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Volcanic rocks of the Mendeleev Ridge (Arctic Ocean) – evidences for existence of the large igneous provinces within Arctic region: on the data of the High Arctic Russian Expedition "Arctic-2012"

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During the complex geological-geophysical survey within August-October 2012 cruise of the Russian Expedition "Arctica-2012" on 9 sampling station (dredge, box-corer, drill-core) spaced on 450 km from the south to north alongside the Mendeleev Ridge were recovered more than 100 kg submarine volcanic rocks (which is represented about 10-15% of the total recovered bottom material), from calc-alkaline basalts, normal and subalkaline tholeites till andesite-dacites, typical lavas with glassy matrix and volcanic breccias, tuff-breccias and subvolcanic dolerites. We have studied 4 volcanic samples which are drill-cored (30-60 cm) of basement rocks at the depths of 2000-2500 m (79° and 83°N) or consolidate fragments of 30 kg weight collected at the steep escarpments with >45° slopes, three of them are tholeitic basalts (SiO_2: 45.4–50.7, $Al2O_3$: 13.7–21.7, MgO: 3.4–4.8, TiO_2: 2.5–2.8, CaO: 4.7–11.4, $Fe2O_3$: 5.9–14.4, Na2O: 2.9–3.8, K2O: 0.5–2.1 %), but the other one – is tuffobreccia with angular fragments of crystallized basalts and dolerites, and hydrated carbonatized (LOI up to 20%, 2 – 35%) matrix. Isotopic and geochemical characteristics of the sample studied (low degree of REE fractionation: Cen/Ybn 1.6-2.2, moderate enrichment of HREE – 10-15×1, low ratios of highly incompatible trace elements: Th/Ce = 0.03–0.04, Th/Nb = 0.14–0.16, Ce/Nb = 1.0–4.1) are very similar to those of high-Ti alkaline basalts of continental traps (CFB) connected with large mantle plume activities [Arndt et al., 1998; Hofmann, 1988] and close to the earlier discovered basalts from Chukcha borderland [Mukasa et al., 2009, 2012]. Measured Sr, Nd Pb isotope compositions of basalts vary from moderately enriched to moderately depleted compositions (143Nd/144Nd= 0.512706 – 0.512887, 87Sr/86Sr=0.704127–0.708580, 206Pb/204Pb=18.66–19.07, 207Pb/204Pb= 15.51–15.65, 208Pb/204Pb=38.42–39.20), reflecting different stages of secondary alterations, melt contamination by sedimentary material of host rocks and progressive magmas evolution during mixing of asthenospheric substances of the upwelling plume with the lithospheric component. Relatively high-radiogenic osmium isotope composition of the studied basalts (187Os/188Omeas=0.51525-1.07316) indicates the presence of significant share of the enriched lithospheric component in the source of basalt melts and the formation of this source at expense of relatively aged substances (model Re-Os ages from 600 to 1200 Ma).

Age determination of the studied basalts effusions by argon-argon method is ongoing process but we have separated about 30 zircon grains mainly magmatic appearance (Th/U=0.6-2.0, long-prismatic grains without any visible signs of digestion and recrystallization, and overgrowths) from 4 samples and determined their U-Pb SHRIMP ages. Obtained age clusters indicate existence of old sialic basement underlying Mendeleev Ridge rocks (captured zircons with the ages of 2.7, 1.9, 1.6 and 0.8-1.2 Ga), which composition could be correlated with continental complexes of the Eurasia margins. At the same time, the finding of the volcanogenic zircons within the basalts with the ages of 127 and 260 Ma does not exclude the plausible existence on the studied territory of Polar Arctic of basalt effusions of two (or more) of igneous complexes corresponded with activities of mantle plumes – Cretaceous-Cenozoic (HALIP) and Triassic-Permian (resembling Siberian traps) ages