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Evolution of lithospheric mantle of the East Antarctic craton: Os isotope composition and PGE distribution in spinel lherzolite xenoliths

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Mantle xenoliths of lherzolite composition from Mesozoic alkaline-ultramafic intrusions of Jetty Peninsula represent the section of the East Antarctic craton mantle to the depths of 60-80 km and demonstrate the abnormally high heat flow which is connected with rifting and destruction of lithosphere (Foley et al., 2006). Os isotope composition of mantle nodules suggests the beginning of lithospheric mantle formation in this part of the East Antarctic craton not earlier than 2400 Ma. Absence of traces of the early Archean lithospheric mantle could prove the partial delamination of lithosphere at the convergent plate boundary in the late Archean or it could show the thermal erosion of lithosphere by deep plume in the Mesozoic during the initiation of the rifting. The following mantle transformations – depletion in basaltic components due to melting and removing of mantle melts, new mineral formation (refertilization) at metasomatic interaction with ascending plume melts, formation of garnet lherzolites in the course of collision between Antarctic and Indian shields and reorganization of all regional lithosphere as well as formation and development of Lambert-Amery glacier rift system (accompanied by dykes and stock-like bodies of mafic and alkaline-ultramafic composition) – to some extent are reflected in Re-Os system of the studied lherzolites. Spinel-garnet lherzolites has the Re-Os isochron age (WR+Ol) of 775 Ma and demonstrate the least fractionated of platinum group elements (PGE) pattern whereas clinopyroxene-rich spinel lherzolites appear in the character of platinum elements distribution to be close to the model composition of the primitive upper mantle, but the least affected by the processes of mantle transformation are considerably depleted clinopyroxene-poor spinel lherzolites. At the same time, the character of PGE distribution and their concentration in the studied lherzolites is caused not by PGE composition in olivine which compose up to 70% in the lherzolites but by microinclusion of sulfides. The timing of process of mantle peridotite refertilization which probably affected all studied xenoliths and is marked by the presence of new generation of clinopyroxene may correspond to the Re-Os whole-rock isochron age – 1590 Ma.
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