# Refertilization of oceanic mantle by old depleted melts: An *in situ* trace element and Os isotope study of ODP Site 1274 peridotites

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ODP Site 1274 peridotites (15°20 FZ, Mid-Atlantic Ridge) record extensive melt extraction; yet observation of interstitial clinopyroxene (Cpx2) and local variations in bulk compositions suggest late melt freezing reactions with melts from different mantle source(s) occurred [1]. *In situ* analyses of Re-Os isotopic systematics in the different sulfide populations and of trace element composition of associated silicates allow us to clarify the sequence of melt extraction and percolation processes.

Three sulfide populations were distinguished: (i) Sulf-1 are residual after melting; (ii) Sulf-2 have abnormal Cu-rich composition akin to solidification products of sulfide partial melts; (iii) Sulf-3 (pentlandite and bornite) is intimately associated with Cpx2. The Sulf3–Cpx2(±Spl2) assemblage represents the crystallization product of a Cu-Ni-rich sulfide-bearing melt, trapped under lithospheric conditions and post-dating the crystallization of Sulf-2. The highly depleted composition of Cpx2 suggests that it crystallized from ultra-depleted melts in disequilibrium with melts produced locally.

$^{187}$Os/$^{188}$Os obtained by LA-MC-ICPMS vary between 0.1097 and 0.1396. Sulf-1 and Sulf-2 define a broadly positive correlation between $^{187}$Re/$^{188}$Os and $^{187}$Os/$^{188}$Os similar to Kane FZ abyssal peridotites (Alard et al., 2005). The first melting event recorded by Site 1274 peridotites is given by the TRD model ages obtained on Sulf-1 (2.16 ±0.30 Ga). Sulf-3 has constant non-radiogenic Os-isotope compositions (0.11044±0.00019, n = 27) but extremely variable 187Re/188Os (0.15-1.05) indicating that Sulf-3 crystallization was recent. Yet, Sulf-3 is significantly less radiogenic than Sulf-1, which requires a long-term evolution in a Re-depleted reservoir. The minimum time required to develop such compositions is given by the TRD model ages of Sulf-3, c.a. 2.5±0.1 Ga. Our results suggest that Site 1274 peridotites were refertilized by melts derived from a highly depleted and significantly older (≥2.5 Ga, Archean) mantle.

[1] Godard *et al.* (2008) *Earth Planet. Sci. Lett.* **267**, 410-425.
[2] Alard *et al.* (2005) *Nature* **436**, 1005-1008.

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# Arsenate-bearing natural schwertmannite-type phase in acid mine drainage (AMD) precipitates from N. Greece

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Schwertmannite is a Fe(III)-oxyhydroxysulphate that commonly precipitates in Fe-rich acid mine drainage (AMD) at relatively low pH (2.5-4.5) and high sulphate concentrations (1000–3000 ppm). It is a poorly crystalline (or nanocrystalline) and metastable phase transforming progressively into goethite over timescales of weeks to months. However, it is considered that As(V)-oxyanions may stabilize schwertmannite acting as an important sink of the above hazardous element in AMD contaminated aqueous environments. We report herein the characterization of arsenate-bearing (As: ~5000 ppm) schwertmannite-type phase in natural AMD precipitates from an active mixed-sulphides mine situated in Chalkidiki peninsula, N. Greece. The characterization of the very poor crystalline, in powder-XRD, material was predominantly performed using thermal analyses (TGA/DTG), FTIR and Raman spectroscopy. Complementary microscopic methods (SEM-EDS and TEM) were also applied. The oxidation state of As was found to be As(V) from XANES spectroscopy at the SUL-X beamline of the ANKA Synchrotron facility (Germany). Additional structural characteristics were obtained from Mössbauer spectra whereas the formation of the precipitate, scavenging significant quantities of As(V), was supported by thermodynamical data based on the chemical composition of the AMD aqueous media.