EXAMINING TRACE ELEMENT PARTITIONING INTO IRON PHOSPHIDE, WITH APPLICATIONS TO IRON METEORITES.

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Introduction: Phosphides are a common phase in many iron meteorite groups. In particular, the IIG group has large amounts of coarse schreibersite $(FeNi)_3P$, and bulk P contents of ~2 wt%, the highest known for any group of irons [1]. There is limited information about trace element partitioning into phosphides in systems relevant to iron meteorites. In this work, we present the first results from our experimental study to determine trace element partitioning behavior into iron phosphide, with applications to understanding the formation and evolution of iron meteorites.

Experimental and Analytical Methods: Experiments were conducted in a 1 atm vertical tube furnace using evacuated and sealed silica tube methods similar to [2]. Starting compositions were mixed from powders of Fe and P, with 25 trace elements added at ~100 ppm levels. Four experiments were run at 1075-1100°C, for durations of 1-6 days, and produced run products that consisted of solid Fe_3P and quenched metallic liquid with ~11 wt% P. Major element abundances were determined by a JEOL 8600 FE SEM, and trace element concentrations were measured by LA ICP-MS (ThermoFinnigan Element2 with New Wave UP213). Partition coefficients for Fe_3P/liquid were determined for V, Co, Ni, Cu, Ga, Ge, As, Mo, Ru, Rh, Pd, Ag, Sn, W, Re, Os, Ir, Pt, Au, Pb, and Bi; the four runs produced the same results, indicating that equilibrium was achieved in <1 day.

First Results: Previous experimental studies reported schreibersite/metal partition coefficients for a few elements in systems with a S-rich metallic liquid [3, 4]. To compare our new results to the previous data, we used the solid metal/liquid metal values determined by [2] in the Fe-Ni-P system to calculate Fe_3P/solid metal values. Comparisons are possible for Ni, As, Mo, Pd, Au, and Pb; our results show very good quantitative agreement with previous determinations for all of these elements with the exception of Pb, which, consistent with previous work, we find exhibits compatible behavior in phosphide but to a less extreme value than reported by [3]. This good agreement is particularly noteworthy as our runs have Ni at trace levels while those of the previous work contained schreibersite with 13-31 wt% Ni [3], suggesting that the Ni content does not have a strong influence on the partitioning behavior in this system. Comparison of our results to schreibersite/metal measurements from iron meteorites [5, 6] show general similarities in the fractionation pattern: enrichments of Mo in the phosphide phase accompanied by low concentrations of Ga, Ge, Ir, and Pt. Our results provide partitioning inputs for iron meteorite crystallization models, in particular for the IIG group for which it has been suggested that schreibersite was a liquidus phase during the final stages of crystallization [1]. Experiments that vary Ni up to ~40 wt%, as observed in irons, are underway to further constrain its influence.

References: [1] Wasson J. T. and Choe W.-H. 2009. *GCA* 73, 4879-4890. [2] Corrigan et al. 2009. *GCA* 73, 2674-2691. [3] Jones J. H. et al. 1993. *GCA* 57, 453-460. [4] Jones J. H. 1993. *Meteoritics* 28, 374. [5] Jochum K. P. et al. 1980. *Z. Naturforsch.* 35a, 57-63. [6] Kurat G. et al. 2002. *LPSC* XXXIII, 1781.

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