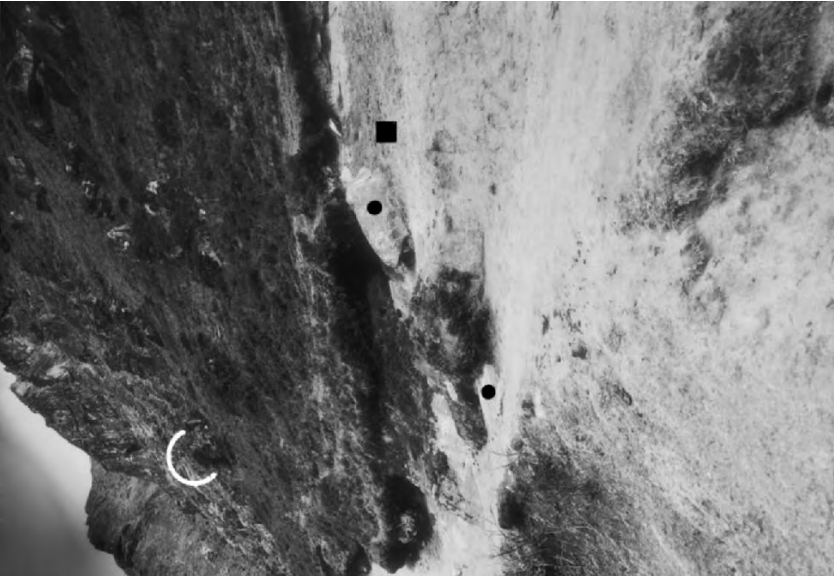






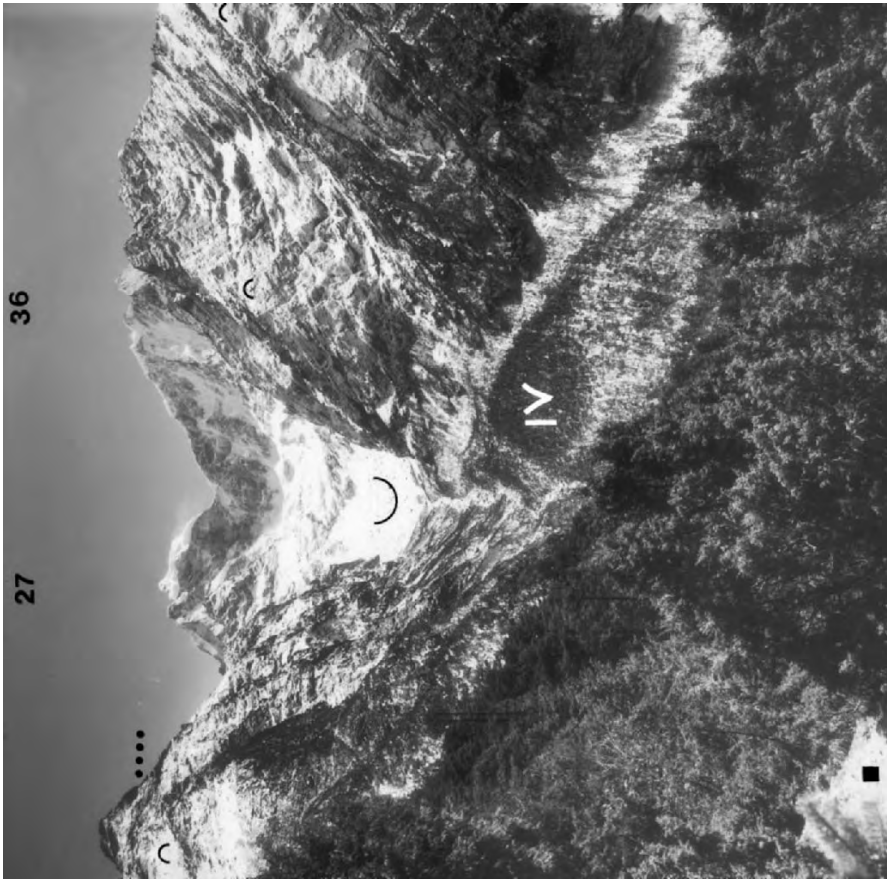
← *Photo 94.* Panorama from the orographic left valley flank of the Imja Drangka SE above the Tengpoche monastery (above III) at 4140 m a.s.l. (Figure 3, Panorama 94) from facing SW (left margin) down the Imja Drangka to Kongde Ri (No. 60, 6187 m) via the inflow of the Ngozumpa Drangka into the Imja Drangka in the NW, the orographic right flank of the Imja Drangka with Taboche (No. 40, 6542 m) facing N, to the Mt. Everest-Lhotse massif (Nos. 1 and 2) up-valley at the valley head in the NE and along the orographic left valley flank looking up-valley on to Amaï Dablang (No. 20, 6856 m). (↓) is the sampling locality of the ground moraine in Figures 49 and 37, No. 27. (■ large) is a ground moraine cover reaching up to 4400–4500 m a.s.l. up the slope (Figure 27 left half of the profile; Photo 95 ■ below No. 27). (■ on the right below No. 60 and left below No. 40) is the corresponding orographic right, in part decametres-thick (■ on the right below No. 60) mantling of the slope by ground moraine reaching up to 4300 m. (○, ●) are orographic right flank abrasions on the gneiss bedrocks in the Ngozumpa- and Imja Drangka. The past upper limits of glacial abrasions and polishings run about 6200 m (... below No. 2), 5300 m (... on the right below No. 40), 4600–4500 m (... on the left below No. 40), 5000–4300 m (... on the right below No. 60) and 4300 m (... on the very left). (○) are cirques and small cirque niches which have been dug in, i.e. which have continued to develop polyglacially during the early and late glacial period. (III) is an end moraine area, which during the Dhampu Stage has been upthrust by the Imja glacier and also by the Phunki glacier which still flows down from Kang Taiga (No. 27) and Tramserku (No. 36) (Figure 3). (II) is the end moraine complex of the Imja glacier near the Khumjung and Namche Bazar settlements (Figure 3) upthrust during the Late Glacial Taglung Stage. Analogue photo M. Kuhle, 15/03/2003.

→ *Photo 96.* Exposure of ground moraine in the orographic left valley flank of the Imja Drangka SE above Tengpoche Gonda (background on the left) at 4000 m a.s.l. (Figure 3, Photo 96); (■) is the sampling locality of sample Figure 51; Figure 37, No. 15; Photo 95↓; (○) is one of the round-edged to rounded erratic tourmaline-granite boulders 'swimming' in the fine material matrix. Several of these boulders are also edged (above ○) and up to 3 m in length. Analogue photo M. Kuhle, 15/03/2003.



← *Photo 95.* Panorama taken from the orographic right valley flank of the Imja Drangka 1.3 km E of the Phortse settlement at 4030 m a.s.l. (Figure 3, Panorama 95) from facing ENE (left margin) to Amaï Dablang (No. 20, 6856 m) via facing SE into the orographic right flank of the Imja Drangka with Kang Taiga (No. 27, 6779 m) and Tramserku (No. 36, 6608 m), via down-valley with Kongde Ri (No. 60, 6187 m) in the SW, via the inflow of the Ngozumpa Drangka into the Imja Drangka in the W as far as into the orographic right flank of the Imja Drangka facing WNW (right margin). (↓) is the sampling locality of the ground moraine sample Figure 51; Figure 37, No. 15; Photo 96 (■). (III) is an end moraine area upthrust by the Imja- and the Phunki glacier during the Dhampu Stage. The latter still flows down from Kang Taiga (No. 27) and Tramserku (No. 36) (Figure 3). (II) is the end moraine complex of the Imja glacier near the Khumjung and Namche Bazar settlements (Figure 3) upthrust during the Late Glacial Taglung Stage. (■) are deposits of ground moraine on the slopes, which in many places have been dislocated solifluidally; partly they are covered by the debris of crumbings. (●● on the right) are two erratic round-edged tourmaline-granite boulders transported down the Imja Drangka over at least 9.5 km. Schist and gneiss outcrop in the underground. (● on the left) is a gneiss boulder which corresponds to the gneiss bedrock here. It has not been transported from far away. Due to its edges, this could be an only small-scale dislocated crumbling. (○, ○) are rock areas of the valley flanks on which glacial flanking abrasions have clearly been preserved since the deglaciation. Thanks to the ground moraine covers and flank abrasions coming to an end in an upward direction, the High Glacial glacier trim-lines have been preserved at 4600–4500 m (... below No. 27), 4300 m (... on the right below No. 36), about 4100 m (Figure 52) up to 4200 m (... on the left below No. 60) and 4300–4500 m (... on the right below No. 60). (○) are cirques and small cirque niches, dug in during the early- and late glacial periods. Analogue photo M. Kuhle, 22/03/2003.

→ *Photo 97.* At 3840 m a.s.l. from the Late Glacial medial moraine slope (■) between Phunki Drangka and Imja Drangka below Tengpoche Gonda (Figure 3, Photo 97) facing SW up the Phunki Drangka looking into the N-exposed valley head with Kang Taiga (No. 27, 6779 m) and Tramserku (No. 36, 6608 m). Since 1982 (see Photo 97 □) the current Phunki glacier ends at 4900 m (above the rocks above ○). (○) marks the trough-shaped valley cross-profile. (IV) is the densely wooded Late Glacial end moraine of this side glacier, which during the Sirkung Stage (Table 1) has been accumulated about 3500–3800 m. (○) are High Glacial (Stage 0) flank abrasions of the Imja Khola main glacier and the joining Phunki side glacier on the outcropping Lower Tibetan granites and gneisses. (...) is the communicating Ice Age glacier level of the main- and side glacier at 4500–4700 m a.s.l. Analogue photo M. Kuhle, 14/03/2003.





↑ *Photo 98.* Panorama taken at 3680 m a.s.l. (Figure 3, Panorama 98) looking from the Late Glacial medial moraine slope (●●) between Phunki Drangka and Imja Drangka below Tengpoche Gonda from facing SE to Kang Taiga (No. 27, 6779 m) and Tramserku (No. 36, 6608 m) up the Phunki Drangka, via facing SW down the Imja Drangka with Kongde Ri (No. 60, 6187 m) up to facing W (right margin), (●●) are round-edged erratic boulders of granite, gneiss, quartzite and metamorphite overlying the outcropping schist in the underground, i.e. in the core of this medial moraine. They are embedded into a fine moraine matrix and reach up to more than 1 m in length (person for scale). (○) is the trough-shaped Phunki Drangka. (IV) is the end moraine of the Phunki glacier of the Sirkung Stage (Table 1) about 3500–3800 m. (II) is the end moraine complex of the Late Glacial Imja glacier of the Taglung Stage (Table 1), on which the Khumjung and Namche Bazar (Nauche) settlements are situated. (○) shows a Late Glacial cirque in a NE-exposition. (■) are covers of ground moraine at different ages which with increasing altitude on the slopes become older and older up to a High Glacial age (Stage 0). So, the ground moraine cover on the orographic right Imja Drangka slope (■ on the right below No. 60) reaches up to 4300 m a.s.l. (Figure 32). (↓) is the subglacial incision of meltwater into the valley ground which has begun in the Late Glacial. It still continues – now subaerially – eroding the ground moraine bed of the Imja Drangka into a V-shape (Figure 32). (○, ○) are flank abrasions on the edges of the banking and strata of grey mica gneisses, which dip at 60° to the E. Their upper limit proves a High Glacial glacier trim-line at 4300–4500 m, still above the uppermost cover of ground moraine (... below No. 36). Further down-valley the glacier levels have run at 4200 and 4100 m (... centre and on the right). Analogue photo M. Kühle, 14/03/2003.



↑ *Photo 99*. Panorama taken at 3665 m a.s.l. (Figure 3, Panorama 99) from the mountain spur between Phunki Drangka and Imja Drangka W below Tengpoche Gonda from looking facing E (left margin) and SE to Kang Taiga (No. 27, 6779 m) and Tramserku (No. 36, 6608 m) up the trough-shaped Phunki Drangka (◡), via facing SW down the Imja Drangka up to facing W (right margin). The spur is mantled with moraine material (● and ◡) and, in addition, with glaciolimnic sands (◻). (● and ◡) are 1.8 and 3.4 m-long (persons for scale) round-edged erratic gneiss boulders overlying the outcropping schist in the underground. Here they lie – obviously having rolled down from the moraine slope, i.e. slightly dislocated – on glaciolimnic sands (◻) (see Photo 100) which have been deposited in a medial moraine lake, i.e. between the orographic right Late Glacial (probably Stage II; Table 1) lateral moraine of the Phunki glacier and the orographic left lateral moraine of the synchronous Imja glacier ca. 300 m above the adjacent valley bottoms. (IV) is the Sirkung-Stage end moraine of the Phunki glacier about 3500–3800 m; (■) are older ground moraine covers on the orographic left slope of the valley (◡, ◡) are glaciogenic flank abrasions preserved in remnantis; partly they are covered by ground moraine up to the polish line (...) at 4300 m (Figure 32). This is verifiable by the development of rills on the upper slope (e.g. on the right below ..., on the left). (◡) is the incision of the Imja river into the ground moraine on the valley bottom of the Imja Drangka. It has started subglacially and continues to develop to the present day (see Photo 102). Analogue photo M. Kühle, 14/03/2003.

→ *Photo 100*. Exposed *in situ*, nearly horizontally layered, and very well-sorted glaciolimnic sands (◻) at 3665 m a.s.l. on the mountain spur mantled with moraine material with, in addition, glaciolimnic sands between Phunki Drangka and Imja Drangka W below Tengpoche Gonda (Figure 3, Photo 100; cf. Photo 99). A plastic disc of 7 cm in diameter on the right of (◻) for comparison. Analogue photo M. Kühle, 14/03/2003.



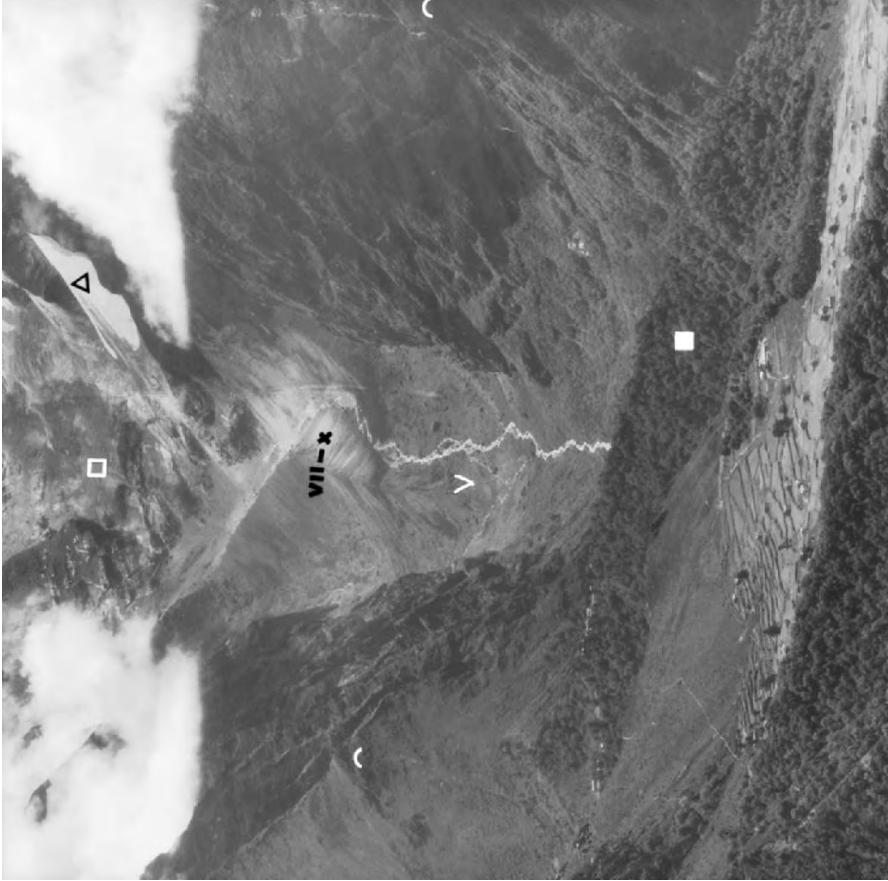


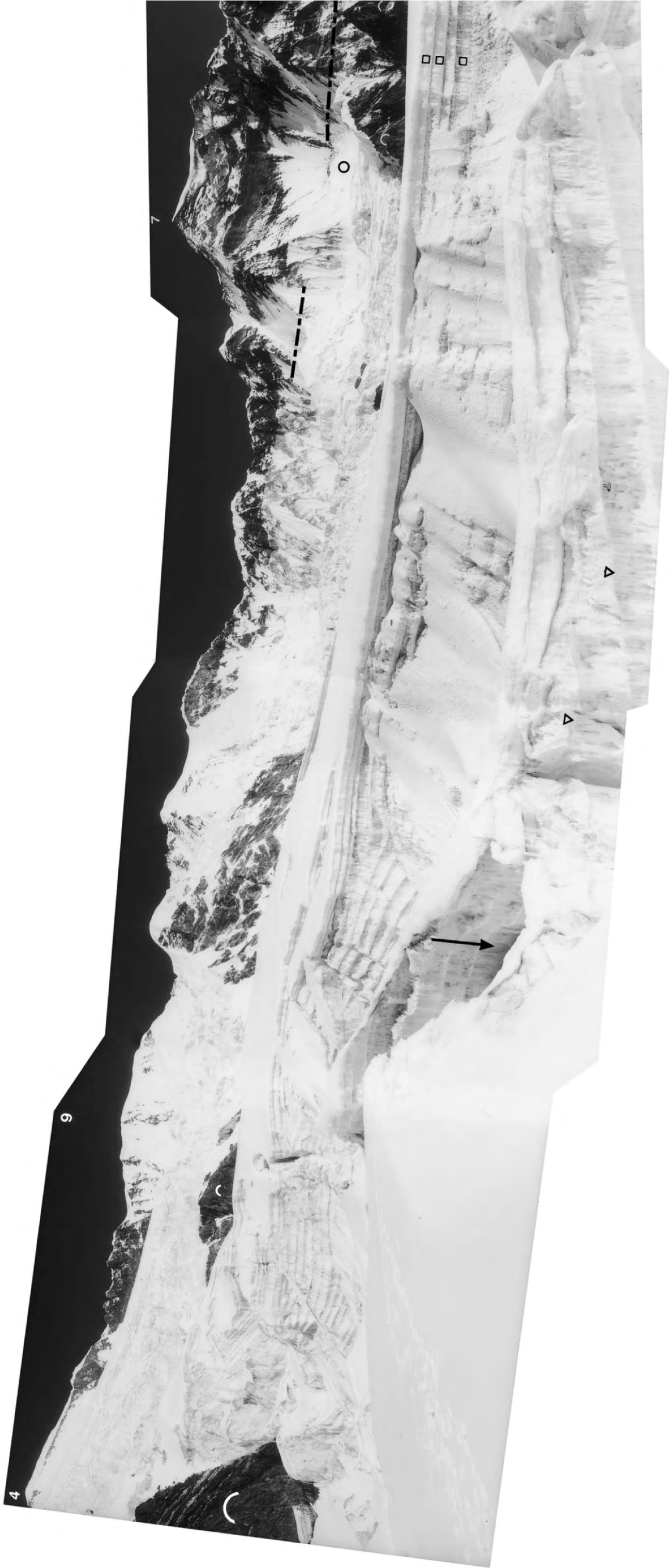
← *Photo 101.* Erratic quartzite-, gneiss- and granite boulders (●) at 3605 m a.s.l. on the moraine-mantled mountain spur between Phunki Drangka and Imja Drangka W of Tengboche Gonda (Figure 3, Photo 101) ca. 250 m above the talwegs of the two valleys. The boulders, some over a metre in length (person for scale) are edged, partly edged and rounded at the edges, as well as more or less round-edged and faceted (●). Rounded boulders only attain the size of a head. This indicates the involvement of glaciofluvial processes in their deposition. (■) are remnants of ground moraines on the orographic left slope of the Imja Drangka. (○ and ○) are glaciogenic abrasions, which on the orographic left side indicate the High Glacial (Stage 0) glacier trim-line (...) at ca. 4300 m (Figure 32). (▼) is the subglacially started and now suberially continued fluvial incision of the Imja river into the ground moraine of the Imja Drangka near to the talweg (see Photo 102). Analogue photo M. Kuhle, 14/03/2003.

→ *Photo 103.* Taken at 4070 m a.s.l. looking from NW above the Dole settlement from the Ngozumpa Drangka (Figure 3, Photo 103) facing SE via the Phortse settlement and the Imja Drangka (■) up to the Phunki Drangka. (□) is the broken-off end of the Phunki glacier tongue covered with a thin layer of surface moraine. Currently it still ends in this position at 4900 m a.s.l. (March 2003; Photo 97). (△) is one of the ice- and snow avalanche cones which at the valley head from the flanks of Kang Taiga (No. 27) and in this case Tramskerku (No. 36) – partly support the feeding of the Phunki glacier. (VII-X) is an orographic right lateral- to end moraine wall about 4600 m built-up during the historical advances of the Phunki glacier from the younger Dhaulagiri Stage (VII; cf. Table 1) up to Stage X ('Little Ice Age'). The moraine wall of Stage V reaches down to 4300 (V). This yields an ELA-depression of ca. 300 m for the neoglacial Nauri Stage V. (○) are glaciogenic flank abrasions on the mountain spurs in the area where the Phunki Drangka flows into the main valley, the Imja Kholu. (■) is the medial moraine ridge built up between the Imja- and Phunki glaciers of the Late Glacial Taglung Stage II. Tengpoche Gonda is situated upon it (on the left of ■). The Imja glacier has reached up to this moraine wall during the Dhampu Stage III, so that now it has become an end moraine. Analogue photo M. Kuhle, 08/09/1982.



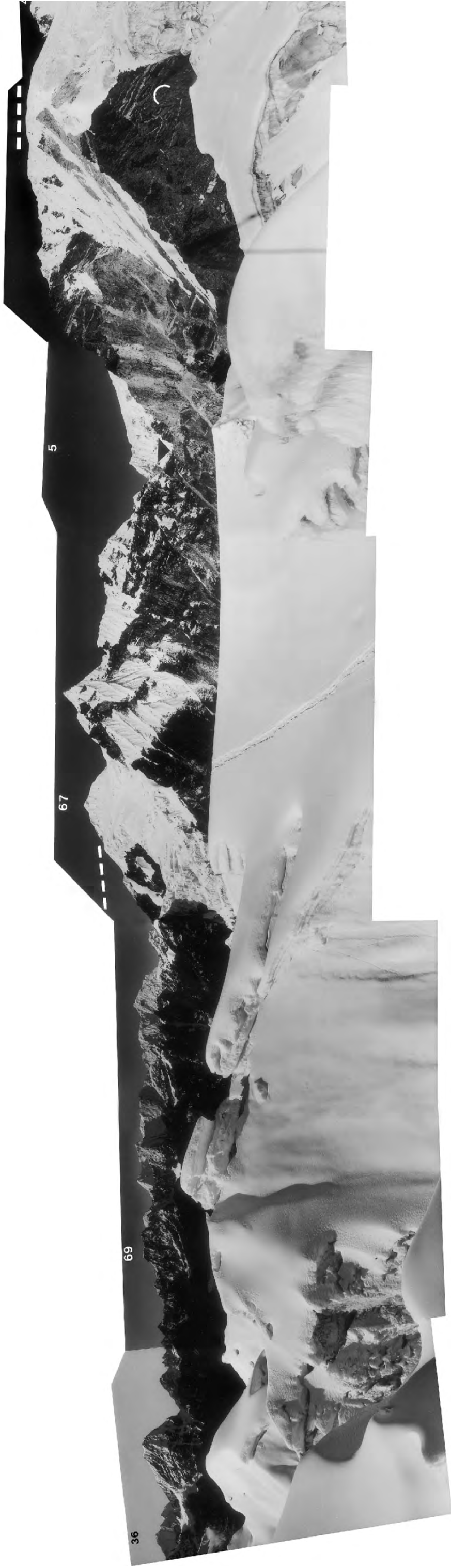
← *Photo 102.* Taken at 3250 m a.s.l. near the Phunki settlement looking down the talweg of the Imja Drangka somewhat above the junction with the Phunki Drangka facing SW (Figure 3, Photo 102). Erratic quartz-, gneiss- and granite boulders (●,○) have accumulated near to the talweg. The Imja river has flushed them out from the ground moraine, then re-arranged and re – sedimentated several times in the form of glaciofluvial deposits (□) and newly flushed free. Due to their rounded, soft form the secondary fluvial reworking of some of these 8 m-long moraine boulders can clearly be recognized (○); others have better preserved the primary edged form of a moraine boulder (●). The glaciofluvial material (□) can also be diagnosed by its matrix changed into coarse grains. It has lost most of the clay portion by flushing out. Analogue photo M. Kuhle, 7/11/1982.



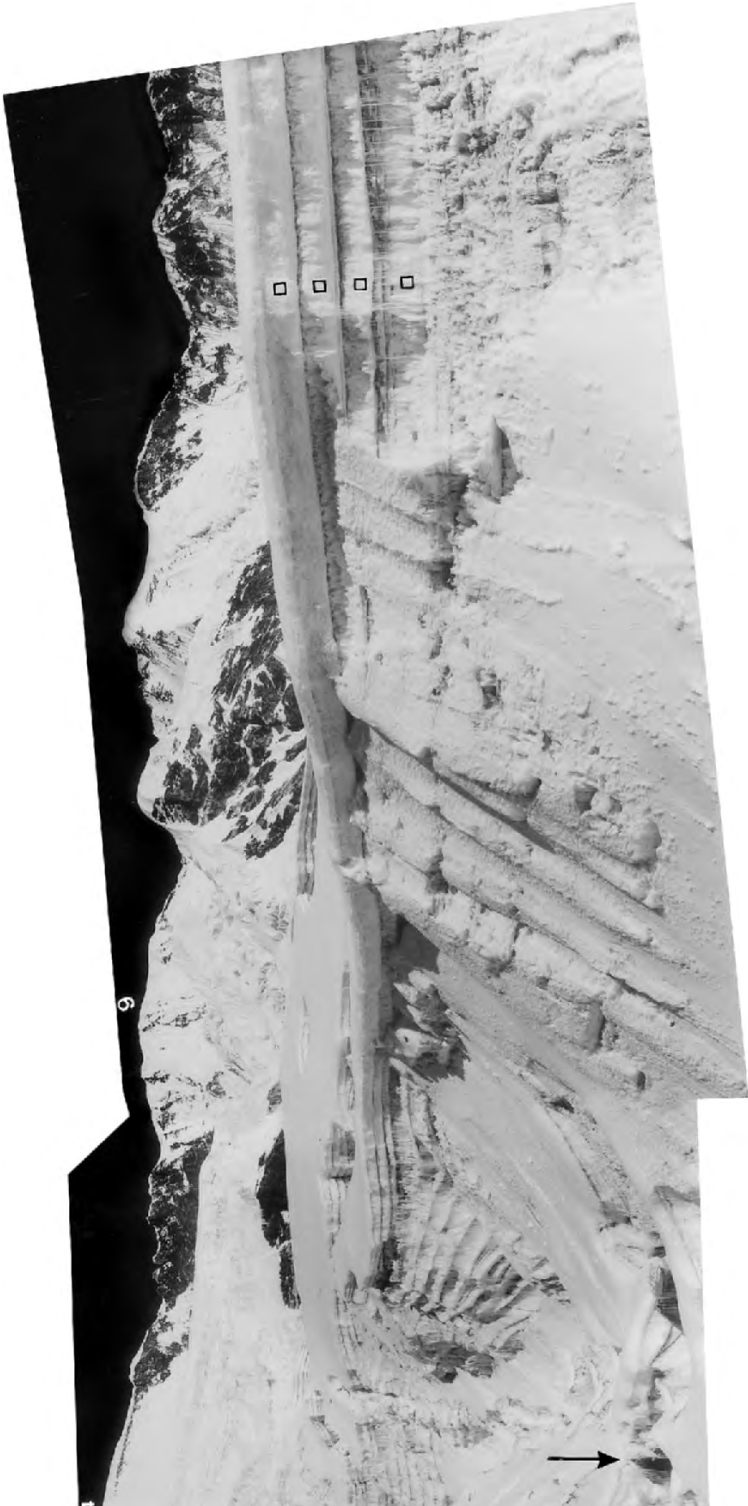


↑ *Photo 106.* Panorama taken at 5850 m a.s.l. from the feeding area of the Ngozumpa glacier between the Lungsampa locality (↷ below No. 4) and Nup La (No. 63) (Figure 3, Panorama 106) from facing W with the 8202 m-high Cho Oyu (No. 4), via the 7806 m-high Ngozumpa Kang (No. 9) in the NW and the 7922 m-high Gyachung Kang (No. 7) in the NNE, via facing ENE to the 6845 m-peak (No. 66) and the 5985 m-high contemporary transfluence pass of the Ngozumpa glacier to the E-adjacent West Rongbuk glacier (No. 63) up to facing ESE to the 7020 m-peak (No. 15). Decametre-thick balconies hang in its S-wall. In this glacier feeding area extending over ca. 36 km², the nourishing of the ca. 21 km-long Ngozumpa glacier mainly takes place by primary snowfall, so that the ‘alpine firm field glacier’ type is concerned (Kuhle 1988f). Owing to this, the annual firm- and firm-ice layers lie horizontally untilted (□) as far down as the ice fall. The 600–1500 m-high steep flanks of Cho Oyu, Ngozumpa Kang and Gyachung Kang (Nos. 4, 9, 7) fringing this firm field, provide its nourishing by avalanches, which amounts to ca. 25% of the total glacier nourishment. The Tertiary source-depression of the valley below Gyachung Kang (○) forms an avalanche cauldron. Down-valley, i.e. below the plane face of the firm field (□), the glacier is torn into transverse crevasses (↵) up to decametre-depths, caused by an abrupt increase in slope. Due to the strongest flow on the glacier’s surface, they show V-shaped cross-profiles. On the surfaces of the firm ice layers on the walls of the crevasses, metre-long icicles (▽) develop by melting ablation during the day. They occur at or 150 m below the local level of the snow-line (ELA = 6000 m a.s.l., Table 3 at the end), (↷) are remnants of glacially shaped rock slopes (Figure 3 below No. 7 and on the left of Panorama 106). As to the current nourishing area, they prove a glacier level which has only been heightened by 300–400 m (---) during the Ice Age. Heavy frost weathering at the black–white line between the white glacier and the dark rock has roughened them since the decrease of the glacier level. Between the summit of Ngozumpa Kang (below No. 9) and that of Gyachung Kang (below No. 7) the light massive tourmaline granites are exposed in the underlying and the horizontally stratified igneous and para-igneous rocks in the hanging layer. They have mainly been developed during the Tertiary (Nepal Geological Map 1985, Sheet No. 71L–D). Analogue photo M. Kuhle, 3/10/1982.

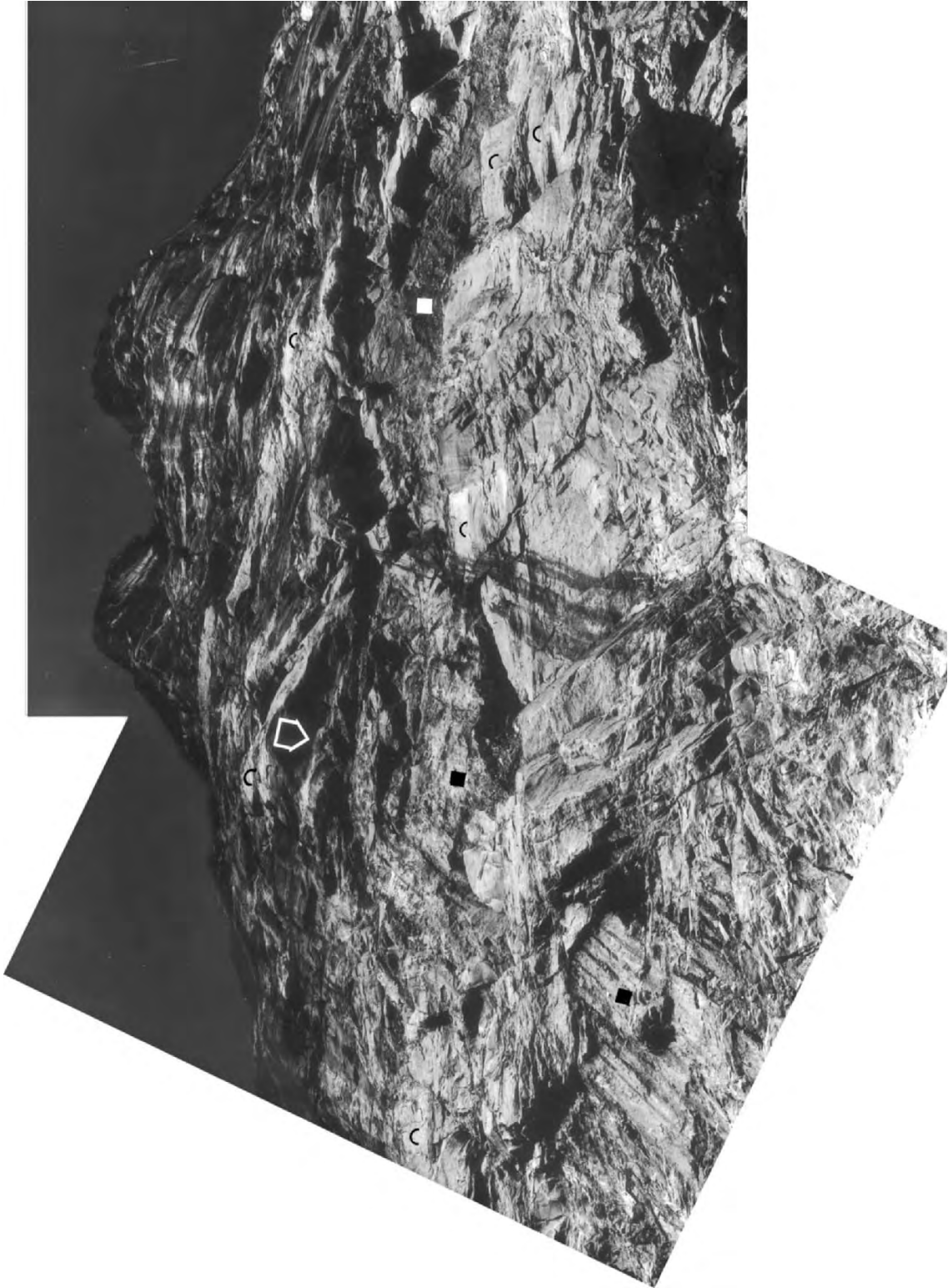




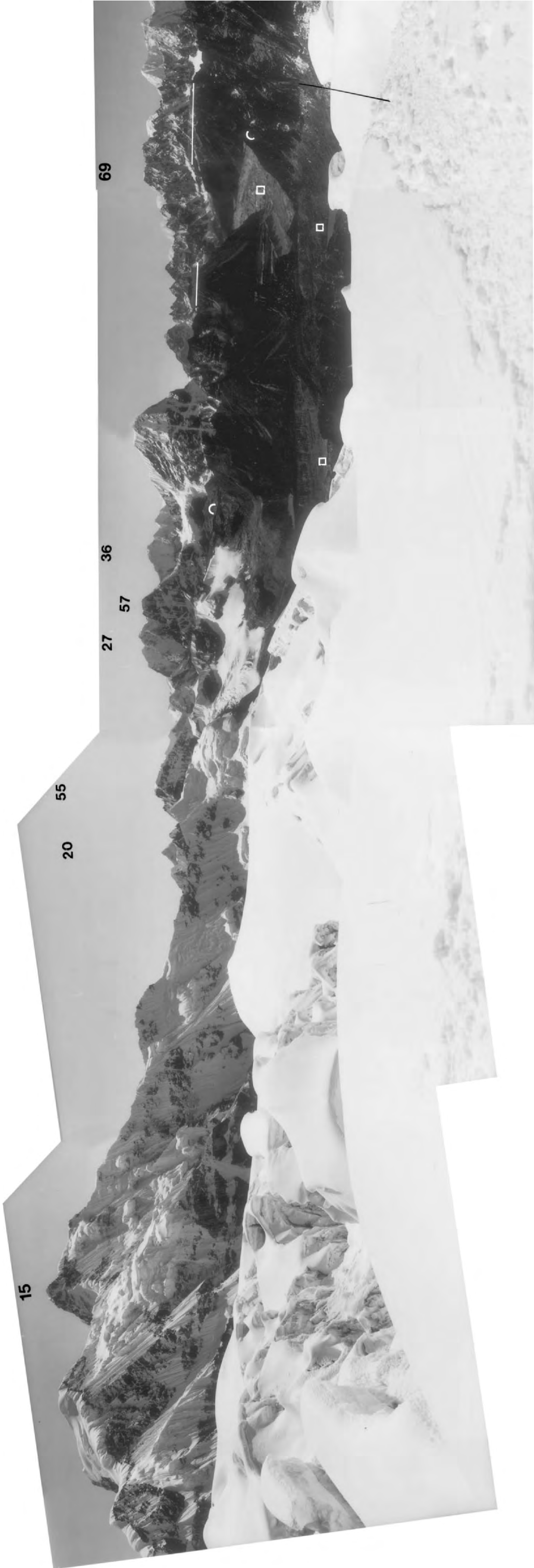
← *Photo 109.* From the orographic right margin of the upper Ngozumpa glacier at 5700 m a.s.l., E below the Lungsampa crest (Figure 3, Photo 109), facing SW looking into the ablation gorge (▼) between the glacier (□) and the rock wall (○). Even at historical times (Stages VII–XI, Table 1) the Paleozoic to Mesozoic gneisses of the metamorphic Tibetan Series (6a after Nepal Geological Map 1985, Sheet No. 71L-D) outcropping there, have still been polished by the glacier. Frost weathering on the black–white limit was able to roughen their polish faces within several decades up to at most a few centuries; the lack of black marking by water-stripes and lichens on the rock argues in favour of a few decades. (△) is a current ice avalanche- and debris cone the core of which contains grèzes litée and regenerated glacier ice. Analogue photo M. Kuhle, 3/10/1982.



← *Photo 107.* Panorama of the nourishing area of the Ngozumpa glacier at 5850 m a.s.l. between the Lungsampa locality (∩ half-left below No. 4) and the 7020 m-peak (No. 15) (Figure 3 Panorama 107) from facing ESE (left margin) via facing SE with the summits of Amai Dablang (No. 20, 6856 m) and the 6145 m-peak (No. 55) and SSE with Kang Taiga (No. 27, 6779 m), Kangchung (No. 57, 6103 m) and Tramserku (No. 36, 6608 m), via facing SSW, looking down the Ngozumpa glacier, with the 6073 m-high Pa Ri (No. 69), facing SW to the 6066 m-peak on the Lungsampa crest (No. 67), across the summit-crest of the 7352 m-high Nangpai Gosum (No. 5) in the W, the 8202 m-high Cho Oyu (No. 4) in the WNW and Ngozumpa Kang (No. 9, 7806 m) in the NNW, up the Ngozumpa glacier, up to facing NNE (right margin) looking across the crest of the Tibetan border, which leads to Gyachung Kang. The viewpoint is in the area up to ca. 150 m below the local glacier snow-line (cf. Table 3 totally below) at the transition of the extended firm-field of the Ngozumpa glacier (from No. 4 up to the right margin) with an approximately horizontal bedding of the firm layers (□) and the steep slope of the gradient curve of the valley, where the 15 km-long Ngozumpa glacier tongue sets in with an ice fall and decametre-deep transverse crevasses (∩). However, the ice discharge in the glacier cross-profile is so heterogeneous that longitudinal crevasses (e.g. on the left of ∩) have also been developed, which, together with the transverse crevasses, separate the ice fall into seracs, i.e. isolated towers of ice (below Nos. 15–36). The ice balconies on the steep walls above 6500 m a.s.l. (e.g. on the right below Nos. 15 and 5) prove that cold ice is concerned (average annual value = colder than −6 °C). The monsoonal precipitation of fog can be diagnosed by the development of fluting ice (e.g. on the right below No. 67 and on the right of No. 36). The 1–2 m-thick firm ice layers (□) are interrupted by annual dirt overlays, mainly arising during the winter between November and February; metre-long icicles, created by daily melting ablation, hang at their surface edges which have been condensed through metamorphism by melting. (---) is the highest verifiable glacier level of the last glacial period, here falling away from ca. 6200 m (--- on the right) to 6000 m (---) (Figure 28). Only some summits (No. 67) of the Lungsampa crest have towered above the glacier trim-line. (▼) is one of those intermediate notches overflowed on a small scale by the past glacier surface situated above (Figure 3 on the left of Photo 110). (∩) shows a glaciogenically triangular-shaped face roughened by frost weathering since deglaciation (Figure 3 above Photo 109). Analogue photo M. Kuhle, 3/10/1982.



→ *Photo 110.* From the orographic right margin of the upper Ngozumpa glacier at 5520 m a.s.l. E below the Lungsampa crest (Figure 3, Photo 110) facing W looking into the gneiss wall (∩), which in the past has been polished by the Ngozumpa glacier. Paleozoic and Mesozoic gneisses of the metamorphic Tibetan Series (6a after Nepal Geological Map 1985, Sheet No. 71L-D) outcrop there. Until as late as historical time (Stages VII–XI, Table 1) the glacier was attached up to (■ white). It has polished the rocks (∩ black below ■ white) and levelled-out the niches with ground moraine (■). There are many rock crumblyings at this level (∩). They are due to undercutting by the historic glacier margin. In the Neoglacial (Stages V–VII) the rock wall has been polished by the glacier up to ca. (∩ above ∩). For the last time the rock alignments above up to the crest have been polished during the Late Glacial (Stages I–IV). The state of preservation of the Neoglacial to Late Glacial polishings is strikingly homogeneous; in contrast, the youngest polishings near to the current glacier in the lower wall section, are small-scale heterogeneous. Analogue photo M. Kuhle, 1/10/1982.



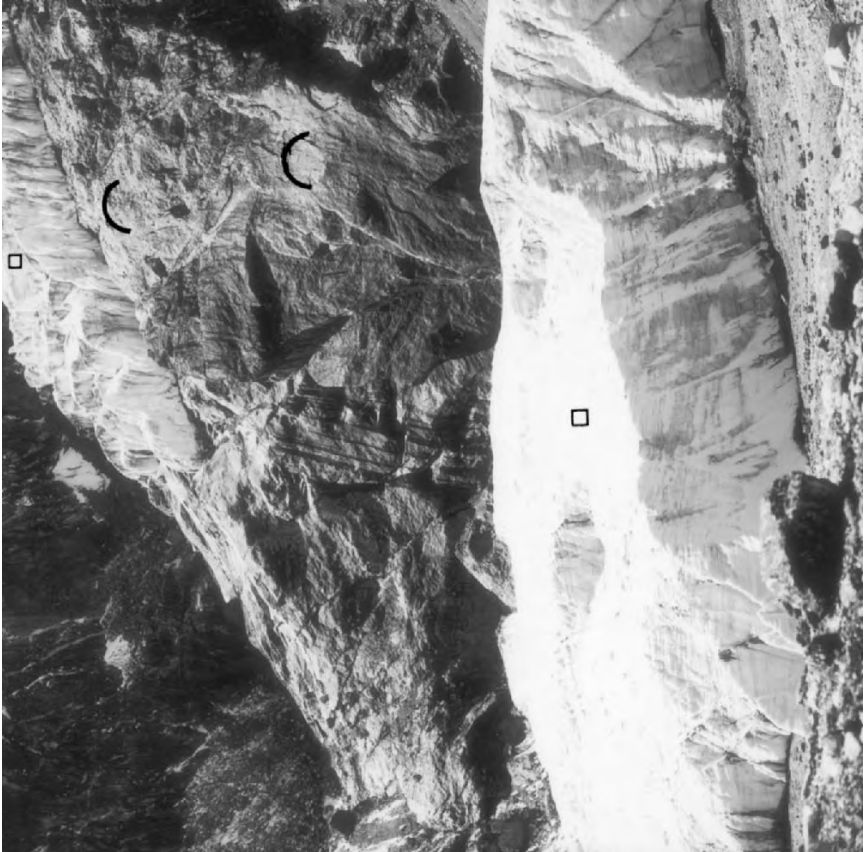
† *Photo 108*. Panorama at 5830 m a.s.l. from the nourishing area of the Ngozumpa glacier between the Lungsampa locality (right margin) and the 7020 m-peak (No. 15) (Figure 3. Panorama 108) from facing ESE (left margin) via facing SE with the summits of Amaï Dablang (No. 20, 6856 m) and the 6145 m-peak (No. 55), to SSE with Kang Taïga (No. 27, 6779 m), Kangchung (No. 36, 6608 m), via facing SSW, looking down the Ngozumpa glacier, with the 6073 m-high Pa Ri (No. 69), and facing SW to the 6066 m-high peak (No. 67) on the Lungsampa crest, across the summit crest of the 7352 m-high Nangpai Gosum (No. 5) up to the root of the Lungsampa crest in the WNW (right margin). Transverse- and longitudinal crevasses and ice towers situated in between subdivide the glacier surface (below ◡ large and below small on the left below No. 67). (◡ on the left and ◻ large) mark the 15 km-long tongue of the Ngozumpa glacier covered with surface moraine, the level of which has melted down by several decametres against the ridges of the attached lateral moraines. (◡) are remnants of glacialenic flank polishing (Figure 3 on the left below Photo 110) mediating up to the High Glacial glacier level at 6200 m (--- white) and 6000 m (--- black) (Figure 28). (◡) is a ca. 5950 m-high notch; as that glacier surface has towered at least 150 m above, it must have been overflowed by the ice (Figure 3 on the left of Photo 110). (◡) is a 5600 m-high rock crest of the Gyuba Tshomoche locality overflowed by the Ice Age glacier. The glacier trim-line has run about 5900 m (Figure 29) and down-valley has fallen away via 5800 m (___ on the left) to 5750–5700 m a.s.l. (___ on the right). (◻ small, centre) is the tongue basin lake of the Lungsampa 6066 m-peak E-glacier (S-glacier tongue) about 5380 m a.s.l., which during Stages ‘VII–VIII (Tables 1 and 3; Figure 19) has still been filled with the end of the glacier. (◡) is a cirque-like form into which a Late Glacial triangular glacier lobe has flowed down from the Lungsampa crest (Figure 3 on the left of Photo 109). (◻) shows post-glacial weathering detritus superimposed upon a glacialenically triangle-shaped slope (Figure 3 above Photo 109). (△) are Holocene to contemporary debris cones, which, since the Late Glacial deglaciation of the rock wall above, have been built up by rock fall of crumblings (Figure 3 half-left below Photo 110). Analogue photo M. Kuhle, 3/10/1982.



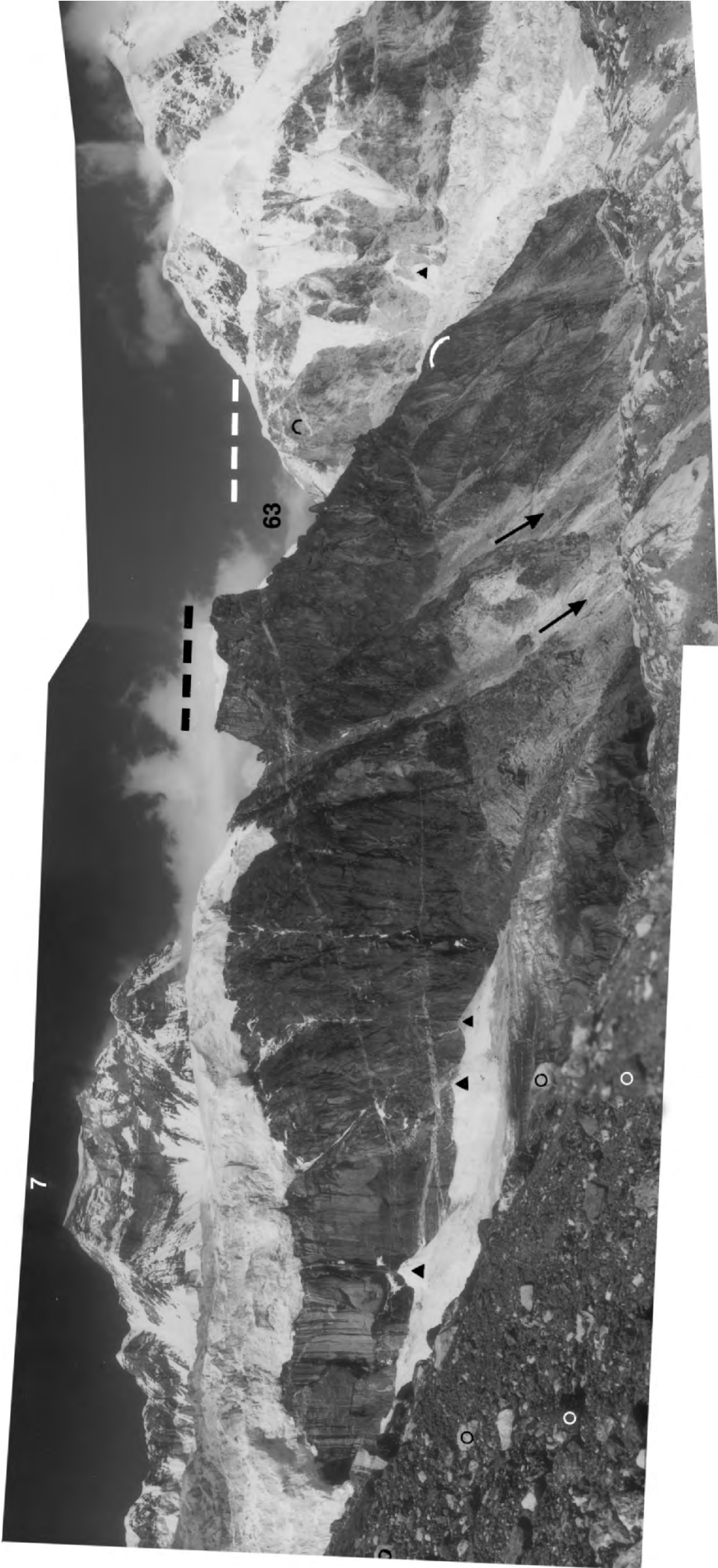


† *Photo 111.* Panorama from the foot of the E-flank of the 6066 m-peak (No. 67) at 5420 m a.s.l. (Figure 3, Panorama 111) from facing SSW (left margin) via facing WNW (No. 67) and NW to the summit of Cho Oyu (No. 4, 8205 m), via facing NNW to the 7806 m-high Ngozumpa Kang (No. 9) up to the W-crest of Gyachung Kang (No. 9) to the NNE (right margin, background). (□) is the orographic right lateral moraine of the upper Ngozumpa glacier, flowing down from its firn field (Photo 106) with an ice fall and glacier outburst. Currently avalanche- (Δ below No. 9) and debris cones of rock crumbings (▼) are heaped up against this right margin of the parent glacier. The Historical to Neoglacial (from Stage XI back to V; Table 1) lateral erosion of the Ngozumpa glacier has concavely cut the older, High- to Late Glacial (Stages 0–IV) convexly rounded flank polishing (○ below No. 4), so that, due to this over-steepening of the wall, crumbings (♂) have occurred (Figure 3, half-right above No. 67), (○) are further examples of the past flank polishing mediating up to an ice-level about 6000 m a.s.l. (---). The rock pinnacles below (on the left below ----) form a crest which – at a dropped ice-level during the Late Glacial – has been sharpened like a glacial horn. The avalanche- and debris cones (the two Δ on the left) testify to a further shaping of ravines between the pinnacles since deglaciation. The ice-fall is partly separated by a rock step rising toward the E, so that at its foot ice avalanche cones (Δ on the right) merge into a continuation of the Ngozumpa glacier. Since 1950 the steep hanging glacier below No. 67, the Lungsampa 6066 m-peak east glacier (south glacier tongue), has melted back from the moraines (■ XII) (cf. Khumbu Himal: 1:50,000, 1978), at the same time leaving behind a dead ice block (●) (Photo 112). The other steep hanging glacier tongue (below No. 4), the Lungsampa 6066 m-peak east glacier (north glacier tongue), flows into the Ngozumpa main glacier. The medial moraine complex between this hanging glacier and the Ngozumpa glacier contains erratic tourmaline-granite boulders (○) from the Himalaya main crest (background on the right) between Ngozumpa Kang (No. 9) and Gyachung Kang which have frequently been removed. Therefore they show a compact, round-edged or faceted form. Analogue photo M. Kuhle, 2/10/1982.

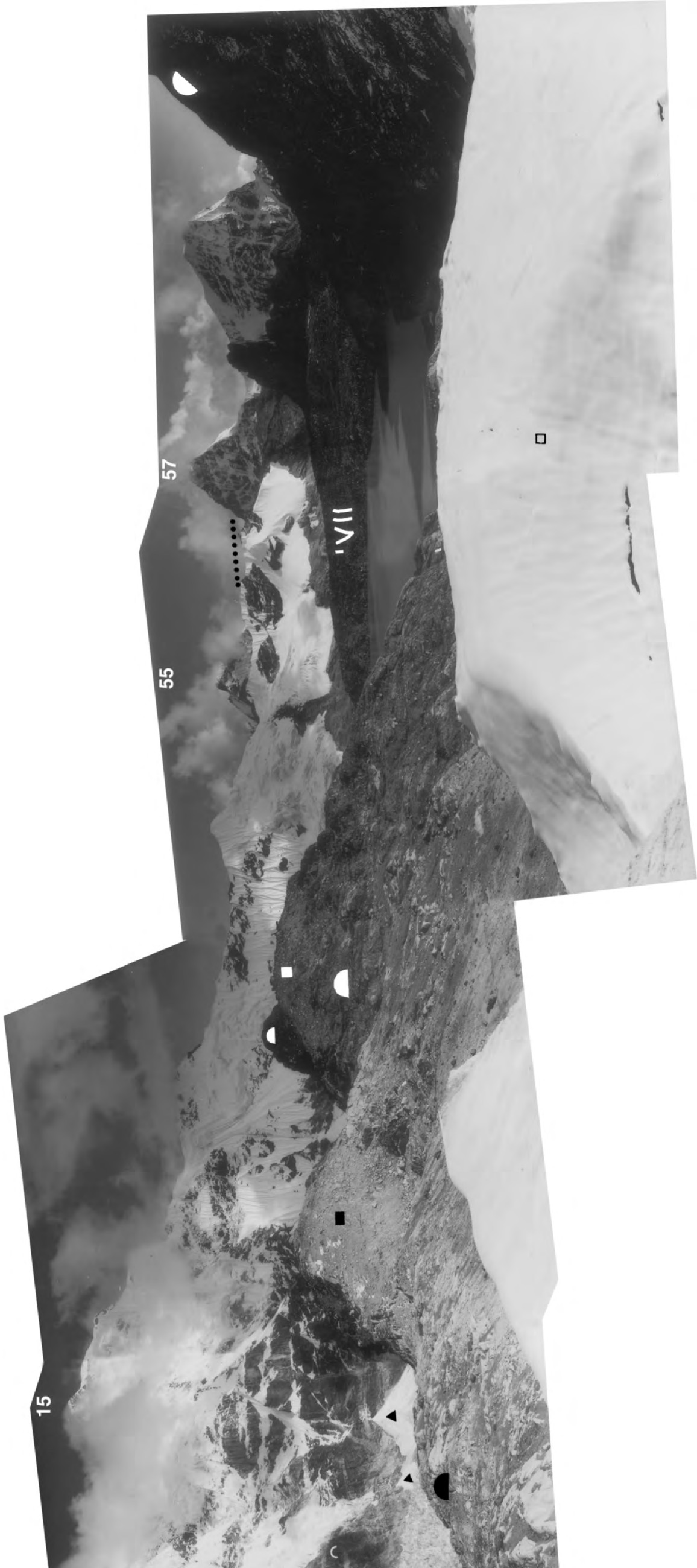


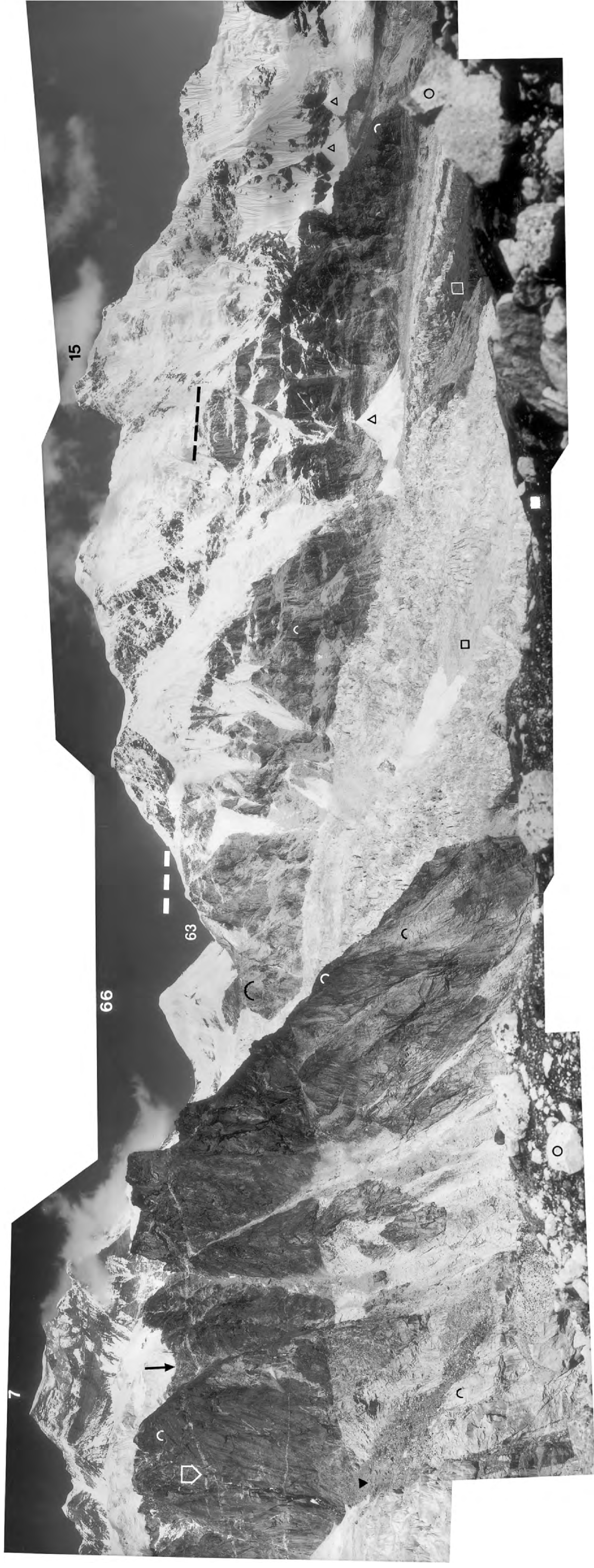


↑ *Photo 112.* Picture taken from above the orographic right margin of the upper Ngozumpa glacier at 5420 m a.s.l., E below the Lungsampa crest (Figure 3, Photo 112) facing W to the active tongue-end of the Lungsampa 6066 m-peak east glacier (south glacier tongue) (□ above) reaching down to ca. 5500 m. At the time of the exposure it was in the process of melting back. (□ below) is a 17 m-thick dead ice block which before 1982, i.e. before this picture was taken, still belonged to this hanging glacier. In comparison with the Khumbu Himal map 1:50,000 (1978), established between 1955 and 1963, it is evident that at that time the glacier tongue still flowed down to 5400 m a.s.l. into the tongue basin in the foreground, i.e. that the dead ice block was still integrated. The older historical positions of this glacier are shown in Figure 3 and Table 3. (∩) are the here very massive gneiss rocks exposed since 1955–1963, which show a glaciogenic rounding but at the same time seem to be strikingly roughened by extended plate-like exarations, detractions and splintered crumbings. Analogue photo M. Kuhle, 2/10/1982.

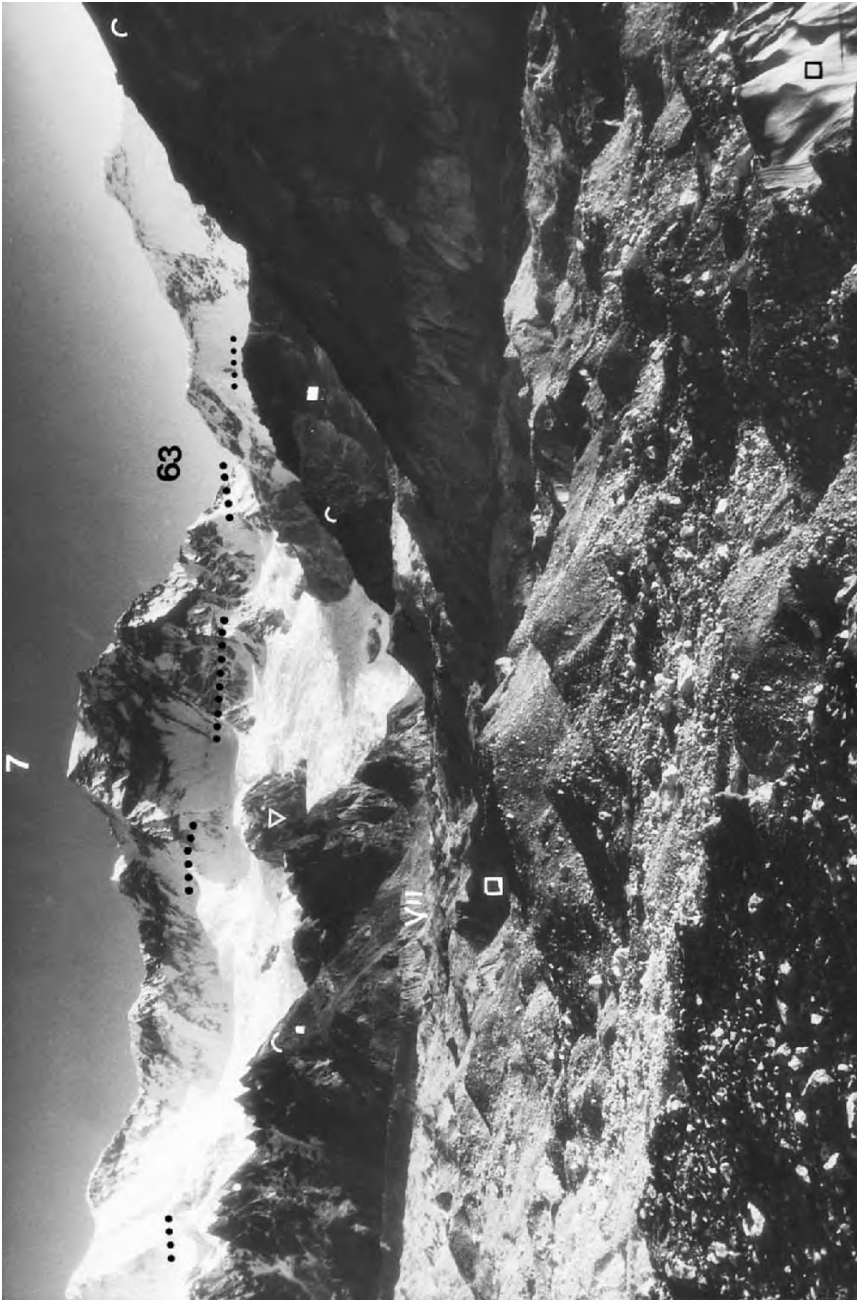


↑ *Photo 113.* Panorama from the foot of the E-flank of the 6066 m-peak (No. 67) at 5430 m a.s.l. (Figure 3, Panorama 112) from facing NNE (left margin) with the 7922 m-high Gyachung Kang (No. 7) and ENE to the nearly 6000 m-high Nup La area (No. 63), via facing E to the massif of the 7020 m-peak (No. 15), via facing SE with the 6145 m-peak (No. 55) and SSE with the 6103 m-high Kangchung (No. 57) with its 6098 m-high W-summit (on the right of No. 57) up to facing S (right margin). In the foreground is the dead ice block (□) covered with fresh snow, situated in the tongue basin of the Lungsampa 6066 m-peak east glacier (south glacier tongue) (cf. Photo 112); down-valley, in the older neoglacial tongue basin, lies the moraine lake (Kyajumba Tso), dammed up by the end moraines of the middle Dhaulagiri Stage (VII) (Table 1; Figures 3 and 19). (●) is the orographic right flank polishing created by the still older, Late- to High Glacial glacier cover (Stages IV–0). (▲) marks a glaciogenic polish threshold between the valley of the Lungsampa 6066 m-peak east glacier (south glacier tongue) and the Ngozumpa main glacier (▲); it is divided into roches moutonnées (▲ white and ▲ above) (Figure 3, Photo 113) and covered by a moraine veil (■) with a thickness of a few metres at maximum. This is made up of round-edged and faceted polymictic boulders (○) which can in part be evidenced as being erratic. In this uppermost section below the snow-line (ELA) the Ngozumpa main glacier is additionally nourished by ice avalanches. They develop ice debris cones on the marginal glacier surface (▲). (∩) are gullies of rock fall which, just as the tracks of the ice avalanches, cut the glaciogenic flank abrasions perpendicularly and, orientated according to the petrographic lines of discontinuity, destroy them. (○ and ○) are preserved remnants of those flank abrasions. (--- and ---) is the High Glacial glacier trim-line reconstructed with the help of adjacent upper limits of flank abrasion. It has run at at least 6200 m a.s.l. in the Ngozumpa valley, down-valley of Nup La (No. 63) (---) and about 5900 m at the Gyuba Tschomoche-ridge (...) (Figure 29). Analogue photo M. Kuhle, 2/10/1982.





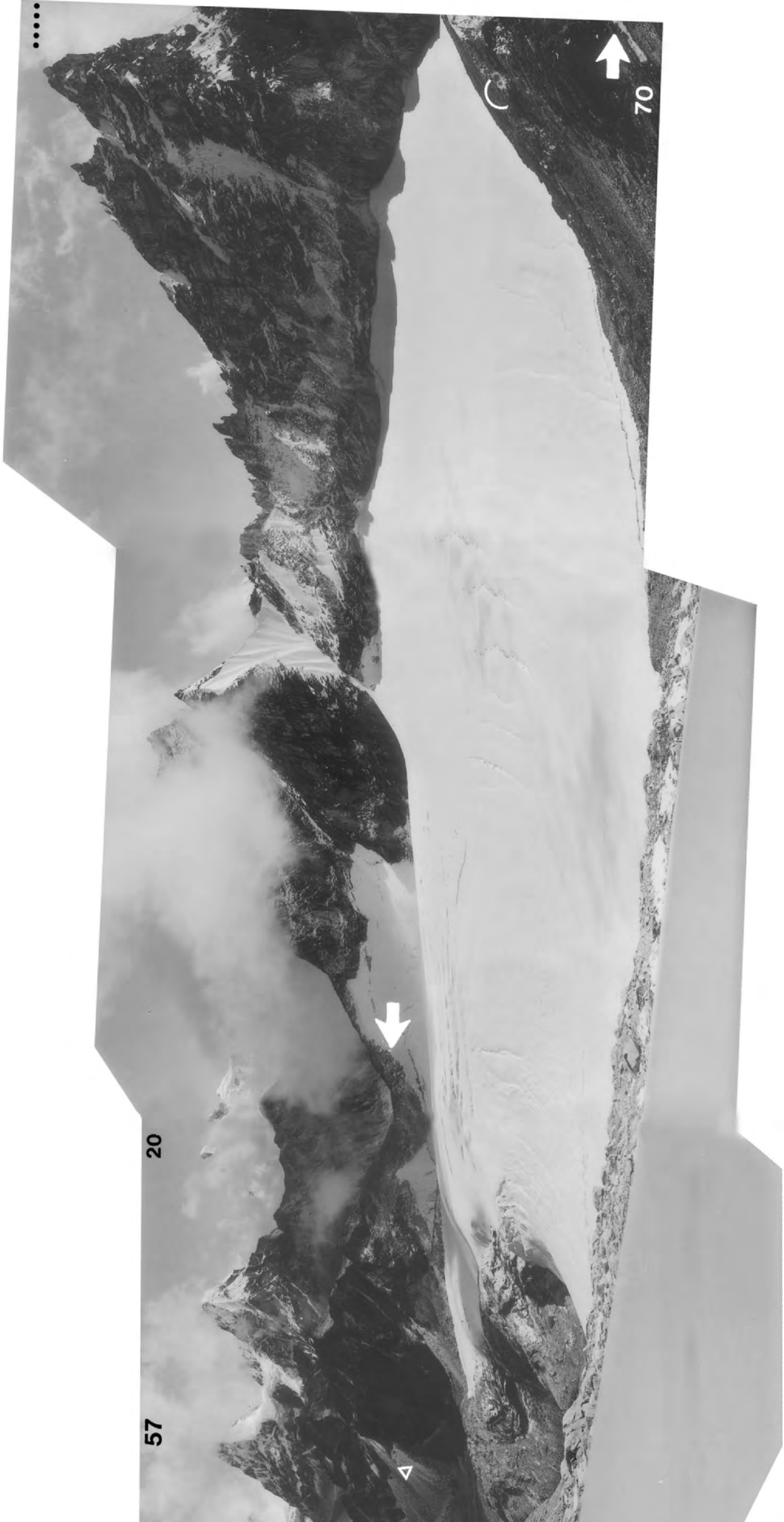
† *Photo 1/14*. Panorama from the hanging valley at the foot of the E-flank of the 6066 m-peak (No. 67) at 5420 m a.s.l. (Figure 3, Panorama 1/14) from facing ENE (left margin) via the 7922 m-high Gyachung Kang (No. 7), the completely névé-covered summit of the 6845 m-peak (No. 66) in the NE and the 5985 or 5860 m-high Nup La (No. 63), mediating to Tibet, on the right side below, via facing E to the 7020 m-peak (No. 15), up to facing ESE (right margin). Here, in the extended confluence area of the upper Ngozumpa glacier (□) (Figure 3), the Ice Age glacier ice has accumulated up to an altitude of at least 6000 (— black) to 6200 m a.s.l. (--- white), as is evidenced by the forms of flank abrasion (○ and ◌). As a function of the currently, i.e. interglacially decreased ice level (□), the past flank polishings have been crossed through, gradually reworked and finally destroyed by hanging glaciers reaching down approximately 1000 m lower, tracks of ice avalanches (e.g. below the breakage of the glacier 4) coming to an end on cones of ice debris (△), and tracks of rock fall (♢) accumulating the rock debris cones (e.g. ▼) on the contemporary glacier surface. (□ black) is the ice surface which just 1000 m below the current orographic snow-line shows a grey colour due to ablation by evaporation and melting. (□ white) is the inner moraine melting out to surface moraine. Avalanches and rock falls (see above) supply its debris. The nearly horizontal rock limit (on the right of ▼) runs between the Lower Tibetan gneiss (6b) and the Upper Tibetan gneiss (6a). (■) is ground moraine with polymict dark boulders of schist and gneiss and light – here erratic – tourmaline granite. It lies 270 m above the glacier surface (□). Analogue photo M. Kuhle, 2/10/1982.

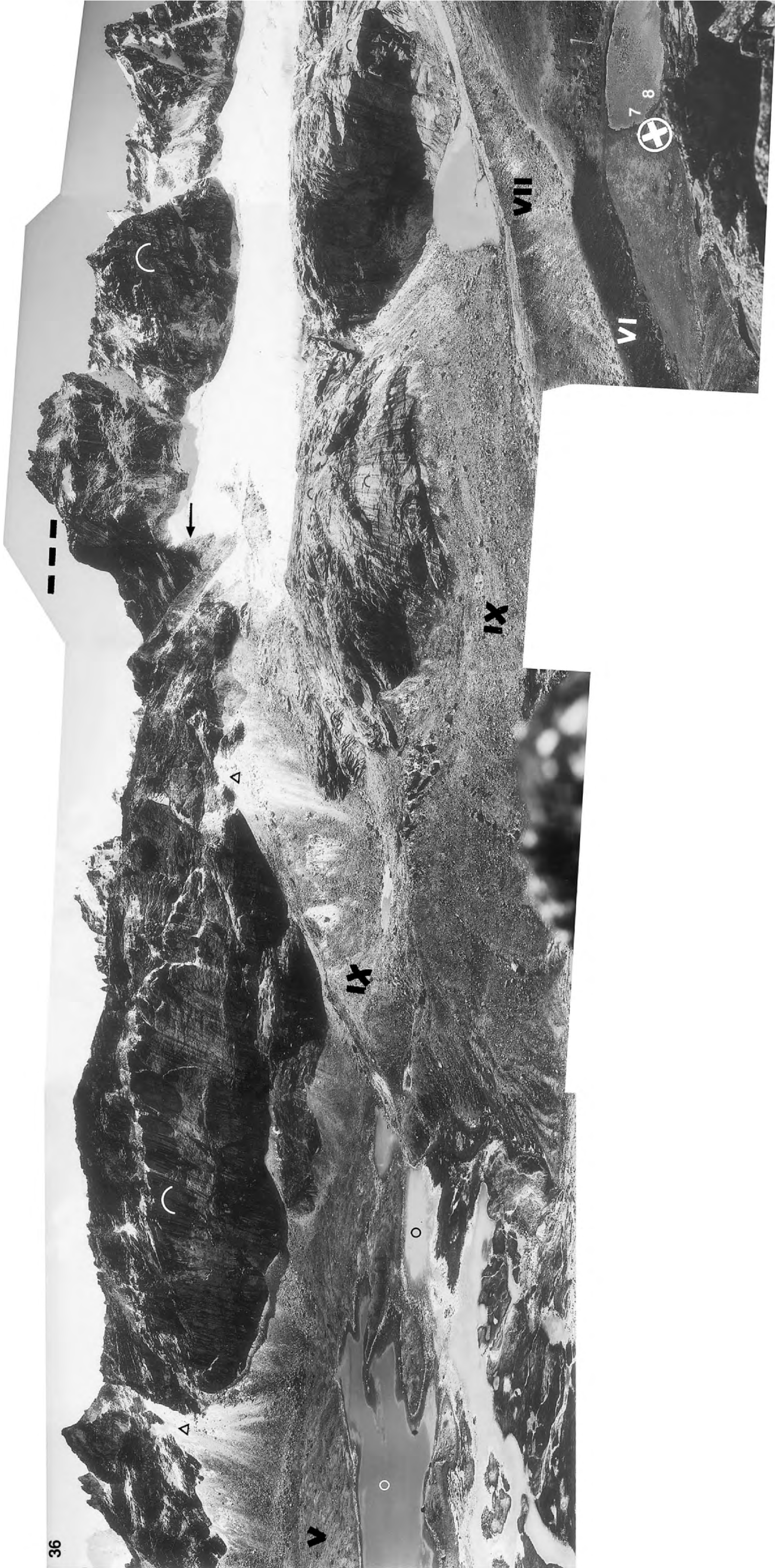


← *Photo 115.* Picture from the surface moraine (□ white) of the Ngozumpa glacier at 5020 m a.s.l. E of the Kendezhung locality (Figure 3, Photo 115) facing NNE looking up the Ngozumpa glacier on to the 7922 m-high Gyachung Kang (No. 7). The crest, towards the W generally far in excess of 7000 m-high, continues on the left side with its up to 7646 m-high summits (background, left margin). On the right, i.e. toward the E, the saddle of the 5985 or 5860 m-high Nup La (pass, No. 63) mediating to Tibet, is located; the snow crest on the right of No. 63 leads up to the 7020 m-peak (No. 15, not visible). The lateral moraine of the oldest historical Stage VII, i.e. the ‘younger Dhaulagiri Stage’ (Table 1, Figure 19) (VII), is attached to the Ngozumpa glacier (□ black is the sheer ice below the surface moraine) which below ca. 5050 m (Ngozumpa glacier tributary stream) up to 5250 m (Lungsampa tributary stream) is completely covered with surface moraine (□). Above, only sporadic remnants of Late- to High Glacial sheets of ground moraine (■) lie on the bedrocks of the steep valley flanks. Again further above, glacialic flank abrasions have been preserved (○ and ○); (○) is situated on a polished-back truncated spur. This flank polishing has created a glacially triangular-shaped face (Figure 3 on the left above Panorama 122). During the Late Glacial the jagged crest on the left above (○) has been sharpened into a form like a glacial horn (Figure 3 between Photo 112 and Panorama 122). (▽) is a rock island in the upper Ngozumpa glacier, which high- to late-glacially has been overflowed by ice and shaped and reshaped into a very large roche moutonnée with a steep, heavily rounded lee slope (Figure 3 halfway between Panorama 106 and the summit of Gyachung Kang. (...)) is the Last Glacial glacier-, i.e. firm level of the upper Ngozumpa glacier in its source area: it lay between 6600 m (on the left below No. 7), 6400 m (below No. 63) and ca. 6000 m a.s.l. (on the right below No. 63). Analogue photo M. Kühle, 22/9/1982.

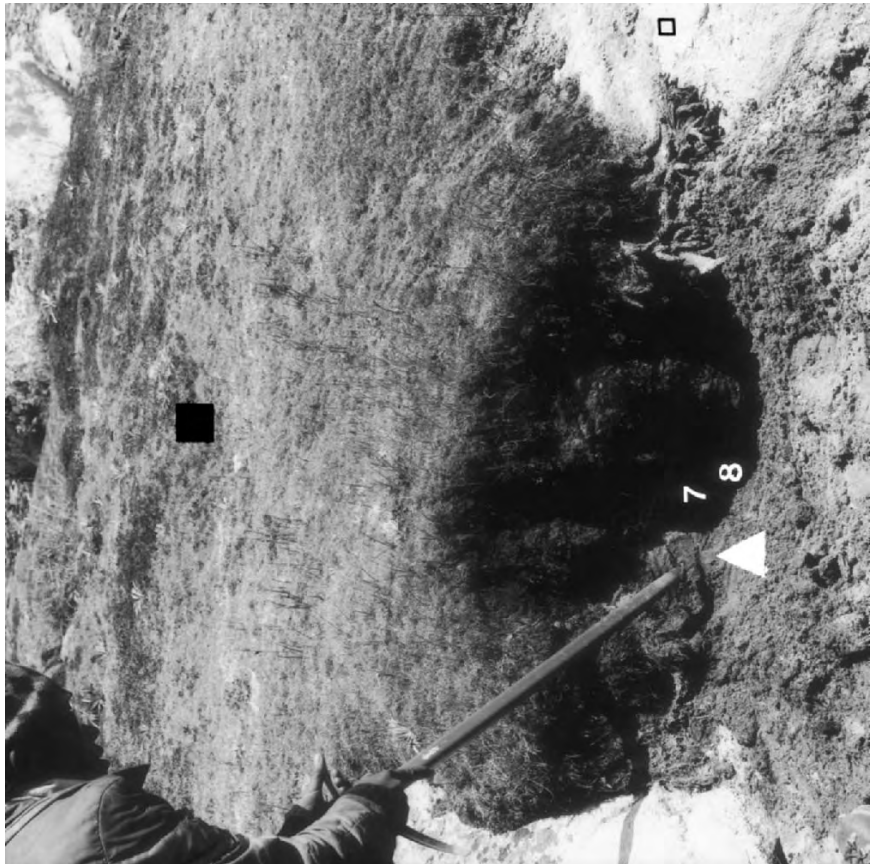
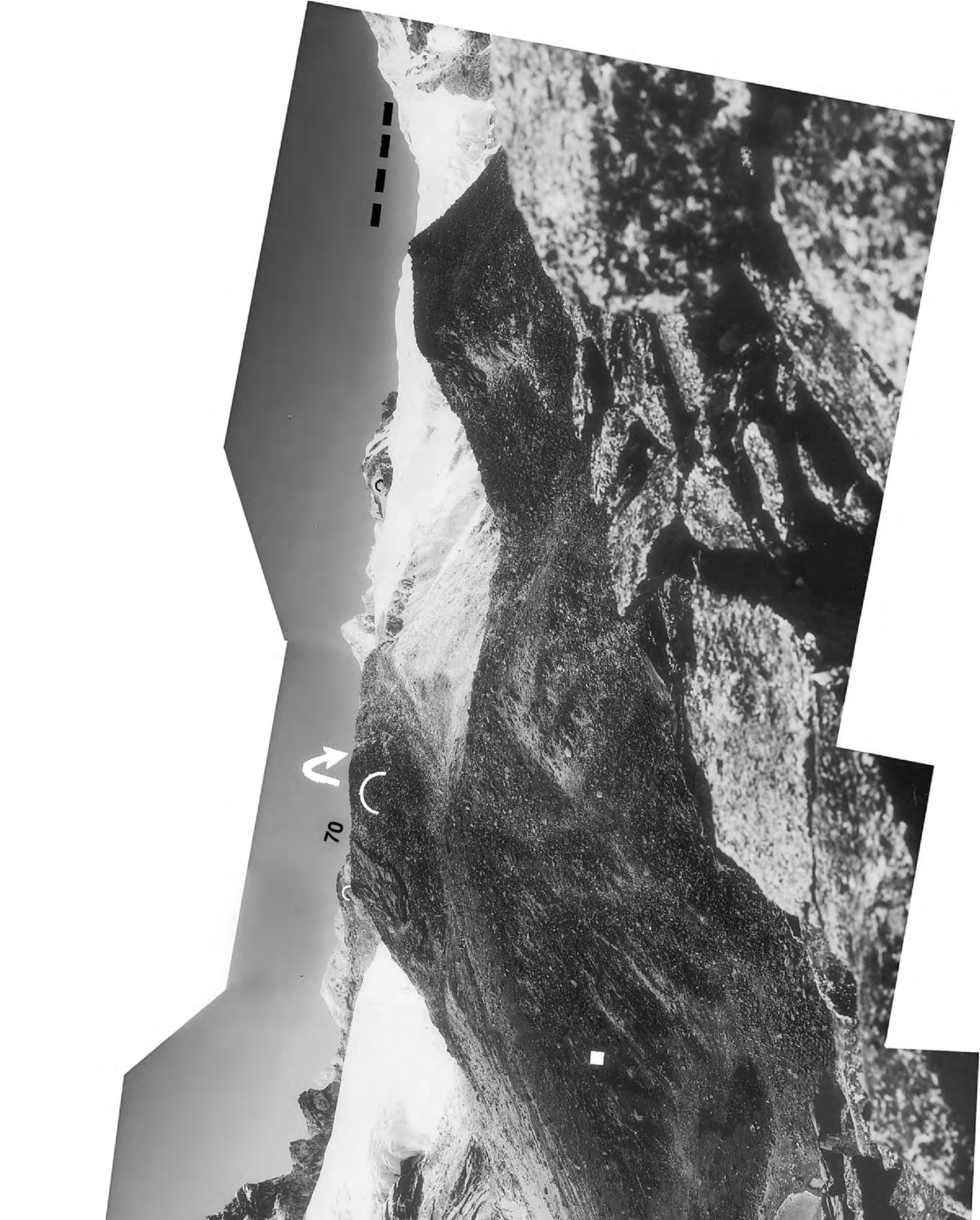


↑ *Photo 1/16*. Panorama from a small plateau ice (foreground) N above the 5570 m-saddle (No. 70) at 5040 m a.s.l. (Figure 3, Panorama 116) from facing NNE (left margin) via NE to the 7922 m-high remnant of an old plain of Gyachung Kang (No. 7; background) and the 6066 m-peak (No. 67) in the ENE beyond, i.e. on the orographic left in the Lungsampa valley, via facing E to the 7020 m-peak (No. 15) beyond the confluence of Ngozumpa- and Lungsampa glacier (□), via facing ESE to Mt. Everest (No. 1) in the background and facing SE to the 6103 m-high main summit of Kangchung (No. 57; on the right of it, separated by a 5637 m-high glaciated saddle, stands the 6089 m-high Kangchung-W-summit) and Anai Dablang (No. 20), up to facing S to the 5885 m-high glacial horn (right margin) and the 5570 m-saddle below (No. 70). (↔) is the past (High- to Neoglacial: Stages 0–VII; Table 1) transfluence pass of the Lhabtshan E-glacier into the SE-adjacent Gyazumpa valley. (70→) is the High- to Late Glacial (Stages 0–IV) 5570 m transfluence pass which has existed between the Lungsampa valley and the W-adjacent Summa valley; (↻) are the corresponding rock abrasions. (...) show the Ice Age glacier trim-lines about 6000 m a.s.l. (cf. Figure 28), proved by the arrangement of the positions of the adjacent glacial abrasions (↻) and upper limits of abrasion. The glacial horns on the right below No. 67 and above No. 70 have been undercut and sharpened by the lower Early Glacial and during the Late Glacial dropped glacier trim-line. (↻ black) is a remnant of a past valley bottom- and old surface abraded and rounded by the Ice Age ground scouring of the glacier. Perennial snow- and firn patches are situated on it, which in the subtropics are very rare. Here was still glacier ice in the historical time, as is evidenced by the minor or even lacking existence of lichens, (Δ) are postglacial debris cones with cores of ground moraines, built-up by crumbings since deglaciation. They are adjusted to ground- (■) and neoglacial end moraines (V), (VII) is the orographic left lateral moraine of the Ngozumpa glacier (□), which there is already covered with surface moraine. Analogue photo M. Kuhle, 28/9/1982.

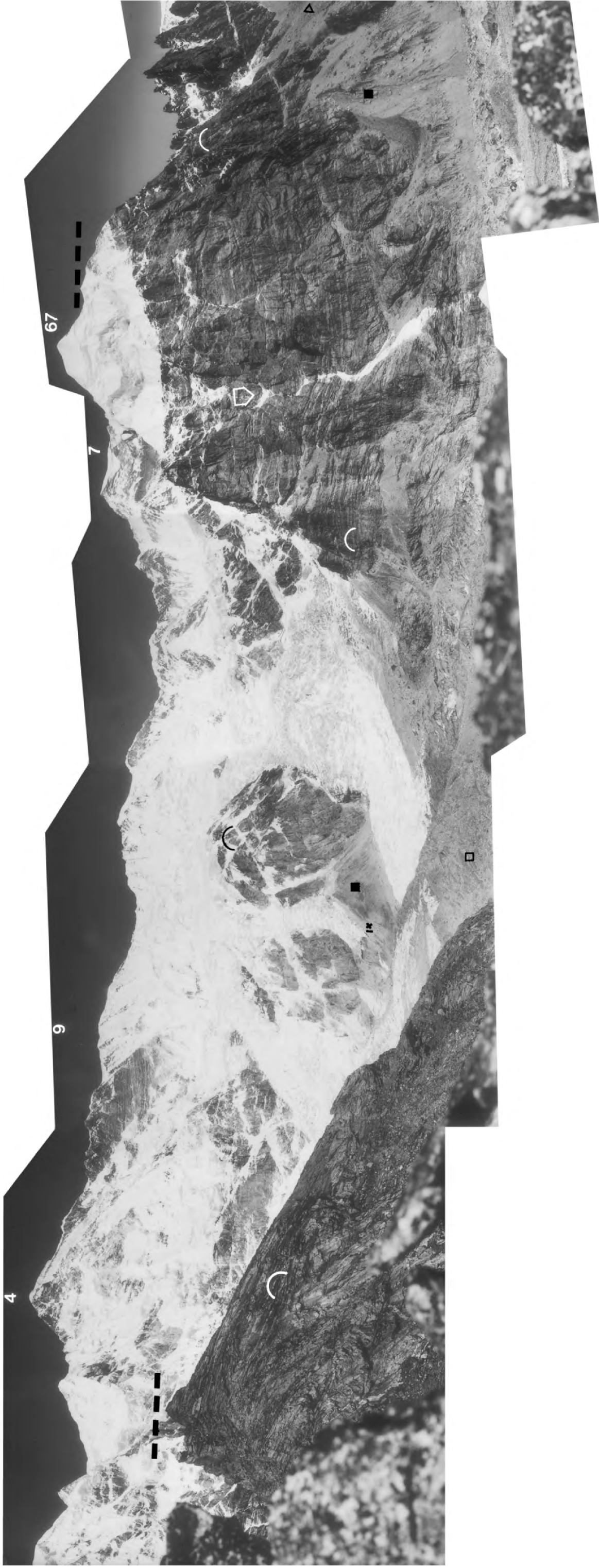




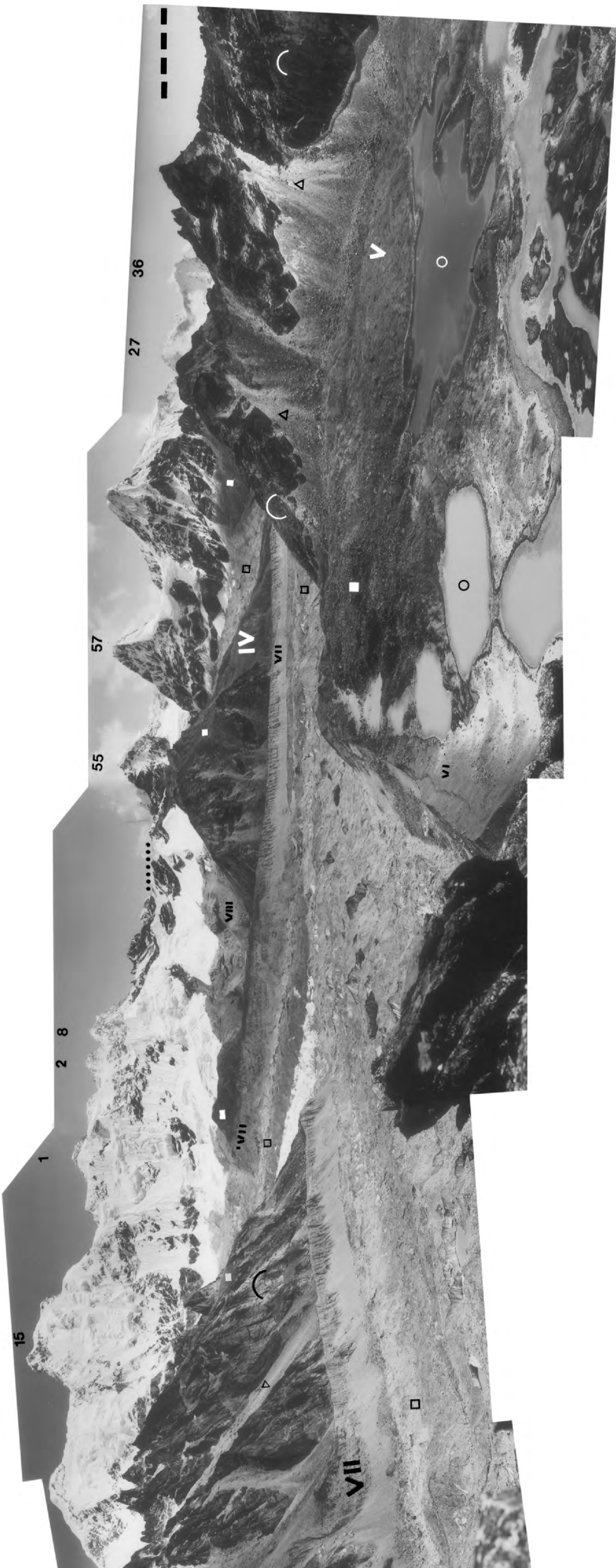
† Photo 117. Panorama from the 5560 m-summit on the orographic left side in the Lhabtshan valley (Figure 3, Panorama 117) from facing SSE (left margin) with Tramskerku (No. 36) in the background, via the orographic right flank of the Lhabtshan valley in the S, up to the 5570 m-saddle (No. 70) in the W, up to facing WNW to the S-crest of Nangpai Gosum (right margin). Lower Tibetan gneisses (6b after Nepal Geological Map 1985, Sheet No. 71L-D), i.e. massive-crystalline rocks outcrop here. They have been polished by the current Lhaptshan glacier and are still preserved in a smooth state (○ black) in its nearest fore-field which has just been cleared of ice. At places where such rocks have been ice-free for at least 2000–4000 years, the glaciogenically abraded rocks are covered with a scatter of coarse boulders weathered *in situ* (○ white on the right and left next to No. 70 and right half of the panorama in the foreground). (The two white ○ from the left) mark glaciogenic flank abrasions more or less strongly roughened by crumbings since the Late Glacial (Stages IV–I, Table 1) deglaciation. (△) are postglacial debris cones with cores of ground moraine, made up by crumbings since deglaciation. (--- centre) is a Late Glacial glacier trim-line at 5800 m a.s.l. (Stage I) which has sharpened the crest into a glacial horn. (--- on the right) shows the maximum glacier trim-line about 6000 m (cf. Figure 28); in both cases a ca. 230–430 m-thick transfluence across the 5570 m-saddle (No. 70) (↔) has taken place. (←) is the past (High- to Neoglacial: stages 0–VII; Table 1) transfluence pass of the Lhabtshan E-glacier leading into the SE-adjacent Gyazumpa valley. (■) is a metre-thick Late Glacial ground moraine cover. (V, IX, VII and VI) are end- and lateral moraines of the neoglacial to historical stages concerned (see Figure 19, Tables 1 and 3), (⊗) is the locality of the two C14-samples (Nos. 7 and 8) of 290 ± 70 and 440 ± 80 YBP (see Photo 118 and Table 2) in a dried up lateral lake. (○) are neoglacial to current end moraine lakes with (○ black) and without (○ white) actual glacier milk. Analogue photo M. Kuhle, 26/9/1982.

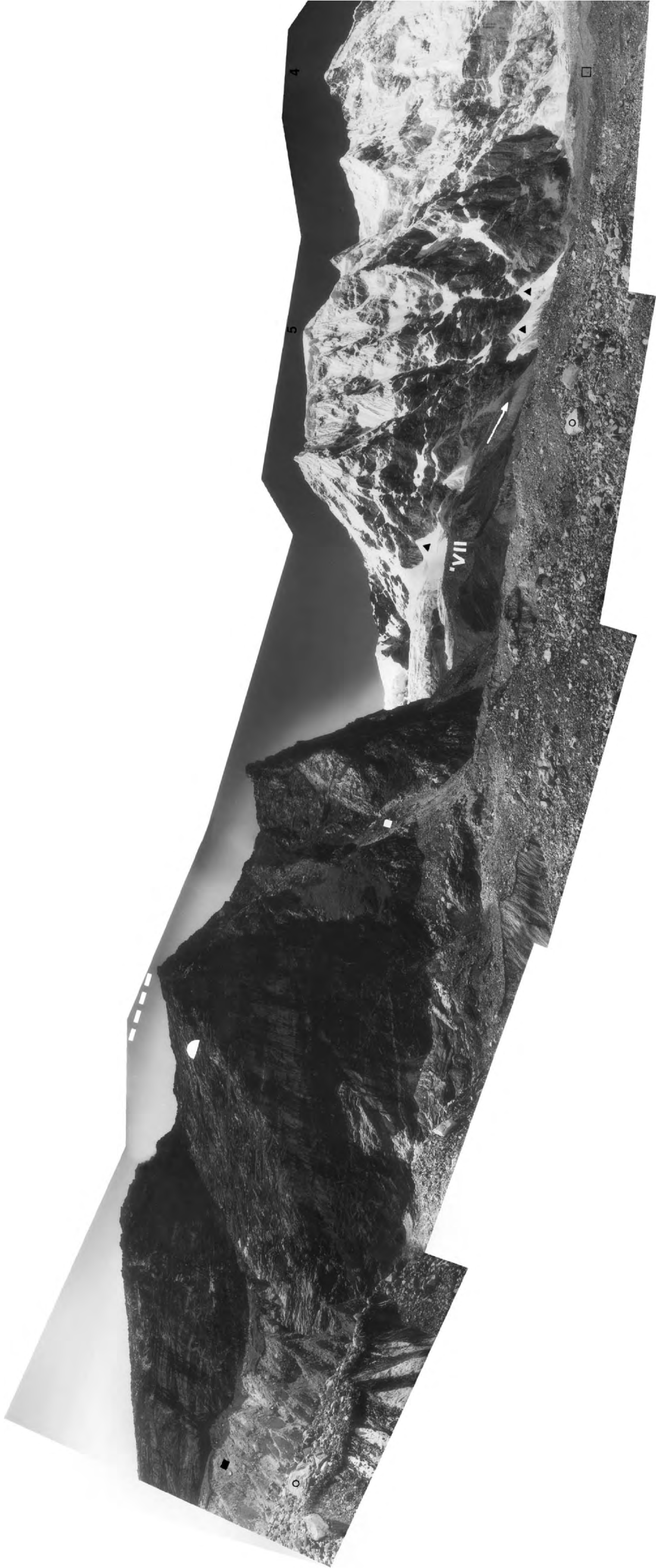


↑ *Photo 118.* Exposure of samples taken in the orographic left lateral valley of the Lhaptshan E-south glacier at 5350 m a.s.l. in the position of the tongue basin of the Lhaptshan 5560 m-summit (Photo 117, Nos. 7 and 8). (■) is moraine material with coarse gneiss- and granite boulders; (□) is sand of lateral aprons overlying this moraine material with a minor thickness. (▲) shows the location of Sample No. 7, 40–42 cm below the surface. Sample No. 8 was taken below from it from a depth of 50 cm. Both the C14-samples consist of root wood from Rhodiola. The age of Sample No. 7 is 290 ± 70 and of Sample No. 8, 440 ± 80 YBP (before 1950). Analogue photo M. Kuhle, 26/9/1982.



↑ *Photo 119*. Panorama from the 5560 m-summit on the orographic left side in the Lhabtshan Drangka (Figure 3, Panorama 119) from facing NNW (left margin) with the 8202 m-high SE-wall falling away to the Lungsampa glacier (□ on the right), via facing NNE to the 7906 m-high Ngozumpa Kang (No. 9), via facing NE with Gyachung Kang (No. 7; 7922 m) in the background and in front of it the 6066 m-peak (No. 67) in the left flank of the Lungsampa Drangka, via facing E to the 7020 m-peak (No. 15) beyond the upper Ngozumpa Drangka and facing WSW with the summits of Mt. Everest (No. 1; 8848 or 8872 m), Lhotse (No. 2; 8501 m) and Nuptse (No. 8; 7879 m), via facing SW with the 6145 m-peak (No. 55) and the 6103 m-high Kangchug (No. 57) with its 6089 m-high W-summit on the right beside it, via facing SSW with Kang Taiga (No. 27; 6779 m) and Tramserku (No. 36, 6608 m) in the background, up to the orographic right flank of the Lhabtshan Drangka in the S (right margin). (— on the left) is the High Glacial (Stage 0; Table 1) glacier trim-line between 6400 m at the valley head of the Lungsampa Drangka in the Cho Oyu SE-wall and ca. 6000 m a.s.l. at the 6066 m-peak (centre of the panorama on the right of No. 67) (Figure 28). At the Gyuba Tschomoche-massif it had an altitude of ca. 5900 m (--- on the very right) is the Late Glacial glacier trim-line during the Late Glacial Stages I–II about 5600–5700 m; the 5553 m summit situated on the left of (--- on the very right) is a glacial horn which, during the Late Glacial Stages III–IV, has no longer been overflowed, but sharpened. Only in some places glacial rock polishings and -abrasions preserved on the valley flanks (○, ◐, ◑) mediate to these Last Glacial glacier trim-lines. As is shown by the large orographic right rock moutonnée (◑ on the very left), they have splintered away due to frost weathering and thus have been roughened or cut in the line of slope by ravines of ice avalanches and rock fall (◐) and damaged by crumbings. In the core of the debris cones (△) built up by these crumbings, hidden remnants of ground- and lateral moraines are contained now. Here and there this can be recognized by debris cones, partly removed, i.e. opened by undercutting of the glacier (■ on the right below No. 67). (■ marks exemplary findings of moraine material. (IV, VI, VII, VIII and IX) are lateral moraines and remnants of lateral moraines of the concerning Stages (cf. Table 1) in the Lungsampa Drangka, Ngozumpa Drangka and Gyubane E-glaciers. (○ white) is an end moraine- and lateral lake without a contemporary connection to the glacier meltwater; (◑ black) are end moraine- and lateral lakes with a current connection to the glacier meltwater, i.e. with an actual suspension load in the water, that is with glacier milk. Analogue photo M. Kuhle, 26/9/1982.





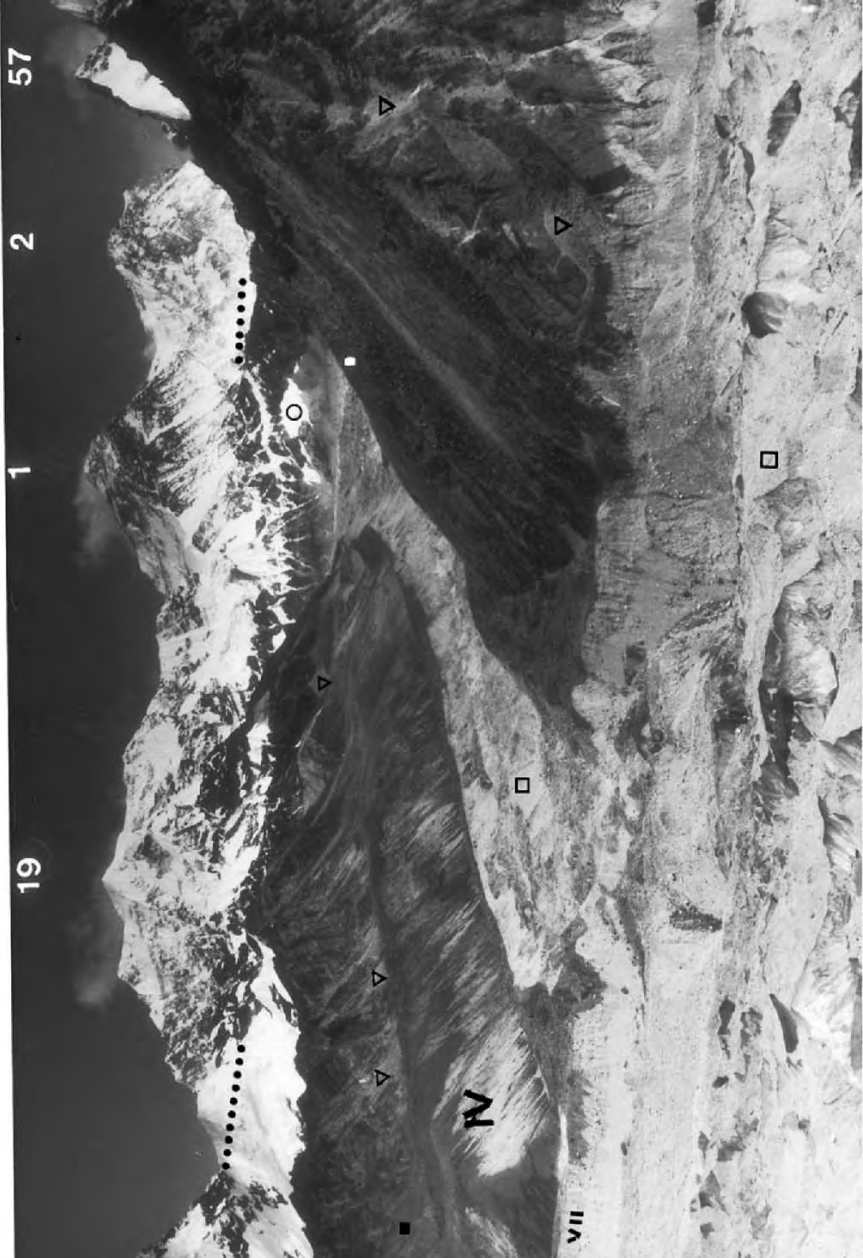
↑ *Photo 120*. Panorama from 5140 m a.s.l. from the centre of the Lungsampa glacier, the orographic right source branch of the Ngozumpa glacier (Figure 3, Panorama 120) from facing SW (left margin) with the S-rock slope of the 5560 m-massif, via facing WNW to the a good 5 km-long Nangpai Gosum crest running nearly continuously above 7000 m (No. 5; its main summit is 7352 m-high – here not visible) and facing NNW with the 8202 m-high Cho Oyu (No. 4) and its 2800 m-high SE-wall, via facing N to the 7806 m-high Ngozumpa Kang (No. 9) and the continuation of the border-crest to Tibet, up to the 7646 m-high rocky W-satellite of Gyachung Kang, facing ENE into the orographic left flank of the Lungsampa Drangka with the 6066 m-peak (No. 67), up to facing ESE (right margin) with the rock teeth of its SE-crest. The N-adjacent 2 km up the Lungsampa glacier up to 5250 m a.s.l., is covered with surface moraine (□); the surface moraine overlay on the sheer ice (◇) is still relatively thin and attains 40–80 cm at the viewpoint. The light surface moraine boulders (○) consist of tourmaline granite. Ice avalanches have torn them out of the middle-high and basal sections of the Cho Oyu SE-wall. The debris of dark igneous- and para-igneous rocks outcropping above and transported by ice avalanches interspersed by debris have a strongly erosive effect. This can be diagnosed by the fresh polishing grooves above the avalanche cones (▲) (see also ♢). (‘VII) is the most striking neoglacial (middle Dhaulagiri Stage; Table 1, Figure 19) end moraine of the southeast Nangpai Gosum glacier, today divided into three tongues (on the left of ‘VII) (cf. Table 3). (→) is a currently active rock glacier. (IX) is a medial moraine inset of the stage from ca. 1650 to 1800 (older than 155 YBP; Table 1) (cf. Figure 19). (■) are exposures of ground moraines and kames (■ on the very right) towering up to 200 m (■ white) above the contemporary glacier surface (□). (▽) are rock gullies with similar fillings of ground moraine, covered by postglacial debris of crumbings. (●) are glacialenic flank abrasions which, e.g. on the orographic left side (● on the right), have polished back a former rock spur into a glacialenically triangle-shaped slope (Figure 3 on the left of No. 67). The large rock head above (IX) is the lee slope of an Ice Age roche moutonnée (Figure 3 in the middle between Panorama 120 and No. 9) roughened through regelation. (---) shows the Ice Age glacier level running about 6000 m a.s.l. (--- on the right) (Figure 28). Analogue photo M. Kuhle, 29/9/1982.



↑ *Photo 121*. Picture taken at the exit of the Lhabishan Drangka from 5160 m a.s.l. (Figure 3, Photo 121) facing N to the 8202 m-high Cho Oyu (No. 4) and Ngozumpa Kang (No. 9, 7806 m) rising in the continuation of its E-crest. (V) is the outer slope of the orographic right neoglacial (older Dhaulagiri Stage, see Table 1) lateral moraine of the Lungsampa glacier (cf. Figure 19); (□) is a related lateral moraine fan with a thin cover of glaciolinnic lake sediments (Figure 3 on the left above Photo 121). The High- to Late Glacial Lungsampa glacier and its right tributary glacier, the Lhabishan E-glacier, has rounded the rock hill of mica gneiss by abrasion (↗). It carries a veil of ground moraine (■ black). The lateral lake (between □ and ■ white) and also the moraine material (■ white) is situated in the Late Glacial (Stage IV) confluence area of the Lhabishan E-glacier and the Lungsampa — i.e. Ngozumpa parent glacier. Analogue photo M. Kuhle, 5.10.1982.



↑ *Photo 122*. Panorama at 5160 m a.s.l. from the orographic right lateral moraine slope of the historical Younger Dhaulagiri Stage (VII, Table 1) of the Ngozumpa glacier (Figure 3, Panorama 122) up the glacier from the confluence with the Lungsampa glacier at 70 m above the ice surface (□ below); from facing SSW down the glacier to the 6073 m-high Pa Ri (No. 69) up to facing SW to the mountain spur between Gyazumpa- and Lhabtsan Drangka (right margin). The centre of the glacier shows up to 20 m high pyramids of sheer ice (between □ above and below); from an altitude of 5000 m downward, the ice stream is completely covered with surface moraine (□ above). In part the good 100 m-high lateral moraine (VII) is undercut by the current glacier and kept steep; it shows large, originally rounded boulders, broken in the middle due to the rearrangement during the youngest transport (○ black). This argues against the surface dating of moraine boulders. On the orographic right side above the historical moraine (VII), lateral moraines of the Neoglacial Stage V, and the Late Glacial Stage IV have remained; above, ground moraine of Stage III (cf. Table 1 and Figure 19) can be observed. (○ white) is a cirque with a block glacier (Figure 3 above Photo 123). The High Glacial (Stage 0 = Würmian) glacier level (...) was in the area of the margins of the panorama about 5900 m a.s.l. (Figure 29) and, in the course of the valley, has dropped to ca. 5700 m (...) on the left of the centre). Analogue photo M. Kuhle, 1/10/1982.



↑ *Photo 123.* Picture taken from the orographic right flank of the Ngozumpa Drangka at 5360 m a.s.l. (Figure 3 Photo 123) facing ENE via the exit of the Gyubanare Drangka with the junction of the Gyubanare glacier (□ above) and the Ngozumpa glacier (□ below); in the background the summits of the 6870 m-high Chumbu (No. 19), of Mt. Everest (No. 1; 8848 or 8872 m), of Lhotse (No. 2; 8501 m) and of the 6103 m-high Kangchung (No. 57). During the Younger Dhaulagiri Stage VII (Table 1) the faces of the Ngozumpa glacier (□ below) and of the orographic left tributary glacier (□ above) covered with surface moraine, have reached the highest level of the lateral moraines (VII) which were immediately attached to them and have overthrust them; in the meantime, i.e. since ca. 400–1700 YBP, the glacier surfaces (□) have dropped here by 40–60 m. (IV) is the at least 200 m-high moraine terrace of the Sirkung Stage, the youngest Late Glacial glacier position. It concerns a terrace-shaped remnant of a ground moraine pedestal (Figure 3 on the right, somewhat above Photo 115). (■) is ground moraine material preserved on the valley slopes situated higher up. (▽) is a display of slight breaks of debris where ground material like that has been broken away, then removed by denudation and buried by debris crumbings. (○) is an active cirque glacier in a W-exposition of the Changri La mountain rib. The Changri La is an Ice Age transfluence pass across which the then Khumbu glacier system was connected with that of the Ngozumpa glacier. The High Glacial Würmian glacier trim-line (...) in this field section ran at ca. 6000 m a.s.l. Analogue photo M. Kühle, 25.9.1982.