

Geomorphology outline of the vicinity of Petuniabukta

Grzegorz Rachlewicz*

Institute of Paleogeography and Geoecology, Adam Mickiewicz University, Poznań, Poland

The relief of coasts, valleys and mountain massifs around Petuniabukta reveals a variety of interesting and unique features. Landscape associations are diversified according to their genesis, intensity of geomorphic processes and age. Main stream of this branch of research arose here as the aftermath from Poznań University expeditions in the last three decades.

Main agents in shaping primary features of landscape were associated with extensive Quaternary glaciations finished ultimately 10 ka BP. The traces of at least four major advances of Spitsbergen – Barents Sea ice-sheet were detected in the not far Kapp Ekholm section. The most spectacular effects of their activity are large valleys and fiords. The last, widespread episode of glaciers advances during the Little Ice Age (LIA – 600–100 BP) was responsible only for the architecture of valley marginal zones.

In Billefjorden, which is glaciated in about 44%, among 23 existing glaciers only one (Skandsbreen) was reported to surge after the LIA. Some premises within the wide area of sharp, non ice-cored ramparts, suggest also a possible surge in the case of Hörbyebreen. Non-surging glaciers commonly leave marginal zones in form of a set of ice-cored morainic ridges. Their setting is closely connected with the layout of the hard-rock basement. In Petuniabukta it can be observed on examples of Svenbreen and Ebbabreen, terminating next to hardly resistant crystalline thresholds. The Ebbabreen LIA marginal zone is located beneath a 50 m high gneiss step, transverse to the valley axis. Valley slopes are dominated by egzaration relief with polished surfaces, striae and glacial undercuts at

the height of 50 m above the valley floor. In the upper part this level is marked by belts of lateral moraines. The marginal zone is shaped in form of an asymmetric oval. Maximum heights of frontal moranic rampart, elevated 20–25 m above the valley floor, lined with outwash sediments, are located in the southern wing. Mass movements on slopes of ice-cored moraines are the most intensive here, filling up englacial voids and crevasses with debris-slides and melt-water derived material. Central part of marginal zone is occupied by a depression with small lakes, drained through a system of ice-cracks, to the springs on the edge of the marginal zone. The central part of terminal moraine continues up the glacier in the form of supraglacial belt, connecting the Bastion nunatak in the central part of accumulation area with the edge of ice. The northern part of marginal zone reveals confined amount of morainic material, as a discontinuous cover on roches moutonné of the crystalline threshold. A spectacular waterfall of the main subglacial outflow from the glacier margin is located beneath it. This outflow generates in majority outwash series at the bottom of the valley. Some smaller hillocks in this part may suggest earlier abrupt slide of ice in the steeper part of the basement rocks. Another type of marginal zone can be observed in the case of Ragnarbreen, showing erosional features in the form of vast depression, taken by the proglacial lake framed by a garland of ice-cored moraines.

Rock walls dominating over valleys, glaciated mostly in upper parts, undergo intensive weathering processes. Beneath flat field surfaces develop structural features of hardness dependent rock outcrops

* e-mail: grzera@amu.edu.pl

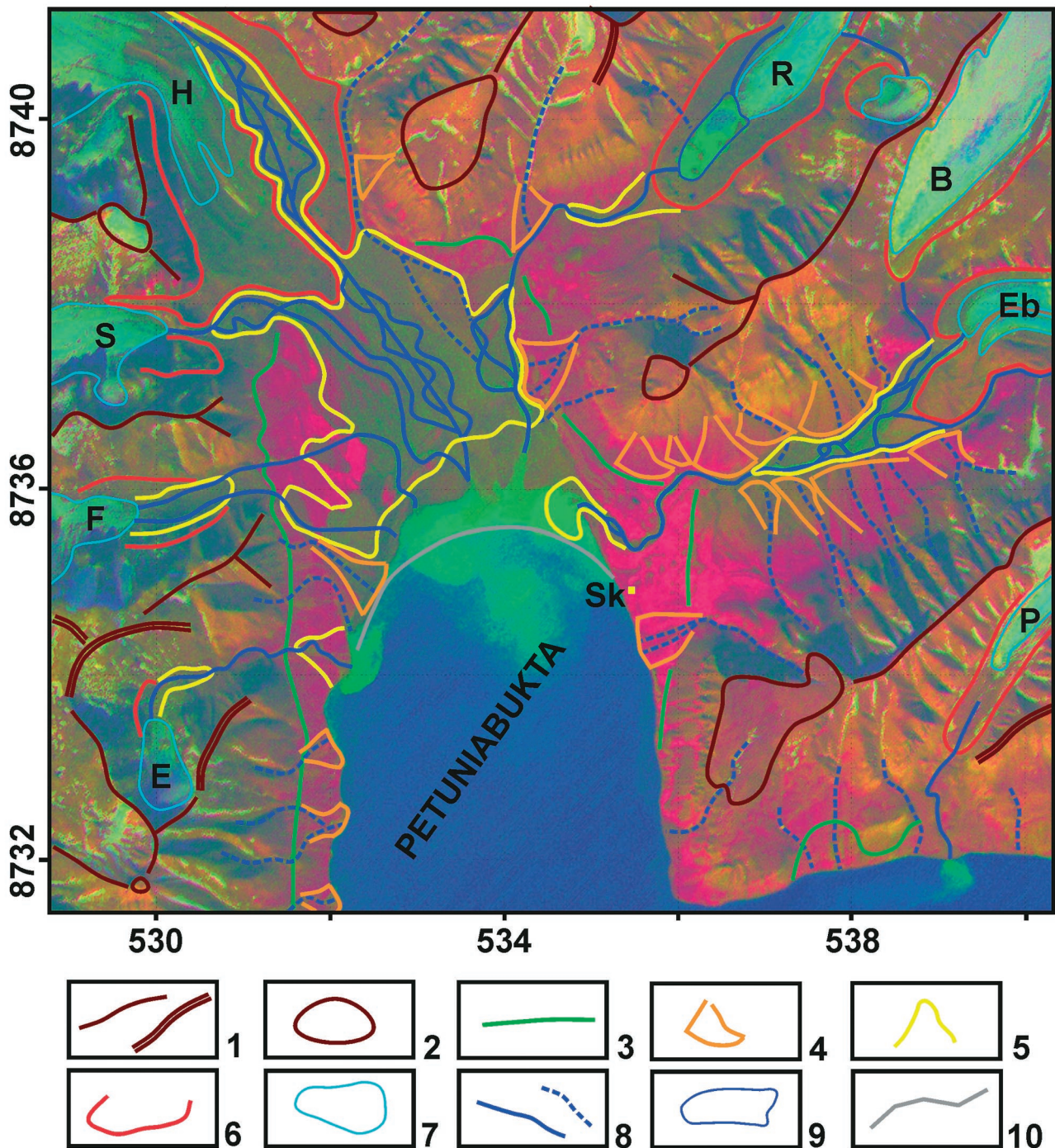


Fig. 9. Main features of geomorphology of Petuniabukta (updated after Karczewski et al. 1990)
 1 – Narrow and rounded mountain crests; 2 – Flat top structural surfaces; 3 – Extent of raised marine forms; 4 – Alluvial fans; 5 – Outwash planes; 6 – Marginal zones of glaciers; 7 – Glaciers; 8 – Periodic (proglacial) and episodic streams; 9 – Lakes; 10 – tidal flat. E – Elsabreen; F – Ferdinandbreen; S – Svenbreen; H – Hörbyebreen; R – Ragnarbreen; B – Bertrammbreen; Eb – Ebbabreen; P – Pollockbreen; Sk – Skottehytta.
 The background satellite (TERRA/ASTER, taken on July 13, 2002) orthophotomap prepared by A. Stach.

underlined by talus cones and solifluction slopes. Their boulder and debris cover is transformed by mass movements associated with snow and rock avalanches and locally by episodic streams.

Lower parts of valleys, especially on the eastern coast of Petuniabukta are developed in form of raised marine terraces to the level of about 80 m a.s.l. The highest terraces in Ebbadalen, where associa-

tions with Pleistocene glaciations are visible, were 14C dated for 37860 ± 1000 yBP. Younger terraces sequence descending from 45 m a.s.l. to the actual coast-line is associated with sea level changes since mid-Holocene. During the younger Holocene, with a progressing warming, central part of the valley was flooded by a sea transgression, recorded in form of a lagoon in the Ebba river mouth. Outflowing glacial



Fig. 10. Mountain walls built of carbonate rocks, talus slopes and raised marine forms (terrace, spit) on the Eastern coast of Petuniabukta (Wordiekammen massive)

rivers in the tide zone accumulate part of bedload and suspended material forming broad tidal flat coupling with outwash cones and planes revealing the greatest intensity of eolian processes.

In Petuniabukta there is a small, although visible range of human-induced landscape changes. Most of them are effects of mining and explorative activity around the settlement Pyramiden as roads and mine waste dumps.

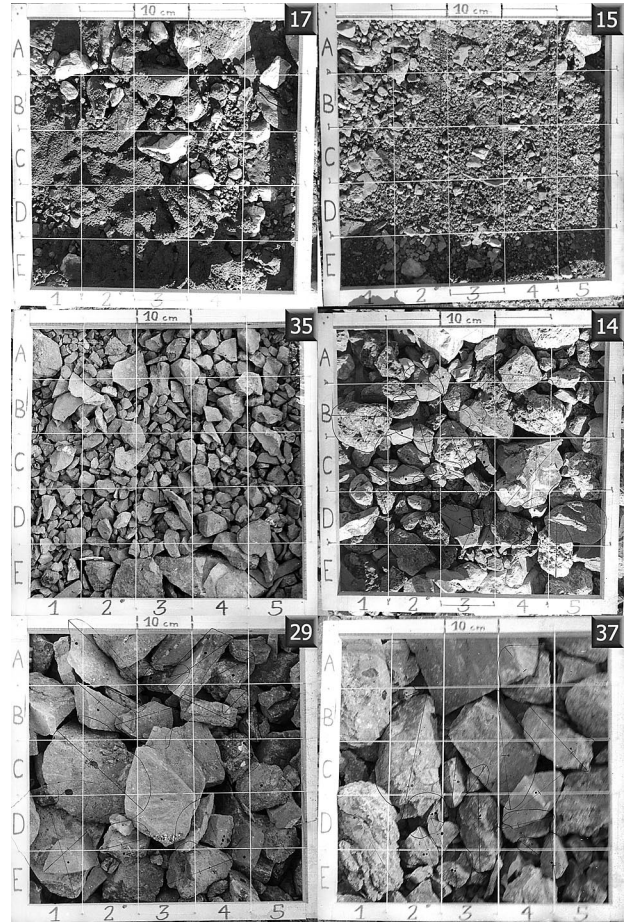


Fig. 11. Facies of slope deposits on western side of Wordiekammen massive (photo Zb. Zwoliński) sample 17 – incorporation of debris facies into mud facies, sample 15 – fine debris facies, samples 35 and 14 – medium debris facies, samples 29 and 37 – coarse debris facies.



Fig. 12. Upper part of Ebbadalen with the marginal zone of Ebbabreen, higher located Bertrambreen and Mittag-Lefflerbreen in the back



Fig. 13. The front of Ragnarbreen with a marginal lake, seen from the morainic ridge of Little Ice Age



Fig. 14. Tidal flat and outwash plain of the inner part of Petuniabukta. Ebbadalen visible in the front and valley glacier Hörbye in the back



Fig. 15. Fifth level of raised marine terrace near Skottehytta, 20–25 m a.s.l. (photo Zb. Zwoliński)



Fig. 16. Supraglacial stream on the Ebbabreen (photo Zb. Zwoliński)

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