Distribution of Pt, Os, Ir during liquid metal segregation under extremely reducing conditions

TRACY RUSHMER

GEMOC, Department of Earth and Planetary Sciences, Macquarie University, NSW 2092, Sydney, Australia (trushmer@els.mq.edu.au)

Experimental deformation studies have been performed on a natural, partially molten H6 ordinarly chondrite (Kernouvé) to enhance our understanding of early differentiation processes. One of the goals of the experiments is to determine the partitioning of siderophile elements during deformation and dynamic liquid metal segregation. We report results from a set of experiments in which deformation was performed under extremely reducing conditions. The study was conducted at temperatures between 925°C and 950°C, at 1.3 GPa confining pressure with a strain rate of 10^{-4}/s. Major element analyses show that in zones of deformation the compositions of both silicate and metal phases are considerably modified. Metallic compositions include (Mg,Fe)S, which is found with Si-bearing FeNi metal (+/- P), and Fe-Ni-S quench metal. Texturally, Fe-Ni-S appears to have been liquid and lines grain boundaries and cracks. Fe-Ni-Si compositions are found in the shear zones produced during the deformation experiment. Si-bearing FeNi metal and (Fe,Mg,Ca,Mn)S are found with silicate glass, forsterite (Fo_{92-96}) and enstatite (En_{98}). We also report highly siderophile element (HSE) concentrations measured in the Fe-Ni, FeS and Fe-Ni-Si metallic phases by LA-ICPMS. Earlier work has shown that the D's of many of the HSE are dependent on the sulfur content of the liquid metal with HSE concentrated in the Fe-Ni solid rather than FeNiS liquid. This also holds true under these reducing conditions however, Pt (not analyzed in earlier runs due to the use of Pt jackets) behaves noticeably differently to either Os or Ir. While Os and Ir are predictable in their distribution, Pt is highly concentrated in the modified Fe-Ni-Si +/- P bearing metal. D values for Pt, Os and Ir between FeNi (solid) and FeS (liquid) outside of the shear zones are approximately 20 for Os, to 70 for Ir and slightly lower for Pt and Au at 4 and 2.5 respectively, as expected. In the shear zones where the metal is reduced, D values for Os and Ir between FeNiSi +/- P and FeS liquid are as with FeNi and FeS, ranging from 11 and 55 for Os and Ir. Au also remains similar at 3.3. Pt, however, jumps consistently to much higher values. These data suggest that Si and possibly P play and important role in concentrating Pt. Further experiments in idealized systems are needed.