

Neoproterozoic sedimentation on the Rybachi and Sredni Peninsulas and Kildin Island, NW Kola, Russia

ANNA SIEDLECKA

Anna Siedlecka, Norges geologiske undersøkelse, Post Box 3006-Lade, 7002 Trondheim, Norway.

Lithostratigraphy and sedimentary facies of the Rybachi and Sredni Peninsulas and Kildin Island

The stratigraphic section of the *Rybachi Peninsula* represents a c. 4000 m-thick succession subdivided into two groups and several formations (Fig.2). The bottom of the succession is not exposed, and the top is erosional with no more record preserved. The succession represents a basinal turbidite system overlain by upper slope deposits. This Rybachi Turbidite System (RTS) consists of turbidites, debrites and deposits accumulated by traction currents and represents a major retrogradational succession (Siedlecka et al. 1995 a). Typical for the RTS is the presence of extrabasinal pebbles to boulders of crystalline rocks in turbidites and debrites and in an olistostrome in the lowermost part of the stratigraphic section, suggesting an active, faulted margin of the basin with nearby exposed, older Precambrian rocks. The abundance of fragments of leucocratic granite in the olistostrome, which are absent in the adjacent basement, suggests that not only downfaulting but also lateral translation was involved in the formation of the faulted margin. Transport of the clastic material, as shown by palaeocurrents, was within the northerly quadrant with a predominant easterly deflection. The Skarbeeveskaya Formation is also turbiditic in its development. It is everywhere in tectonic contact with the remainder of the Rybachi rocks and therefore can only loosely be compared with the upper parts of the main Rybachi succession (Siedlecka et al. 1995 a).

The succession of the *Sredni Peninsula* is up to 2000 m thick. It is subdivided into the Kildinskaya and Volokovaya Groups and into several formations (Fig. 2). It is predominantly terrigenous, rests unconformably on the older Precambrian crystalline substratum and its top is erosional with no more record preserved. Fluvial, coastal marine and deltaic facies have been recognised (Siedlecka et al. 1995 b). There are several unconformities in the lower Kildinskaya Group and there is a major subaerial unconformity with a pronounced topographic relief between the Kildinskaya and Volokovaya Groups. The

Volokovaya Group is missing on *Kildin Island* where the Kildinskaya Group reaches c.1300 m in thickness. The lower Kildinskaya on Kildin Island is terrigenous-dolomitic and comprises several levels with columnar stromatolites.

Age and stratigraphic relationship between the Rybachi and Sredni successions

It had been realised for several decades that a fault zone separates the Rybachi and Sredni Peninsulas. It has also been concluded on the basis of postulated field evidence that the Rybachi succession rests unconformably upon the Kildinskaya Group of Sredni and is therefore stratigraphically younger and probably equivalent to the Volokovaya Group (Negrutsova 1971).

The contact between the Rybachi and Sredni rocks is faulted (Roberts 1995, Roberts & Karpuz 1995). There is, however, no field evidence that the Rybachi succession is unconformably overlying the Kildinskaya Group. Therefore, the Rybachi-Sredni stratigraphic correlation cannot be suggested on the basis of field observations (Siedlecka et al. 1995 a, b).

Microfossil assemblages from the pre-Karuyarvinskaya part of the Kildinskaya Group suggest a Late Riphean (R3) age while the fairly rich assemblage of the Karuyarvinskaya Formation indicates a Latest Riphean (R4) age for this particular formation (Samuelsson 1995). A Late Riphean age was also suggested for the Volokovaya Group by Lyubtsov et al. (1989). More recently, the assemblage recovered from

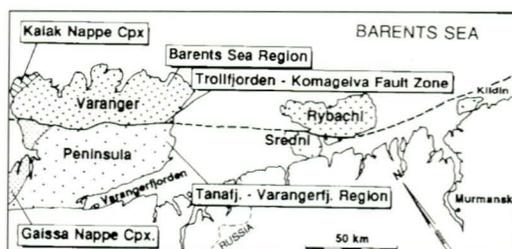


Fig. 1. Location map.

redeposited from the Kildinskaya Group. Rb-Sr dated detrital illite in the Volokovaya Group is c.900 Ma and diagenetic illites from the Kildinskaya and Volokovaya Groups show a Vendian age of c.610-620 Ma (Gorokhov et al. 1995). In summary, the radiometric ages suggest a Late Riphean rather than Vendian time of sedimentation.

Correlation with the Neoproterozoic sections of the Varanger Peninsula

The previously suggested continuation of the Trollfjorden-Komagelva Fault Zone (TKFZ) of the Varanger Peninsula across the isthmus between Rybachi and Sredni is well documented by new evidence (Roberts 1995, Roberts & Karpuz

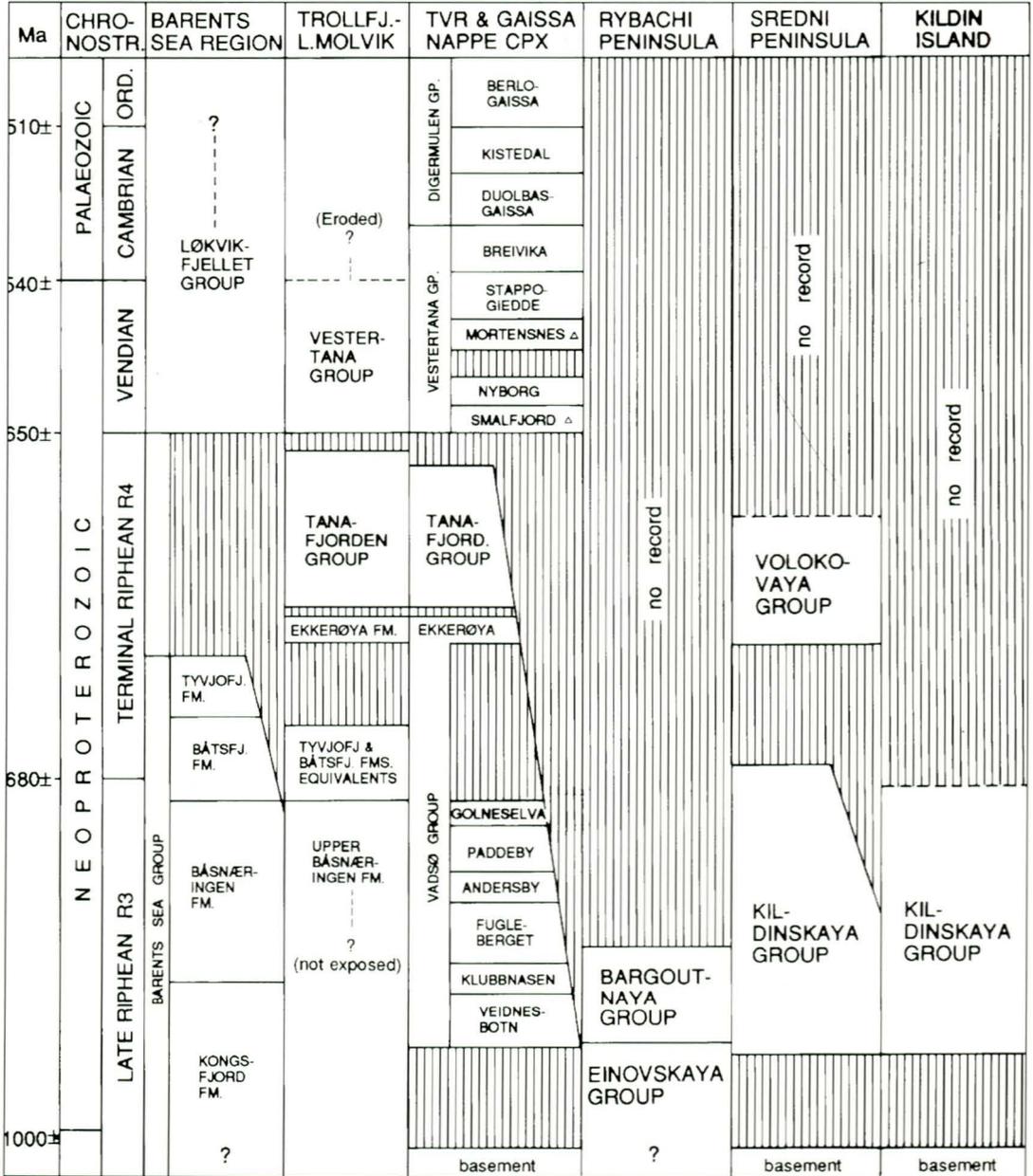


Fig. 3. Stratigraphic correlation table of areas from Varanger Peninsula in the northwest to Kildin Island in the southeast.

1995). The Rybachi Turbidite System is broadly comparable to and stratigraphically correlative with the Upper Riphean Kongsfjord Submarine Fan of the Barents Sea Region (BSR) of Varanger Peninsula (Figs. 1, 3).

Correlation of the stratigraphic succession of Sredni with that of the Tanafjorden-Varangerfjorden Region (TVR) of Varanger is not straightforward. Traditionally, the Volokovaya Group was correlated with the Varangerian glacial record, primarily because of the pronounced unconformity at the bottom of both successions. The Late Riphean age of the Kildinskaya and Volokovaya Groups makes this correlation questionable. Correlation between the bulk of the Late Riphean Vadsø Group of the TVR and the Kildinskaya Group is suggested instead, and the pre-Ekkerøya and pre-Volokovaya stratigraphic breaks are considered equivalent. This means that the Volokovaya Group might be broadly correlative with parts of the Tanafjorden Group (Fig. 3).

A previously suggested correlation between parts of the successions of the TVR and BSR, across the TKFZ (Siedlecka 1975, Vidal & Siedlecka 1983), is supported by the recent work in the Trollfjorden-Lille Molvik area where an unconformity between the upper Barents Sea Group and the Ekkerøya Formation was well documented by Rice (1994). The better founded and refined correlation is shown in Fig. 3. The proposed Båsnæringen-Vadsø-Kildinskaya correlation is based on microfossil assemblages (Vidal & Siedlecka 1983, Samuelsson 1995). The Einovskaya - Bargoutnaya - Kongsfjord-Båsnæringen correlation is suggested on the basis of comparison between the development of two retrogradational, basin floor, turbidite-to-upper slope systems (Siedlecka et al. 1995 a). There may well be an age difference between these Upper Riphean turbidite systems; however, the proposed correlation seems to be the most reasonable one at the present stage of the work. It also fits with the upthrusting of the Rybachi upon the Sredni succession during the inversion stage of basin deformation.

Basin development - a summary

The Late Riphean basin formed in the NE marginal zone of Baltica along a faulted margin, a presumed precursor of the TKFZ. The basin margin remained inactive after the initial phase of downfaulting and a retrogradational, submarine turbidite-to-upper slope system developed adjacent to the marginal escarpment, filling in the Rybachi (and BSR) basin. In a later stage of basin infilling, fluvial-coastal successions accumulated on the basin shelf. A subsequent relative sea-level

fall in the time interval between the Kildinskaya and Volokovaya and in pre-Ekkerøya time, and a possible reactivation of the marginal fault, were followed by a new period of overlapping, shallow sedimentation on Sredni and in the TVR.

Acknowledgement

The author is grateful to Johan Petter Nystuen for his critical comments on the manuscript.

References

- Gorokhov, I.M., Turchenko, T.L., Baskakov, A.V., Kutuyavin, E.P., Melnikov, N.N. & Sochava, A.A. 1995: A Rb-Sr study of multistage illite generation in shales of the Pumanskaya and Poropelonskaya Formations, Sredni Peninsula, NW Kola Region. (Extended abstract). *Nor. geol. unders. Special Publ.* 7, 00-00.
- Lyubtsov, V.V., Mikhailova, N.S. & Predovsky, A.A. 1989: Lithostratigraphy and microfossils of the Late Precambrian of the Kola Peninsula. *AN SSSR, Kola Branch*, 129 pp. (in Russian).
- Negrutsa, V.Z. 1971: Stratigraphy of the Hyperborean deposits of the Sredni and Rybachi Peninsulas and the Kildin Island. In: Problems of Precambrian Geology of the Baltic Shield and the Russian Platform cover. *VSEGEI* 175, 156-186 (in Russian).
- Raaben, M.E., Lyubtsov, V.V. & Predovsky, A.A. 1995: Correlation of stromatolitic formations of northern Norway (Finnmark) and northwestern Russia (Kildin Island, Kanin Peninsula). *Nor. geol. unders. Special Publ.* 7, 00-00.
- Rice, A.H.N. 1994: Stratigraphic overlap of the Late Proterozoic Vadsø and Barents Sea Groups and correlation across the Trollfjorden - Komagelva Fault, Finnmark, North Norway. *Nor. Geol. Tidsskr.* 74, 48-57.
- Roberts, D. 1995: Principal features of the structural geology of Rybachi and Sredni Peninsulas, and some comparisons with Varanger Peninsula. *Nor. geol. unders. Special Publ.* 7, 00-00.
- Roberts, D. & Karpuz, M.R. 1995: Structural features of the Rybachi and Sredni Peninsulas, Northwest Russia, as interpreted from Landsat-TM imagery. *Nor. geol. unders. Special Publ.* 7, 00-00.
- Samuelsson, J. 1995: Biostratigraphy of Kildin Island and the Sredni and Rybachi Peninsulas, Kola, Northwest Russia - preliminary results. (Extended abstract). *Nor. geol. unders. Special Publ.* 7, 00-00.
- Siedlecka, A. 1975: Late Precambrian stratigraphy and structure of northeastern margin of the Fennoscandian Shield (East Finnmark-Timan Region). *Nor. geol. unders.* 316, 313-348.
- Siedlecka, A., Negrutsa, V.Z. & Pickering, K.T. 1995 a: Upper Proterozoic Turbidite System of the Rybachi Peninsula, Northern Russia - a possible stratigraphic counterpart of the Kongsfjord Submarine Fan of the Varanger Peninsula, Northern Norway. *Nor. geol. unders. Special Publ.* 7, 00-00.
- Siedlecka, A., Lyubtsov, V.V. & Negrutsa, V.Z. 1995 b: Correlation between the Upper Proterozoic successions in the Tanafjorden-Varangerfjorden Region of the Varanger Peninsula, Northern Norway, and of the Sredni Peninsula and Kildin Island in the Northern coastal area of the Kola Peninsula in Russia. *Nor. geol. unders. Special Publ.* 7, 00-00.
- Vidal, G. & Siedlecka, A. 1983: Planctonic, acid-resistant microfossils from the Upper Proterozoic strata of the Barents Sea Region of Varanger Peninsula, East Finnmark, Northern Norway. *Nor. geol. unders.* 382, 45-79.