PETROGENESIS OF THE BIMODAL RAPAKIVI-RELATED VOLCANITES OF THE ISLAND OF HOGLAND, 1.64 GA WIBORG BATHOLITH, RUSSIA.

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The island of Hogland is situated at the eastern part of the Gulf of Finland near the southern margin of 1.64 Ga Wiborg rapakivi granite batholith (WB). The basement is represented by the Svecofennian supracrustal and magmatic rocks overlaid by subhorizontal strata of quartzite conglomerate (0-20 m in thickness). These rocks are covered by anorogenic rapakivi-related volcanites.

The volcanic succession is the following: lower strata of quartz porphyry 0-10 m; strata of basalt plagioclase-porphyrites 0-40 m; upper strata of quartz porphyry up to 100-m.

Basalt plagioclase-porphyrites have $\varepsilon_{Nd}(T)$ value = -1.8,T = 1640 Ma [1] and might be syngenetic to gabbro-anorthosites or diabase dykes of WB and Suomenniemi batholith (SB) [2].

Geochemically, the plagioclase-porphyrites of Hogland are alkaline basalts similar to gabbro-anorthosite-related diabases of WB and SB in a view of their petrochemistry and REE patterns [2]. However, these basalts exhibit extreme variations in Na_2O and K_2O (0,15 - 5,5 and 1,3 - 4,7, respectively). K_2O/Na_2O-ratio for these rocks is ranging between 0,3 to 20. Basaltic tuffs and lava breccias indicate the contents of Na_2O as low as 0,15 wt % (K_2O/Na_2O=20).

Subhorizontal strata of thin granular quartzite's (0,5-2 m in thickness) are exposed as a screens among the basalts. Quartzites have the following composition: SiO_2 = 76,4-78,6 wt%, K_2O = 3,6-3,7 wt%, and Na_2O - 0,15 wt%. Remarkable enrichment in potassium may indicate that these rocks might have initially been formed as chemical sediments from the Na-poor water enriched in K and Si.

Pillow structures are typical for some of the plagioclase-porphyrites overlapping the quartzites. Spherical pillows having 0.5-1m across are encompassed by a thin, 0.01-0.05 m, film of fine-grained quartzites. Typically, the outer zone of the pillows are enriched in K_2O (3-4 wt %) and relatively poor in Na_2O (2,8-3,8 wt %) compared to their cores (Na_20 = 3.9-5.5, K_2O = 1.3-1.8 wt.%). In fact, K_2O/Na_2O increases from 0.33 up to 0.9-1.5 towards outer rim parts of the pillows. We suppose that these variations were caused by interaction between basaltic magmas erupted at the shallow-submarine environment with hot, K-rich, Na-poor water.

U-Pb conventional dating of zircons gave 1640±11 Ma upper intercept age for the quartz porphyries underlying the basalt plagioclase-porphyrites. The age of quartz porphyries of the overlying upper strata was previously well-constrained to be 1638±4 Ma (1). These data confirm that quartz porphyries of the island of Hogland were formed contemporaneously with the rapakivi granites of WB and SB.

The quartz porphyry of the upper strata have ε_{Nd} (T) = -1, similar to that in the rapakivi granites from WB and SB [2]. This indicates that rapakivi granites

and the upper quartz porphyries of Hogland might been derived from the same Svecofennian crustal source. Quartz porphyries of the lower strata gave ε_{Nd} (T) = - 4,8. It is likely, that initial magma for these rocks was derived from the mixed Archean and Proterozoic sources, similarly to the current interpretation of Sm-Nd-data for the rapakivi granites of 1.54 Ga Salmi batholith, Karelia [3]. At the same time, the quartz porphyries of the upper and the lower strata are nearly identical in chemical composition and REE patterns.

A pillow-like structures were recognized in the quartz porphyries on the north-east coast of the island. We suggest that felsic volcanites of Hogland might, at least in part, have been formed at the submarine conditions.

The quartz porphyries of Hogland are similar to the ovoid-bearing rapakivi granites of WB in a sense of their bulk composition and REE patterns. However, the porphyries described herein, are displaying unique proportions of K_2O (6-8,9 wt %) relatively to Na_2O (0,2- 0,75 wt %). Their K_2O/Na_2O-ratio varies from 10 to such high as 50, which substantially exceeds that in the rapakivi granites indicating approximately 2.

Abnormal proportions of alkalis in the quartz porphyries, taken together with field evidences such as presence of the pillow-like structures, are interpreted here as a consequence of the interaction between magmas and hot, K-rich, Na-poor water. Textural and chemical evidences supporting this idea were found also in the granite-gneisses of the basement which were metasomatically altered, overheated, recrystallized and, sometimes, partially molten due to heating conducted from the overlying volcanites. For example, the content of potassium and, in turn, K_2O/N_2O-ratio was extremely elevated in the granite-gneisses that underwent metasomatism, recrystallization and re-melting compared to those remained unaltered.

We assume that both regime of alkaline components in volcanites and reworking of the underlying granite-gneisses were caused by the water-magma, water-rock interactions. Our data allow us to speculate, that potassium-saturated hydroterms were formed due to release of fluids derived from the rapakivi-granite magma into waters of closed reservoir.

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The research described in this publication was made possible in part by Grant RFFI 97-05-65446.