Ir partitioning between chromite and silicate melt – The influence of fO_2

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It is inferred from bulk compositions of chromite ore that chromite is capable of concentrating the IPGE (Os, Ir and Ru). Stratiform chromitites of layered intrusions as well as podiform chromitites are generally enriched in the IPGE up to a factor of 100 compared to Earth's mantle. Whether the IPGE are dissolved in the chromite lattice or present as discrete phases (e.g. osmiridium alloys) attached to chromite is not well constrained.

We are experimentally investigating the partitioning of Ir between chromite and a natural picritic melt doped with 20 wt.% $FeCr_2O_4$ component and 5 wt.% IrO_4. In order ot promote chromite grain sizes suitable for LA-ICP-MS analysis, charges are doped with Li tetraborate and run at 1700°C (2.5 GPa). Run products are silicate glasses coexisting with chromite, and (Ir,Fe) alloys.

Results confirm that Ir becomes more soluble in both chromite and silicate with increasing fO_2. $D_{Ir}^{chromite-melt}$ increases from 13 ± 4.4 to 140 ± 6 (Fig. 1).

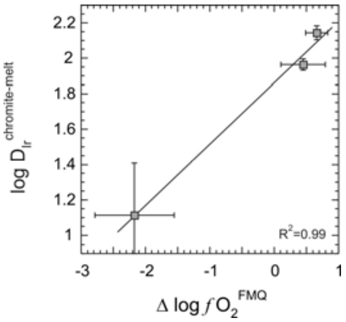

Figure 1: $D_{Ir}^{chromite-melt}$ vs. fO_2. The partitioning of Ir into chromite is strongly fO_2 dependant.

Hence at fO_2 conditions appropriate to the Earth's mantle (FMQ-2 to FMQ) Ir is clearly compatible in chromite. The enrichment of IPGE in chromitites can therefore be attributed to chemical partitioning into the chromite lattice. Nevertheless discrete PGE-alloys or PGE-rich sulfides attached to chromites may also play an important role in fractionating and concentrating the IPGE, since silicate melts are easily saturated especially under reducing conditions.

Seasonal and spatial variations of stable isotopes (O and D) in Orgnac Cave pools

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The Orgnac Cave in southern France opens at 305 m a.s.l.. A shaft and a wide down-sloping gallery give access to 3 rooms: Orgnac II, III and IV located around 100-120 m below the plateau surface. 250 samples, from 19 pools, for the measurement of the stable isotope ratios of oxygen and hydrogen were collected in 50 ml polyethylene bottles, between the summer of 2005 and the fall of 2008. The $^{18}O/^{16}O$ ratio of water samples was measured on CO_2 equilibrated with the water at 25°C (analytical reproducibility of ± 0.1‰). The D/H ratio was measured on H_2 equilibrated with the water at 25°C using a Pt based catalyst (analytical reproducibility of ± 3‰). Both stable isotope measurements were made on the same sample using a Gas Bench II interfaced with a Finnigan Mat Delta XL mass spectrometer at the G.G. Hatch Laboratory, at University of Ottawa. The narrow range (± 0.4‰) observed in the $^{18}O/^{16}O$ ratio of water samples reflects strong attenuation of the seasonal rainfall isotopic variation due to mixing of recharge water from different events in the system. However the D/H ratio values show unexpected large range (up to 10‰) in each pool (Fig 1). On November 12, 2008, values (n=25) between -35 and -45‰ were measured in the $3m^3$ pool 1 while $^{18}O/^{16}O$ ratio values were at the same time between -6,35 and -6,45‰. Reasons are examined to explain why the co-variance between D/H and $^{18}O/^{16}O$ in Orgnac Cave pools are not plain.

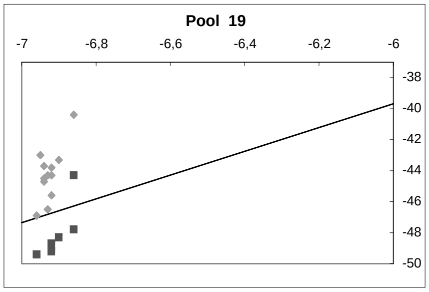

Figure 1: : O and D in pool 19. August 05 – November 06