

# Most abyssal peridotites are old!

O. ALARD

GEMOC, Department of Earth Sciences, Macquarie University,  
Sydney, Australia (oalard@els.mq.edu.au)  
Lab. Tectonophysique, CNRS-Univeristé de Montpellier,  
France

Melting of uprising convective mantle at mid-oceanic ridge produces two complementary products: a depleted mantle residue and igneous crusts (e.g., MORBs). Abyssal peridotites (AP) are assumed to be representative of this residue, as such they should provide key insights into the nature of the MORB source mantle, i.e., the convective upper mantle. However, whole-rock Os isotopic composition of AP is often extremely unradiogenic and yields unexpected old Re-depletion ages ( $T_{RD} \approx 2$  Ga) in such a young environment.

Magmatic sulfides are the main carrier of highly siderophile elements in the mantle including Os and Re. Recent studies have shown that several sulfide populations characterised by different micro-structural occurrences and compositions coexist at the thin section scale and record the various episodes of melting and melt-rock reaction events. Therefore, by establishing the Re–Os isotopic systematic of various sulfide populations, one could shed some new light on the intricacy of melt extraction and percolation processes beneath mid-oceanic ridge.

Two populations of magmatic sulfides have been recognized in most AP from all geodynamic settings. Type-1 sulfides are associated with primary silicate assemblage, their composition and trace elements abundance (e.g.,  $Pd/Ir_N < 1$ ) indicate that they are residual after melting. Type-2 sulfides are associated with “impregnation”  $Cpx_2$ . This feature along with their high metal/sulfur compositions (Ni-, Cu-rich) and their high Pd/Ir ( $Pd/Ir_N > 1$ ) demonstrates that these sulfides were precipitated during melt-rock reaction. AP from the Kane fracture zone (MAR) Type-1 sulfides have  $^{187}Os/^{188}Os$  as low as 0.110, which is indicative of a long-term evolution in a low Re–Os environment (i.e., depleted mantle) and yield  $T_{RD}$  age ca. 2.5 Ga. Type-2 sulfides in contrast have radiogenic composition up to 0.20. This is typical of Os-sulfide systematic observed in most AP. However, in Leg 209 (15°N MAR), Type-2 sulfides have a narrow range of extremely unradiogenic Os yielding  $T_{RD}$  age ca. 2.6 Ga and are older than Type-1 sulfides (ca. 2.3 Ga). Associated  $Cpx_2$  are extremely depleted in trace elements (e.g., REE). This indicates that the percolating melt was derived from an old and depleted mantle reservoir. Similar melt compositions have been found as inclusion in MORB phenocrysts.

Magmatic sulfides and whole rock in AP from various geodynamic setting (MAR, SWIR, and EPR) and from ophiolites (Ligurides, Oman) yield systematically  $T_{RD}$  ages older than 2 Ga and thus suggest a widespread occurrence of old and depleted mantle reservoirs (as Proterozoic SCLM) in the MORB source mantle.