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DIFFERENT SCALES OF Os ISOTOPIC HETEROGENEITY IN OPHIOLITE CHROMITITES FROM SAGUA DE TÁNAMO AND MAYARÍ MINING DISTRICTS (EASTERN CUBA)

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We performed in situ laser ablation MC-ICP-MS measurements of Os isotopes in platinum-group minerals (PGM) included in unaltered chromite from ophiolite chromitites of the Sagua de Tánamo mining district (eastern Cuba). The results reveal important heterogeneities at the km, hand sample and thin section scales. Initial 187Os/188Os (calculated at 90Ma, the estimated age of ophiolite formation) spans from 0.1185 to 0.1295 in the whole district. These values correspond to γOs = -8.1-0.4, calculated by comparison with the Os isotopic evolution of the primitive upper mantle (PUM; Meisel et al., 2001, GCA 65), and all but one PGMs have γOs lower than PUM. PGMs in a single hand sample from the Caridad Mine exhibit 187Os/188Os ratios from 0.1185 to 0.1274, which overlap almost the entire range of values measured in the Sagua de Tánamo district. In one thin section from the same mine 187Os/188Os varies between 0.1200 and 0.1263 in two PGMs that are only few millimetres from each other. The few analyzed PGM grains from the Mayarí district have 187Os/188Os = 0.1271-0.1272 (γOs = -1.4) that are generally higher than in Sagua de Tánamo and much more homogeneous.

The sub-PUM (i.e. negative) initial γOs values can be explained by Re depletion during a long history of partial melting starting at 1.61 Ga, as indicated by calculated Os model ages. However, the heterogeneous isotopic signature of PGMs in a single hand sample and thin section suggests a more complex magmatic scenario for the formation of PGMs and the host chromite. At such small scales, the formation of PGMs with variable Os isotopic signatures requires a heterogeneous genetic environment where melts with different Os isotopic compositions coexist in space and/or time. This scenario can be achieved during chromite crystallization by mixing in mantle conduits of primitive and differentiated melts. Each new batch of primitive melt (with its own Os isotopic signature inherited from a highly heterogeneous mantle source) mixes turbulently with the pooled, differentiated melt promoting the crystallization of chromite and, as a consequence, the formation of PGMs attached at grain boundaries of chromite. Once PGMs become completely trapped in chromite, they retain their Os isotopic signature because the host chromite prevents any exchange with incoming melts. Thus PGM formed from successive batches of isotopically different melts would be the responsible of the heterogeneity observed at different length scales in the chromitites (Gervilla et al., 2005, CMP 150; Frei et al., 2006, EPSL 241).