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In situ Os isotopic compositions of sulfides in Kerguelen mantle xenoliths (Indian Ocean) : Proterozoic subcontinental mantle fragments under the Kerguelen Archipelago ?

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The Kerguelen Islands represent the apex of the second largest oceanic plateau on the Earth, the Kerguelen oceanic plateau. The Kerguelen Plateau is mainly the result of a voluminous magma output from the long-lived Kerguelen Plume (115 Ma). Mantle xenoliths from the Kerguelen Islands (TAAF, south Indian Ocean) represent the greatest known diversity of xenoliths in an oceanic setting and represent a rare opportunity to examine the composition and evolution of the lithospheric mantle beneath an oceanic plateau and the geological processes related to plume-lithosphere interactions. Microstructural, mineralogical and geochemical studies on peridotite mantle xenoliths (harzburgites, dunites) have shown that the lithospheric mantle evolution can be described by a high degree partial melting event followed by multiple metasomatic events due to the percolation of trace-element enriched melts in the depleted lithospheric mantle. In particular, late percolation of very evolved CO_2-rich silicate melts originating from the Kerguelen plume have precipitated sulfides and carbonates in interstitial position in dunites and in some rare harzburgites. Two different populations of sulfides were evidenced by petrographic and electron microprobe techniques ; a Fe-Ni-rich sulfide population (Mss-Pyrhottite-Pentlandite) and a Cu-Fe-Ni-rich sulfide population (pentlandite-chalcopyrite). We have investigated the in situ Os isotopic compositions of the sulfide populations by LA-MC-ICPMS in conjunction with

the bulk-rock Os isotopic compositions of the same xenoliths.The bulk $^{187}Os/^{188}Os$ isotopic compositions of harzburgites and dunites range from 0,1160 to 0,1468. The range of $^{187}Os/^{188}Os$ in single sulfide grains in a single sample obtained by LA-MC-ICPMS is similar to that found in the bulk-rocks on the whole Kerguelen Archipelago (0,1176-0,1452) and testify of Os isotopic heterogeneity at the scale of the sample. The finding of unradiogenic Os isotopic compositions in bulk-rock harzburgites devoid of base metal sulfides is corroborated by the finding of some interstitial Mss with very unradiogenic Os isotopic compositions, giving Rhenium-depletion ages up to 1,4 Ga. These old rhenium-depletion ages indicate that some mantle xenoliths and sulfides have been isolated from the convecting mantle since the Proterozoic (max. of 1,6 Ga), such as it is commonly seen in cratonic mantle domains. We interpret these unradiogenic Os isotopic compositions as evidence for the presence of old subcontinental lithospheric mantle delaminated and incorporated in the newly formed indian oceanic lithosphere during the Gondwana breakup. In contrast, most Cu-Fe-Ni sulfides have more radiogenic Os isotopic compositions than the Primitive Mantle estimate (up to 0,1452) and testify that the sulfide crystallised from melts that have evolved in a high Re/Os environment for a long time in order to develop the radiogenic Os signature. Such a radiogenic component may reside in the Kerguelen plume as a recycled component (ancient oceanic crust ?) or may derive from melting of pyroxenite bodies in the upper mantle.