Molybdenum concentrations in chondrites, stony and iron meteorites

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Variations in isotopic amount ratios and elemental concentrations among meteorite classes has been researched intensely and well documented. Isotopic abundances, including variations due to fractionation, as well as elemental concentration of molybdenum is of particular interest in regards to meteorites. Enrichment in one isotope compared to another can indicate nucleosynthetic sources and the nucleosynthetic stage at which formation occurred. The main distinguishing factor for meteorite classification is iron content. Molydenum is moderately siderophile which indicates that variation in molybdenum concentration amongst meteorite classes is expected. Carbonaceous chondrites represent the primordial material from which our solar system formed. Subsequent differentiation of Mo in planetesimals results in Mo concentration variations in stony and iron meteorites.

Nineteen meteorites were prepared chemically for analysis under strict conditions to eliminate possible contamination, in particular, Zr and Ru isobaric interferences. The selection of meteorites includes rare carbonaceous chondrites such as Tagish Lake, Allende and Murchison. Each sample was analysed for Mo concentration using a double spike technique by thermal ionization mass spectrometry. The Mo concentration of chondritic samples varied from 1 - 2.5 ppm while iron meteorites ranged from 1 – 29 ppm. Zagami and a particular sample of Sayh al Uhaymir had concentrations of ~0.5 ppm. These concentrations are in accordance with Mo concentrations measured in: Orgueil, Ivuna and Mundrabilla [1].

[1] Wieser & DeLaeter (2000) *Fresenius J. Anal Chem.* **368**, 303-306.

Ultra-depleted domains in the oceanic mantle lithosphere

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Many mantle xenoliths sampled in ocean islands (OI) are ultra-refractory spinel harzburgites (OIu: high $cr\#_{sp}$, high Fo_{ol}, low $(Al_2O_3)_{opx}$, low HREE in opx) that, on average, are more refractory than MOR peridotites (MORP). OIu are common in the Canary Islands, Madeira, Cape Verde Kerguelen, Samoa and Loihi seamount. OIu rocks formed by high degrees of partial melting leading to total exhaustion of primary cpx. minor amounts of secondary cpx has formed by unmixing from opx and recrystallization. High Re-Os model ages indicate that some OIu rocks are significantly older than the surrounding oceanic crust, and thus cannot represent mantle residues complimentary to this crust. Laser analyses of cpx in some OIu xenoliths from the Canary Islands give $^{87}Sr/^{86}Sr$ ratios of 0.7027-0.7028, i.e. well below those of Canary Islands basalts. This implies that the ultra-refractory nature of the Canarian OIu was acquired some time in the past. Thus they do not represent plume material, and have not acquired their ultra-refractory nature through recent, plume-related processes. We interpret the OIu xenoliths as fragments of "exotic" material (continental mantle or recycled oceanic mantle lithosphere) trapped in the oceanic mantle lithosphere. Strong similarities (in whole rock and mineral major element compositions) to some series of oceanic sub-arc mantle suggest that the OIu peridotites may have acquired their ultra-refractory nature through similar processes (fluid-fluxed melting). The proportion of ultra-refractory peridotites among ocean island xenoliths is high; of 241 OI harzburgites and lherzolites 68% have Fo contents ≥ 90.5, i.e. as high or higher than in average MORP. Their common presence in ocean islands, and their presence along some mid-ocean ridges and in sub-arc mantle, suggests that ultra-refractory material may be important in the convecting mantle.