The duration and stages of the Malaya Pana and Fedorovskoe deposits formation: Geochronologycal U-Pb zircon data (Kola Peninsula)

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The Kola Peninsula is one of the unique geological provinces both in Russia and in the world, where Pt-Pd Fedorovskoe and Malaya Pana deposits contained first hundreds of tons of estimated platinum metal resources have been discovered. The deposits belong to the Pt-bearing Fedorovo-Pansky layered intrusion which is situated in the central part of the Kola Peninsula and is one of 14 major Early Proterozoic layered massifs of the Northern belt occurring at the border between Early Proterozoic volcano-sedimentary rift sequences and Archaean basement gneisses.

The U-Pb zircon ages of the massif evolution stages corroborate the geological-petrological conclusions made on the basis of prospecting works on the long-time and polyphase history of the Fedorov-Pana massif. The following isotope-geochronological data have been defined: 2526 – 2516 Ma – pyroxenite and gabbro of the Fedorovskoe deposit magma chamber, 2515 – 2518 Ma – Pt-bearing gabbro of Federovskoe stratiforme deposit; 2501 – 2496– 2485 Ma [1] – gabbro-norite and gabbro of the main phase of the Malaya Pana magma chamber and disseminated platinum-metal mineralization and relatively rich Cu-Ni sulphide mineralization in the basal part of the Malaya Pana and Fedorovskoe non-stratiforme deposits; ca. 2470 Ma [1] – pegmatoid gabbro-anothosite and, probably, fluid-associated rich platinum-metal ores of the Lower Layered Horizon (Malaya Pana deposit); ca. 2450 Ma [1] – anorthositic injections and, probably, local lens-like rich Pt-Pd accumulations of the Upper layered Horizon (Malaya Pana deposit).

The research is performed under the support of grants RFBR № 07-05-00956 and ofi-a № 05-05-08208, SciSchool – 1413.2006.5, State contract with the Federal agency of science and innovations № 02.445.11.7403.

[1] Bayanova (2004) S.-Peterburg.: Nauka. 174 P.

A genomic, stable isotopic, and organic geochemical analysis of freshwater microbialites

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Actively forming modern microbialites in the $PO_4^{=}$-limited waters of the Cuatro Ciénegas (CC) basin in northern Mexico provide a unique analogue to the ancient stromatolites of early Earth. Initial petrographic observation of these modern microbialites reveals 5 visually-distinct, sub-millimeter scale layers that show varying color and texture and increasing carbonate abundance with depth. In this study, we have employed genomic, stable isotopic, and organic geochemical techniques to better understand community structure, nutrient cycling processes, and the preservation of isotopic and organic geochemical signatures in the 5-layers of the living freshwater microbialites from CC.

Culture independent metagenomic and 16S rRNA gene analyses of bacteria and archaea have enabled us to construct a well-developed representation of the microbial community structure and function. Results depict a community dominated by cyanobacteria and proteobacteria, whose coordinated autotrophic and heterotrophic metabolic activities create microenvironments favorable for carbonate accretion. Stable isotopic analysis of the intracrystalline organic matter reveals C, N, and S profiles that support the genomic work, further suggesting the co-occurrence of autotrophic and heterotrophic organisms and aerobic and anaerobic nutrient cycling processes, including denitrification and sulfate reduction. $\delta^{13}C$ values of $CaCO_3$ from the 5 layers decrease with depth reflecting the progressive incorporation of increasing amounts of respired carbon released during the remineralization of cyanobacterially-derived biomass.