The Neoproterozoic alkaline rocks of the Yenisey Ridge, western margin of the Siberian Craton: Mineralogy, geochemistry and geochronology

I.V. VERNIKOVSKAYA[1,2], E.B. SAL'NIKOVA[3], A.E. VERNIKOVSKAYA[2], N.YU. MATUSHKIN[1,2] AND A.M. YASENEV[1,2]

[1]Novosibirsk State University, Russia, (visit_irena@mail.ru)
[2]Institute of Geology and Mineralogy, Russian Academy of Sciences, Novosibirsk
[3]Institute of Precambrian Geology and Geochronology, Russian Academy of Sciences, St. Petersburg

The Srednetatarka alkaline massif is composed of ijolites, forming the central zone and foyaites making up the outer ring area. These medium to course grained rocks were intruded by pegmatite dikes. The main minerals are alkali feldspar (mainly microcline), nepheline, aegirine (or aegirine-augite), alkali amphibole (mainly arfvedsonite) ± lepidomelane, ± eudialyte, ± astrophyllite-kupletskite. Among accessory minerals there are titanite, fluorite and zircon.

Enrichment of Zr, Nb and Ce in titanite and astrophyllite-kupletskite from foyaites was discovered using electron microscope investigation and x-ray spectroscopic analyses. The water enriched fluid inclusions in fluorite from ijolite have homogenization temperatures from 175 ºC to 200 ºC. Thus, the crystallization of fluorites was in the postmagmatic stage of the Srednetatarka massif formation.

The rocks of the Srednetatarka massif are highly fractionated and enriched in Rb, Th, U, Nb, Ta, Hf, Zr, Tb and Y, and depleted in Ba, Sr, P and Ti. They also have large REE contents (∑REE = 123 - 362 ppm), LILE enrichment (La_N/Yb_N=8-16) and negative Eu anomalies (Eu/Eu* changes from 0.2 to 0.9).

The Srednetatarka foyaite yielded a U-Pb titanite age of 698±2 Ma. Together with the previously-dated 696 Ma (Ar-Ar, biotite) trachydolerite of the Zakhrebetninsk complex (Postnikov, 2005), these intrusive rocks are the oldest alkaline rock of the Yenisey Ridge which could be formed in anorogenic setting.

One of the most interesting facts about these alkaline rocks is that Nb, Ta, Zr mineralization and a Al deposit associate with the Srednetatarka massif.

References

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Hf and Nd isotopic composition of sediments, old and new

J.D. VERVOORT[1], T. PLANK[2], P.J. PATCHETT[3] AND J. PRYTULAK[4]

[1]School of Earth and Environmental Sciences, Washington State University, Pullman, WA 99164, USA (vervoort@wsu.edu)
[2]Department of Earth Sciences, Boston Univ., Boston, MA, 02215, USA (tplank@bu.edu)
[3]Department of Geosciences, University of Arizona, Tucson, AZ, 85721, USA (patchett@email.arizona.edu)
[4]Department. of Earth Sciences, Univ. Bristol, Bristol, UK, BS8 1RJ (j.prytulak@bristol.ac.uk)

We examine the Hf and Nd isotopic data for over 200 sediment samples in order to constrain Lu-Hf and Sm-Nd isotope systematics in the silicate Earth. The samples we have analyzed include sediments preserved on the continents and deposited in the ocean basins previously published [1] as well as unpublished data from >120 samples from 14 DSDP and ODP sites, chosen to represent the full range of sediment types and depositional environments. The most striking feature of the sediment data, as previously noted [1], is the strong positive correlation between Hf and Nd isotopes in these diverse terrigenous sediment samples. This sediment Hf-Nd array is coincident with the Hf-Nd mantle array as defined by MORBs and OIBs and collectively has been termed the terrestrial [1] or crust-mantle array. This array radiates from a depleted end-member with radiogenic Nd and Hf (ε_{Nd} ~10; ε_{Hf} ~16) toward evolved crustal values with very negative ε_{Nd} and ε_{Hf} values and represents mixing between components derived from the depleted mantle and components derived from continental crust.

The most prominent exceptions to this array, noted in the early Hf-Nd work on sediments [2,3], are ferromanganese crusts and nodules and metalliferous clays, which lie along a shallow slope above the terrestrial array. This anomalous array of authigenic sediments appears to represent, at least in part, the isotopic composition of seawater. This "seawater array" most likely results from the preferential dissolution of high Lu/Hf phases that are easily weathered such as apatite in old continental crust [4,5]. Regardless of the deviation from the terrestrial Hf-Nd array by metalliferous sediments and seawater, the tight coherency of the sediment Hf-Nd array with the OIB array indicates efficient mixing within the mantle through convection and on the Earth's surface through diverse sedimentary processes, and also effective transfer between the two through the recycling of crustal materials via subduction zones.

Referneces

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