The age of basalts and gabbro-dolerite of the Mendeleev Rise (the Arctic Ocean) from data on zircon U-Pb dating

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The problem of the structure, material composition and the history of the Arctic Ocean (AO) floor is widely debated and currently central. New geological and geophysical data indicate that the floor of the Eurasian part of the Arctic Ocean overlays the crust of oceanic type, and Lomonosov Ridge and Chukotka Plateau are blocks of continental crust. The nature of Alpha-Mendeleev Ridge still remains a topic of keen discussion.

New data are discussed on U-Pb dating of zircons from basic and intermediate magmatic rocks sampled in 7 sites of Mendeleev Rise during the expedition „Arktika-2012". First estimates of the age of those rocks appeared to be extremely contradictory and uncertain. In the basalts from the bedrocks, U-Pb age of zircons varies in a wide range: 127.5; 260; 668; 950; 1650, 1900 and 2700 million years. A similar range of U-Pb ages is noted in zircons from gabbro-dolerite fragments 288 ± 6; 500 ± 5; and 761 ± 3 (Morozov *et al*., 2013). Dating the same rocks with the use of $^{40}Ar/^{39}Ar$ method (Vernikovskiy *et al*., 2014) showed a narrower range of values (259 ± 13 – 471.5 ± 18.1 million years), which allowed the authors to state PZ1 age for the Mendeleev Rise.

To solve this problem, we studied zircons from bedrock basalts that were drilled at a depth of about 2600 m and from gabbro-dolerite dragged from the slopes of Mendeleev Rise. Preparation of zircon samples separated from the above-mentioned rocks was conducted with the use of conventional methods; U-Pb analyses were carried out in TsII VSEGEI with multi-collector secondary ion high resolution mass-spectrometer SHRIMP II. Differences are noted between young and old zircons in morphology and habitus (Opt) as well as in the inner structure (cathodoluminescence – CL). The former are characterized by prismatic form of crystals, oscillatory zoning, frequent sectors in CL, missing cracks and insufficient amount of inclusions (crystals may be both rounded and for the major part unrounded). Whereas ancient zircons are elongated or elongated prismatic, have forms close to isometric, show cores in CL, roundness and considerable fissuring.

Histograms of U-Pb age of zircons and Arens-Veseril diagrams for bed-rock basalts (Fig. 1. a, b) and gabbro-dolerite fragments (Fig. 1. c, d) are demonstrated. According to the data obtained, concordant age of young zircons from bedrock basalts 128.13 ± 1.3 million years corresponds to their crystallization stage and synchronous volcanism K1 abundant both in rises and islands of the Arctic Ocean. Concordant U-Pb age of late magmatic zircons from gabbro-dolerite fragments is 151 ± 2 million years and corresponds to J-T times of trapp magmatism in Siberia.

The studies of isotopic composition of Nd and Sr in these rock groups (Kremenetsky *et al*., 2014) showed the difference of basalts (ε_{Nd}(T) from +4.3 to +7.0; $^{87}Sr/^{84}Sr$ from 0.70365 to 0.7049) from gabbro-dolerite (ε_{Nd}(T) from – 33.1 to +2.9; $^{87}Sr/^{86}Sr$ from 0.7050 to 0.7233), and thus confirmed that the source of bed-rock basalt matter of Mendeleev Rise had been mantle melts, which, as distinct from MORB, were formed with melting of enriched mantle in continental conditions.

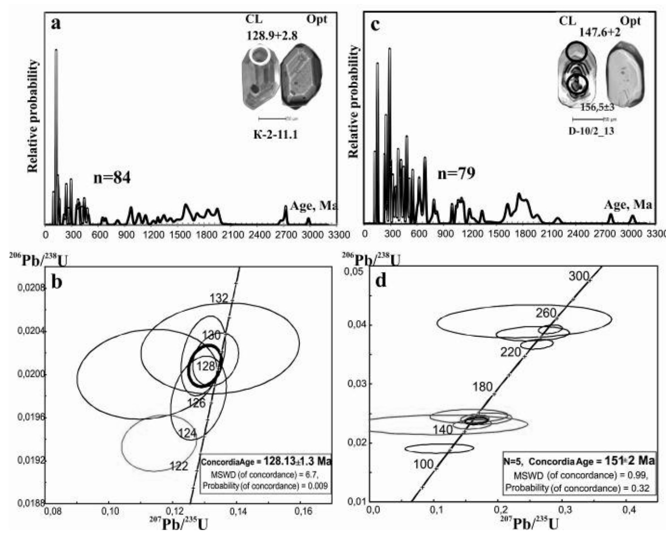

Fig. 1.: Age probability plots of U-Pb datings and diagram of Arens-Veserill with concordia of zircons from the bedrock basalts (a, b) and gabbro-dolerite (c, d).

Beside the age values characterized above, in both groups, more ancient polychronous peaks are recorded (Fig. 1. a, c) (450; 654; 1132; 1756 and 2795 million years), zircon U-Pb ages close to them (400; 700; 1100; 1650 and 2600 million years) from basalts, gabbro and alkaline volcanic rocks raised from the floor of the Central Atlantic. This may have been a consequence of contamination with young mantle melts of the ancient mantle fragments in the newly formed oceanic lithosphere or fragments of the ancient complex of the core base of the modern Atlantic Ocean.

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