Siderophile elements in Paleoarchean Camel Creek komatiites from East Pilbara Terrane, Western Australia: implications for secular evolution of Archean-Proterozoic mantle

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It was proposed that the abundances of highly siderophile elements (HSEs) in komatiite sources increased during Archean, possibly indicating progressive mixing of the late veneer materials into the deep mantle [1]. However, recent studies argued for an increase in oxygen fugacity of the mantle during the same period [2, 3]. This implies that the lower HSE concentrations in Paleoarchean komatiites may not represent the source characteristics; they rather reflect the lower oxygen fugacity of the Paleoarchean mantle, which limit the release of HSEs into the melt during partial melting. In order to better understand the chemical evolution of Archean-Proterozoic mantle, we performed the analyses of major, trace, and HSE abundances coupled with the Re-Os isotope systematics for Paleoarchean Camel Creek komatiites from the East Pilbara Terrane, Western Australia with the use of XRF, ICP-MS, and TIMS after fused-glass bead and Carius tube digestions [4-6]. Our results show that the abundances of Al, Si, P, Ca, Sc, Ti, V, Mn, Fe, Zn, Ga, Ge, Y, Zr, Nb, REEs, Hf and Ta in the whole-rock of ultramafic cumulates, komatiitic basalts and evolved basalts show strong inverse correlation with the MgO contents, whereas their Cr, Co, Ni, Os, Ir and Ru abundances are positively correlated with the MgO contents. This confirms that crystal fractionation of a single common magma created the observed concentration variations, which are not systematically affected by disturbance due to secondary processes such as low-*T* alteration or metamorphism. The estimated compositions of the parental magma display V/Sc ratio of 4.8-5.3 and the Ru abundance of 2.1-4.2 ng/g, both of which are significantly lower than the estimates of post-Archean komatiites/picrites, and are similar to those of archetypal komatiites from the Paleoarchean Barberton Greenstone Belts in Kaapvaal craton. These results suggest that parental magmas of Paleoarchean komatiites share common characteristics having lower V/Sc ratio and HSE abundances. However, there are no clear correlation when all available data for komatiites/picrites are viewed on the diagram of V/Sc vs Ru abundance. Thus, the present study cannot constrain whether secular increase of oxygen fugacity or progressive mixing of late veneer are responsible for the lower HSE abundances in Paleoarchean komatiites. Further systematic study on the behavior of siderophile elements during partial melting under different oxidation states is crucial for discriminating the two scenarios.

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