Geophysical Research Abstracts
Vol. 13, EGU2011-1488, 2011
EGU General Assembly 2011

Origin and development of the Earth's core: Evidence from the Earth's tectonomagmatic evolution and paleomagnetic data

Evgenii Sharkov

Institute of Geology of Ore Deposits, Petrograpgy, Mineralogy and Geochemistry RAS, Petrology, Moscow, Russian Federation (sharkov@igem.ru)

Cardinal change of tectonomagmatic processes occurred on the Earth in interval from 2.35 to 2.0 Ga, when typical for the early Precambrian (Archean and early Paleoproterozoic) high-Mg mantle-derived magmas were substituted by geochemical-enriched Fe-Ti picrites and basalts, typical for the Phanerozoic within-plate settings and practically absent earlier. New type of magmatic melts, appeared in the Middle Paleoproterozoic, was characterized by elevated and high contents of Fe, Ti, Cu, P, Mn, alkalis, LREE, and other incompatible elements (Zr, Ba, Sr, U, Th, F, etc.). Thus, in this time absolutely new material began to involve in tectonomagmatic activity. Where this material was stored and how it was activated?

From our point of view, the established succession of events could be provided only by a combination of two independent factors: 1) the Earth originally was heterogeneous, with silicate mantle and primordial iron core, i.e. formed due to the heterogeneous accretion, and 2) the downward heating of the Earth (from the surface to the core) was occurred and accompanied by the cooling of its outer shells.

However, according to paleomagnetic data, the magnetic field on the Earth alreadexisted about 3.45 Ga (Tardino et al., 2010). Because a new substance began to take part in tectonomagmatic processes much later, it is considerated that liquid iron, responsible for the magnetic field in Paleoarhean, derived from chondrite material of the primary mantle, how it is suggested in homogeneous accretion model. This iron in form of a heavy eutectic Fe + FeS liquid flowed down and accumulated on the surface of still cold solid primordial core, generating the magnetic field, but was not participate in the geodynamic processes. Only melting of the primordial iron core, which occurred later, had led to the dramatic change in the development of our planet.

So, geological-petrological and geochemical (absence of chemical equilibrium between the Earth's core and mantle, etc.) data available testifies that the material of primordial iron core was substantively differ from iron of chondrite origin. So, the modern Earth's core was formed after full melting of the primordial core and mixing the both materials by convection, which occurred only in the middle Paleoproterozic.