Finite speed of mantle homogenization and Hf-W assessments of the Earth's core age

YURI A. KOSTITSYN, ELENA V. BIBIKOVA AND ERIC M. GALIMOV

Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow, Russia (kostitsyn@geokhi.ru)

Assessments of the core formation time based on Hf-W isotopic system vary from 45±5 Ma [1] to about 30 Ma [2] since CAI creation depending of the assumptions of initial $^{182}Hf/^{180}Hf$ and some features of the core segregation styles. Another important connivance for such calculations is that all the mass of the proto-earth material had been separating to silicate and metal phases homogeneously, or produced W isotopic heterogeneity of mantle rocks was erased very fast, for first millions of years. If it was not the case, above assessments of core formation time are highly underestimated.

Observed long-term Pb-Sr-Nd-Os mantle isotopic heterogeneity, having mean age about 1.8 Ga, imply impossibility of fast isotopic homogenization of mantle as a whole, even at much higher temperature and partially melted state.

In contrast to short-living isotopic systems using of U-Pb system does not yield a significant shift in mean core formation age calculation. Effective time of the core formation is about 120 Ma that is based on lead model age of MORB.

Numerical modelling was used to test various scenario of one- and two-stage prolonged core formation without fast mantle isotopic homogenization. In two-stage models the first stage could be related with primary metal segregation and the second one – with Fe^{2+} disproportionation on silicate Fe^{3+} and metallic Fe^0 [1, 3].

Both ^{142}Nd anomalies in ancient rocks of West Greenland [4] and Pb-Pb isotopic system in rocks and feldspars of West Greenland [5] evidence that the first “basaltic” crust was formed no later than 4.3 Ga ago. At this stage water was only on the surface of the Earth. The process of gradual oxidation initially highly reduced mantle became a driving force for the ascent of the first plums formed at the core-mantle boundary. Later melting of hydrated basaltic crust under the influence of ascending plums produced first tonalitic crust after 4.0 Ga.

[1] Wood B.J. & Halliday A.N. (2005) *Nature.* **437,** 1345-1348. [2] Jacobsen S.B. (2005) *Annu. Rev. Earth. Planet. Sci.* **33,** 531-570. [3] Galimov E.M. (2005) *EPSL* **233,** 263-276. [4] Caro G. *et al.* (2006) *GCA* **70,** 164–191. [5] Kamber B. (2003) *CMP* **145,** 25–46.

Adsorbophysical fields and atmosphere composition

O.B. KOTOVA

Institute of Geology, Uralian Branch, Russian Academy of Sciences, Syktyvkar, Russia (kotova@geo.komisc.ru)

New Method of Atmosphere Composition Formation

Our new method of the atmosphere composition formation presents a model of natural processes taking place during photoradiation of the gas-mineral system. Adsorbophysical fields of gas-mineral system [1] and correlation between molecular processes in gas phase and atomic processes in a mineral adsorption phase and electronic processes in the mineral itself were studied. For example, during irradiation of oxygen-fine-dispersion mineral systems many ionic forms can be formed. These ionic forms define all consequent natural processes (see Fig. 1).

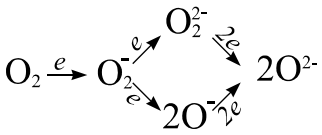

Figure 1: Ionic forms in radiated oxygen-mineral system

Discussion of Results

It was experimentally shown that surface reconstruction by photostimulated defect formation is characteristic of oxide containing fine-dispersion mineral systems. During reconstruction, gas phase oxygen can compete with moving oxygen ions of oxygen containing fine-dispersion mineral system lattice if it captures energetically beneficial position. Thus, minerals could be generators of oxygen and other molecules from atmosphere. We revealed mechanism of transformation of lattice oxygen into free form atmosphere oxygen through adsorbed forms. Contrary reaction is also possible.

[1] Kotova (1999) *Terra Nova* **10.**