Geophysical Research Abstracts
Vol. 12, EGU2010-5495-2, 2010
EGU General Assembly 2010


# Origin of Siberian Large Igneous Province : link between petrology and geodynamics

A. V. Sobolev (1,2,3)

(1) Max Planck Institute of Chemistry, Geochemistry, Mainz, Germany (alexander.sobolev@mpic.de, +49-(0)6131-371351), (2) Vernadsky Institute of Geochemistry, RAS, Moscow, Russia, (3) LGCA, University Joseph Fourier, Grenoble, France

The composition of parental melts and their mantle sources were recently reconstructed for different types of Siberian Flood basalts [1] and meimechites [2] based on the compositions of olivine phenocrysts and their melt inclusions. It was shown that mantle source of early flood basalts (Gudchikhinskaya suite) was composed entirely from olivine-free pyroxenite, produced by reaction of recycled oceanic crust and peridotite. The composition of these lavas suggests that they were likely produced at depths of more than 130 km. However, in a very short time (150 m or 5% of lava column) afterwards the source composition of lavas (Tuklonskaya suite) has drastically changed incorporating up to 60% of peridotite. In addition, source of lavas has moved upwards to the depths of less than 70 km, where the major volume of Siberian traps have been produced. These observations suggest very fast, even catastrophic removal of at least 60 km of lithosphere, which led to massive melt production.

Based on experimental and modeling results it was suggested that a Permian–Triassic plume, with potential temperature of up to 1650ºC transported a large amount of recycled ancient oceanic crust (up to 15-20%) as SiO2-oversaturated carbonated eclogite. Low-degree partial melting of eclogite at depths of 250–300 km produced carbonate-silicate melt that metasomatized the lithospheric roots of the Siberian shield. Further rise of the plume under relatively attenuated lithosphere (eg. 130-140 km in Norilsk area) led to progressive melting of eclogite and formation of reaction pyroxenite, which then melted at depths of 130–180 km. Consequently, a large volume of melt(Gudchikhinskaya suite) penetrated into the lithosphere and caused its Relay-Taylor instability and destruction. Delaminated lithosphere that included fragments of locally metasomatized depleted harzburgite subsided into the plume and was heated to the temperatures of the plume interior with subsequent generation of meimechite magma. Meimechites showed up at the surface only under thicker part of the lithosphere aside from major melting zone above because otherwise they were mixed up in more voluminous flood basalts.

I further show that meimechites, uncontaminated Siberian flood basalts and kimberlites all likely share the same source of strongly incompatible elements, the carbonated recycled oceanic crust carried up by hot mantle plume.

References:
1. Sobolev, A.V., Krivolutskaya N.A., and Kuzmin, D.V. (2009). Petrology of the parental melts and mantle sources of Siberian trap magmatism. Petrology, 17 (3), 253-286.
2. Sobolev, A.V., Sobolev, S.V., Kuzmin, D.V. , Malitch, K.N., and Petrunin, A.G. (2009). Siberian meimechites: origin and relation to flood basalts and kimberlites. Russian Geology and Geophysics, 50, 1–33.