

U and Th deficit in primitive mantle xenoliths and the nature of core power activity

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The goal of this study was to check the hypothesis according to which the core energy activity is due to radioactive decay of U and Th contained in the core. The idea of such checking consisted in the following: to identify xenoliths of the geochemically closed primitive mantle (PM) material, to determine concentration of U and Th in them and using balance calculation to estimate the content of these elements in the core which is a complementary reservoir to the PM. Original analytical data for 53 mantle xenoliths together with the numerous published data were analyzed. The material of geochemically closed PM was identified on the basis of MREE and HREE concentration, Al/Mg, Ca/Al, Mg/Si, Sr/Mg ratios and isotope composition of Pb and Os. Concentration of U (13-36 ppb) and Th (37-59 ppb) in such material is similar to that in chondrites, but lower than concentration of these elements, which would take place in silicate shell formed from chondrites after segregation of the core devoid of U and Th content. This deficiency is most distinctly apparent if to compare the U and Th concentration observed in the PM xenoliths with that in the silicate shell produced from CV-chondrites. All this allows us to assume that deficient elements of the primitive mantle are located in the liquid core complementary to it. The balance calculation showed that, according to the results obtained, the U concentration in the core corresponds to 19 ppb at initial concentration of uranium for Bulk Earth like that in C1 and 25 ppb at this initial concentration like that in CV. According to the calculations [1], such U content is high enough to generate a thermal energy from 3 up to 4.5 TW out of 7 TW attributed to the core. Taking into account that the estimated U and Th concentration in the core corresponds to the minimal value (because their content in the PM may be overestimated due to some contamination of xenoliths by hosted basalt) the hypothesis of the core power activity generated by radioactive decay of U and Th looks valid.

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Reference

[1] Malavergne V., Tarrida M., Combes R., Bureau H. (2005), *Lunar and Planet. Sci.* **XXXVI**, 1823.

A mechanism of fluid transport through minerals

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Previous explanations for the movement of aqueous fluids through rocks have concentrated on the availability of pre-existing pathways, such as grain boundaries and stress fractures (Kostenko *et al.*, 2002). Such pathways undoubtedly play a major role in allowing easy access for fluid transport. However, there is a lot of evidence that fluids migrate through minerals, which are reactive in the presence of an interfacial fluid layer (Putnis *et al.*, 2005; Putnis and Putnis, 2007). Using time-lapse photography, fluid movement through a single crystal of a simple salt is observed at room T and P and presents a model for more complex mineral systems, showing similar textural and compositional equilibration features. The pseudomorphic replacement of one phase by another is characterised by the development of porosity in the product phase. This porosity provides the pathway for mass transport through the parent phase, which is replaced by the product at a moving interface within the mineral during an interface-coupled dissolution-precipitation replacement process. Replacement textures commonly occur in relation to fluid-driven regional metamorphism and large scale metasomatism e.g the gabbro - to eclogite facies transition, western Norway (John *et al.*, 2007), serpentinization and rodingitization of the oceanic lithosphere and scapolitization of gabbro (Austrheim *et al.*, 2007), suggesting that dissolution-precipitation is an important mechanism behind large-scale metamorphic and metasomatic processes.

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