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Detrital zircons of deep-sea sediments of the Arctic ocean – key to the understanding of High Polar Arctic tectonics

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Zircons from sedimentary rocks bear the information on composition of vast territories often inaccessible for geologic investigation but which are the source of material. The studies of modern beaches and fluvial deposits demonstrate the efficiency of reconstruction of composition and distribution of rock types based on clastic zircon characteristics (Zircon, 2003).

We have studied nine 0,5 kg specimens (every meter) from gravity-corer sample of deep sea-bottom sedimentary cover within the Geophysicists Spur region (Lomonosov Ridge) which represent first 9 meters of the section formed during 70 000 years. Heavy fraction is composed by garnet, tourmaline, titanite, rutile and by 200-300 grains of zircon per sample. Zircons in all samples are different in morphology and inner structure: from faceted needle-like to perfectly rounded, from colorless to brown opaque, with thin growth zones and inherited cores, as well as homogeneous.

U-Pb SIMS SHRIMP isotope dating (50 grain analyses for each sample) was applied to two key specimens from the depth of 12-14 and 505-507 cm. The age probability distribution diagrams show that the main age peaks are of 138-147, 200-300, 400-800 and 1845-2000 Ma; few grains of 2700 Ma and one grain is 3000 Ma old. Our previous data for the zircon age distribution for box-corer sample of hemipelagic sediment from the North Pole (Grikurov et al., 2011) revealed peaks of 160, 200-450 (max 260-300 Ma), 800, 1855, 2000 and 2600 Ma.

Zircons from three samples above show common features: 1) presence of Archean grains (>2400 Ma), 2) defined age peak of 1800-2000 Ma (ca 30% of grains), 3) lack of Grenvillian age zircons, 4) youngest ages of 40-160 Ma. Thus, all three studied samples have very similar provenance source, the deposition time of sandstones, from which had mainly formed the modern (<30 000 years) sediments, is Jurassic ($\leq$140-160 Ma). About 50% of analyzed zircons falls to the age interval 200-500 Ma. However, grains distribution is appreciably different for Polar sample (200-450 Ma) and Geophysicists Spur (200, 300, 400-600 Ma).

It is known, that formation of modern deep-sea sediments takes place mainly due to fluvial discharge (ca 90%), erosion of oceanic bedrocks and coastal beaches. Wind-borne component and extraterraneous dust are not significant (<1%). Transportation of continental material by icebergs (ice-rafted debris) is added to these sources in polar areas. Well-known Permian-Triassic sandstones of Arctic coast (including polar islands) are defined by the presence of Grenvillian age zircons – Canadian Arctic, Alaska, Greenland (Miller et al., 2006), while Jurassic-Cretaceous sandstones of the South Anjui Zone, Chukotka and New Siberian Islands of Russian Arctic (Miller et al., 2008) have clastic zircon with ages very similar to the obtained by us for deep-sea sediments. We suppose that modern deep-sea sediments were formed either due to ablation of these sandstones with distal transportation of detritus (highly unlikely), or due to weathering of similar rock of oceanic highs of Lomonosov Ridge. The last is more realistic because the similarity of the Lomonosov Ridge and north-east continental Arctic is proved by geophysical data (Jokat et al., 1992).