Geophysical Research Abstracts
Vol. 13, EGU2011-12232, 2011
EGU General Assembly 2011

Magma dynamics in the Siberian LIP

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The Siberian enormous igneous province contains the world's second richest ore deposits and is linked directly to the most devastating mass extinction. Rocks of two distinctly different magma series are present in the province. The low-Ti tholeiites are continental flood basalts with remarkably restricted, petrologically evolved compositions. They contain moderate concentrations of incompatible trace elements, moderate fractionation of incompatible from compatible elements, distinct negative Nb-Ta anomalies, and εNd values of 0 to +2. The primary magmas were derived from a relatively shallow mantle source, and evolved in large crustal magma chambers where they acquired their relatively uniform compositions and became contaminated with continental crust. The high-Ti series comprise a wide range of rock types, from meymechite and picrite to trachytes, with a wide range of compositions (MgO from 0.7 to 38 wt%), high concentrations of incompatible elements and extreme fractionation of incompatible from compatible elements. These rocks lack Nb-Ta anomalies and have a broad range of εNd values, from -2 to +5. The parental magmas formed by low-degree melting at extreme mantle depths. Low densities imparted by high volatile contents led them to bypass the large crustal magma chambers and ascended rapidly to the surface. Interaction of the tholeiitic magma with crustal wall rocks was instrumental both in the formation of the ores and the environmental impact: assimilation of sedimentary sulfate triggered the segregation of ore sulfide and release of a cocktail of greenhouse and toxic gasses (CO2, CO, SO2, halocarbons) caused the mass extinction.