LITHOPHILE TRACE ELEMENTS IN MAGMATIC IRON METEORITES.

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Introduction: The chemical composition of iron meteorites reflects the conditions and processes under which they formed, such as condensation, oxidation and fractional crystallization. Magmatic irons are characterized by steep trends of Ir versus Ni consistent with formation by fractional crystallization. Assuming that magmatic irons formed in the cores of molten asteroids in the presence of coexisting silicates we expect lithophile trace elements, e.g., Si to be dissolved in metal melts in concentrations of the order of 10 to 100 ppm [1]. Earlier work has shown that concentrations of Si are extremely low in all groups of iron meteorites, magmatic and non-magmatic. Concentrations around ~0.12 ppm apparently reflecting low temperature processes rather than high temperature metal/silicate melt equilibrium [1]. We have started systematic analyses of lithophile elements, Si and Al, as well as Cr and P in IVB, IVA and IIIAB iron meteorites.

Analyses: Trace concentrations of Si, Al, Cr and P were analysed with a Cameca ims1280 HR2 at the CRPG in Nancy at high mass resolution (M/ΔM ~7000). Sensitivity factors for all elements were calculated relative to the intensity of ^{56}Fe and based on intensities in known standards from the Bundesanstalt für Rohstoffe (BAM). The spot size was about 20 µm allowing to separate between Ni-rich and low-Ni lamellae if Widmanstätten patterns were wide enough.

Samples: We analysed 2 to 8 spots in Ni-rich or Ni-poor areas in the IVB iron Hoba, IVA-an iron Steinbach, one IC iron Bendego and three IIIAB irons Turtle River, Grant and Acuña. Trace concentrations of Si and Al are highest in metal of Hoba (Si = 0.75 ppm and Al = 0.05 ppm) and Steinbach (Si = 0.25 ppm and Al = 0.02 ppm), respectively. Concentrations in metal of the IIIAB are identical and extremely low with Si = 0.04 ppm and Al = 0.007 ppm. The aluminum concentration in Bendego is slightly higher with Al = 0.013 ppm while Si is as low (Si = 0.04 ppm) as in IIIAB irons. No difference in concentrations of these two elements between Ni-rich and Ni-poor metal was observed. P and Cr concentrations are high and variable in Hoba (P = 4100-7300 ppm, Cr = 180-475 ppm in Hoba) and low in Steinbach, Bendego and all IIIAB irons. In addition, there is a clear anticorrelation of P with Cr; kamacite being high in Cr and low in P and taenite being low in Cr and high in P.

Conclusion: Our results confirm previous studies [1] that Si concentrations in iron meteorites are significantly lower than expected from metal/silicate melt equilibria. This is also confirmed by low Al concentrations. Apparently lithophile elements do not reflect the high temperature history of iron meteorites. Concentrations of Cr and P are lower than bulk metal INAA data [e.g., 2]. This indicates that bulk analyses may be dominated by inclusions rich in such elements.

References: [1] Pack A. et al. 2011. *Meteoritics & Planetary Science*, in revsion. [2] Wasson J. 1999. *Geochimica Cosmochimica Acta* 63: 2875-2889.