Lithospheric control of the DUPAL anomaly in the northern hemisphere: case study of the Early Miocene basalts of the East Sayan, Siberia

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The DUPAL anomaly, named after Dupré and Allègre, has been originally described for Indian MORB and some other basalts of the southern hemisphere with elevated $^{208}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ at given $^{206}Pb/^{204}Pb$ relative Atlantic MORB. There are contrasting views on its origin with the following hypotheses: (1) the DUPAL is due to a crust-mantle differentiation event and the DUPAL basalts are sourced by low mantle plumes, (2) the DUPAL is due to focussed subduction and the DUPAL basalts are sourced by recycled slab material, (3) the DUPAL is due to lithospheric delamination and the DUPAL basalts are sourced by recycled low crustal material. Beyond the southern hemisphere the DUPAL type basalts were also found in several regions of the northern hemisphere – the East Sayan, Siberia is an example. The DUPAL like anomaly was reported there for the Early Miocene volcanic rocks erupted within the so-called Late Neoproterozoic Tuva-Mongolia massif, whereas coeval basalts erupted within younger lithospheric blocks lack the isotopic signatures of the DUPAL anomaly. In this study we report new data on a profile of the Early Miocence basalts (15.1-17.3 Ma by K-Ar method), which crosses the boundary of the Tuva-Mongolia massif from the side of the Early Precambrian Siberian Craton. It appeared that lead isotope signatures sharply change at the boundary between the Tuva-Mongolia massif and the Siberian Craton. The basalts on the cratonic side are characterized by truly DUPAL lead isotope signatures, whereas the basalts on the side of the Tuva-Mongolia massif have elevated $^{208}Pb/^{204}Pb$ but normal for the northern hemisphere $^{207}Pb/^{204}Pb$. Sr-Nd-isotope and trace element signatures are not that pronouncedly different in basalts of the two lithospheric blocks. Our results suggest that the DUPAL anomaly in the East Sayan is of lithospheric origin, as probably elsewhere in the northern hemisphere.

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