First data on composition of volcanic rocks from the northern part of Sredinny Range, Kamchatka

***A.O.Volynets*[1], *M.M.Pevzner*[2]**

[1]*Institute of volcanology and seismology FED RAS, Petropavlovsk-Kamchatsky, Russia*

[2]*Geological Institute RAS, Moscow, Russia*

This study is focused on composition of volcanic rocks from the northernmost part of Sredinny Range of Kamchatka. Sredinny Range (SR) represents a back-arc of the present Kamchatka subduction system according to the most researches' opinion (Avdeiko et al., 2002; Churikova et al., 2001, etc.); Benioff zone is located at 350 km depth in the southern part of SR, beneath Khangar volcano, and is not observed further to the north (Gorbatov et al., 1997). Active volcanic front ends on the latitude of Shiveluch volcano. Nevertheless, recent geochronologic research revealed Holocene eruptions in SR up to 180 km to the north-north-west from Shiveluch: Spokojny volcano (N 58° 08', E 160°49') was active in early and middle Holocene, last eruption 5400 ^{14}C years B.P.; Nilgimelkin monogenetic lava field (N 57° 58', E 160° 39') was formed during fissure eruption 5500 ^{14}C years B.P.; X cinder cone (N 58° 10', E 160° 48') erupted 4000 ^{14}C years B.P.; and the youngest edifice, Tobeltsen cinder cone and lava flow (N 58° 15', E 160° 44'), were formed around 3500 ^{14}C years B.P. (Pevzner, 2006). Here we present first data on composition of major and some microelements of the volcanic rocks produced by Pleistocene eruptions of Spokojny volcano and surrounding monogenetic lava field, Pleistocene Snegovoj shield volcano; Holocene Nilgimelkin and Tobelsten monogenetic cinder cones and underlying Neogene lava flows.

All studied rocks belong to calc-alkaline medium- to high-K series and fall into the field of previously studied volcanic rocks from the other parts of Sredinny Range (Volynets et al., submitted; Volynets, 2006; Churikova et al., 2001). Most samples are basaltic andesites, with some basalts and andesites; products of Pleistocene Spokojny volcano and Neogene lavas, exposed in the upper part of Cherpokvejem River, are represented by dacites. Plateau-basalts are exposed in the upper part of Voyampolka River. Two trends can be identified on K_2O-SiO_2, MgO-CaO, Rb-MgO diagrams (Fig.1A). Holocene Tobeltsen and Nilgimelkin basaltic andesites, Pleistocene Snegovoj andesites, monogenetic lavas of the Voyampolka headwaters and andesitic monogenetic lava flow near Spokojny volcano compose first trend. These rocks belong to medium-K series; they have rather low Mg content (3.17-4.59 wt.% for basaltic andesites and 3.15-3.51 wt.% for andesites). Pleistocene monogenetic lavas of Spokojny volcano surroundings compose second trend. It is characterized by higher K_2O content (the samples are actually located on the margin between medium and high-K rocks), higher MgO (3.51 wt.% (andesite) -7.32 wt.% (basalt)). At the same MgO content, rocks, forming second trend, are slightly more CaO-rich. Spokojny' dacites are more alkali-rich and lye on the boundary of dacites and trachydacites on the classification diagram $Na_2O+K_2O - SiO_2$. A single sample of Neogene plateau-basalts from Voyampolka River is located on Harker diagrams between plateau-basalts from Left and Right Ozernaya Rivers and is similar to Right Ozernaya plateau-basalts by microelements content (Volynets et al., submitted, Volynets, 2006). In general, analyzed samples have the same concentrations of V, Cr, Co, Ni, Cu, Zn, Rb, Sr, Ba, Nb, and Y as previously studied volcanic rocks of Sredinny Range (Volynets et al., submitted; Volynets, 2006). Concentrations of fluid-mobile elements are more or less constant in all samples from basalts to andesites: Ba 400-700 ppm, Sr ~500 ppm, Rb 8-22 ppm. Due to the fact that Ba and Nb have similar partition coefficient in melt, but behave quite opposite way in fluid, Ba/Nb ratio does not depend on partial melting processes and immediately increases at fluid presence, so it can be used as indicator of fluid involvement. Most studied rocks have Ba/Nb 30-80 (Fig.1B), what means that these rocks contain moderate amount of fluid in the source. Neogene lavas and Pleistocene monogenetic lava flow in the Cherpokvejem River headwaters have higher Ba/Nb ratio: 168-202 and 123, respectively; this indicated substantial fluid influence to magma genesis in a zone, where no active subduction is registered by modern geophysical data. Nb/Y ratio in studied volcanic rocks varies in a wide range from 0,14 to 0,74 (Fig.1B). Lowest values are typical for Neogene lavas, both acid and basic. Higher Nb/Y ratio, observed in Pleistocene surroundings of Spokojny volcano and northernmost sampled sites, may be connected either with lower degrees of melting in the source, or with enrichment of the source with HFSE (which is also reflected in high Nb content in these samples: 13-18 ppm). Previous studies have shown, that OIB-like mantle source involvement in magma generation is necessary for explanation of the specific features (i.e. HFSE enrichment) of the SR volcanic rocks (Volynets et al., submitted, Volynets, 2006, Churikova et al., 2001). Available data for the north of SR do not allow making a well-reasoned conclusions regarding mantle, slab and/or other sources in magma genesis, and further research should be done; nevertheless, similarity of the geochemistry of the volcanic rocks from the north part of SR with the volcanic rocks from the rest of SR suggests relatively similar source composition and uniform melting process within the whole Sredinny Range. Therefore, presence of young (Late Pleistocene and Holocene) volcanic centers in the north SR and geochemical characteristics of their products, indicating involvement of slab component and OIB-like source in their genesis, again raise up a question of the geodynamic situation in this region.

This study was financially supported by RFBR grant 07-05-00536, 08-05-00092, FED RAS 09-III-B-08-465, Program 16 of RAS Presidium.

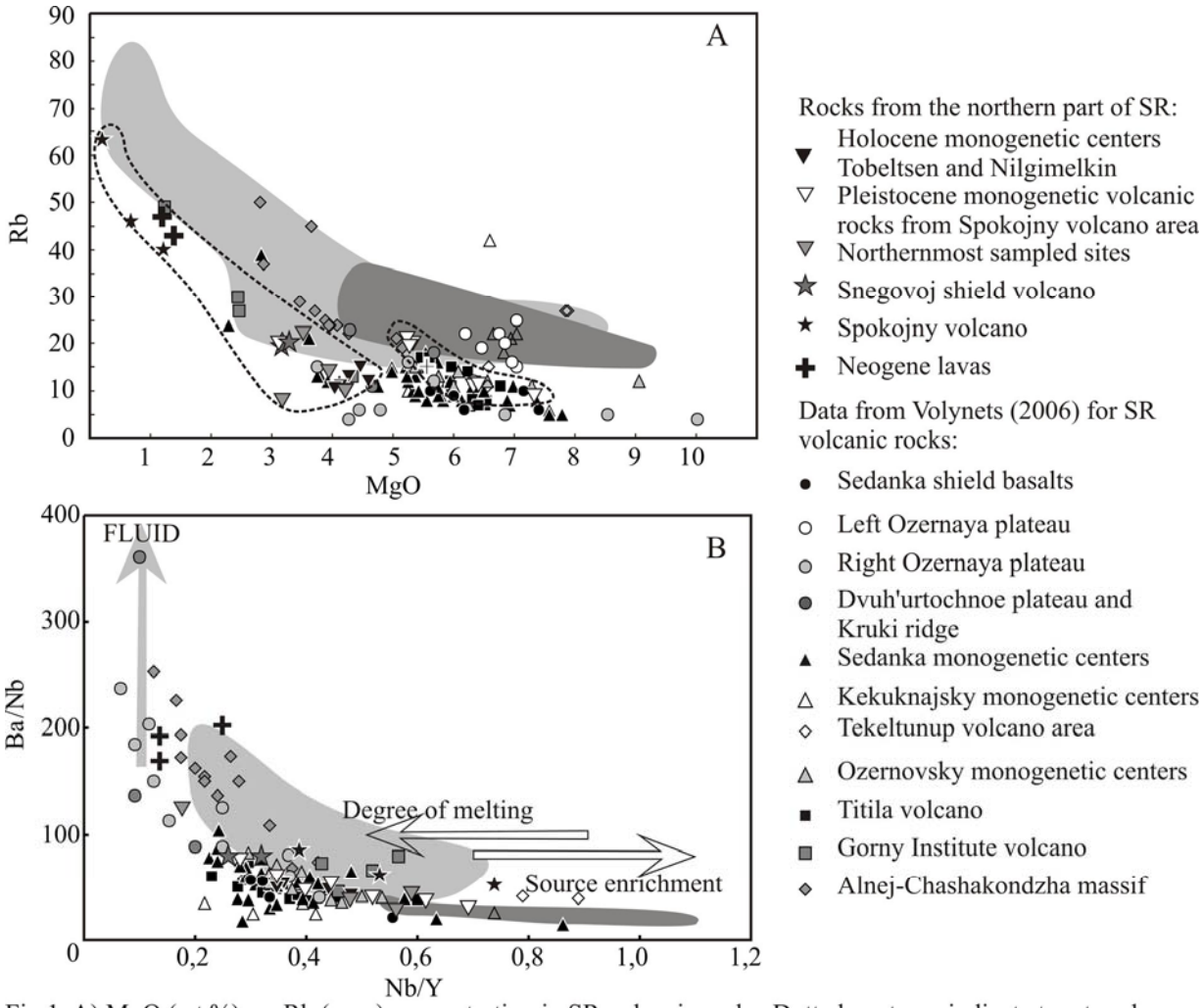

Fig.1. A) MgO (wt.%) vs. Rb (ppm) concentration in SR volcanic rocks. Dotted contours indicate two trends, observed for the northernmost sampled rocks.B) Ba/Nb vs. Nb/Y ratios in SR volcanic rocks. Data from Left Ozernaya plateau basatls are not included to the diagram B, due to much higher Ba/Nb ratio in these rocks (Ba/Nb >1000 at Nb/Y 0,04-0,11). Light gray field corresponds to reference data from SR IAB (island-arc-type basalts) ; dark gray field - Ichinsky WPB (within-plate type basalts) from (Churikova et al., (2001). Discussion see in text.

References:

Avdejko G.P., Popruzhenko S.V., Palueva A.A. Tectonic Evolution and Volcano-Tectonic Zoning of Kurile- Kamchatka Island-arc System // Geotectonic, 2002. Volume 4, p. 64-80 (in Russian)

Churikova T., Dorendorf F., Woerner G. Sources and fluids in the mantle wedge below Kamchatka, evidence from across-arc geochemical variation // Journal of Petrology, 2001. Volume 42 (8), p. 1567-1593

Gorbatov A., Kostoglodov V., Suarez G. Seismicity and structure of the Kamchatka subduction Zone // Journal of Geophysical Research, 1997. Volume 102 (B8), p. 17883 – 17898

Pevzner M. Holocene volcanism of the Northern Kamchatka: space and time aspects // Dokladi RAS, 2006. Volume 409, #5. P. 648-651 (in Russian)

Volynets A. Pleistocene-Holocene volcanism of Sredinny Range, Kamchatka: composition of rocks and geodynamic model. PhD thesis, Moscow, 2006, 145 p. (in Russian).

Volynets A., Churikova T., Woerner G., Gordeychik B., Layer P. Mafic Late Miocene - Quaternary volcanic rocks in the Kamchatka back arc region: implications for subduction geometry and slab history at the Pacific-Aleutian junction // submitted to Contributions to mineralogy and petrology.