PATOS DE MINAS: A LA-ICP-MS STUDY OF KAMACITE AND A SULFIDE GLOBULE.

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Introduction: Patos de Minas (hexahedrite: 5.36 wt% Ni) shows few angular nodules of troilite with daubreelite exsolution lamellae [1]. The studied polished section has a particularly round sulfide globule (~ 4.5 mm in diameter) containing a spherical silicate inclusion (400 µm in diameter). Trace element abundances (SIMS) in the Fe-rich silicate phase shows that their REE contains a weak signal of the group II CAI REE abundance pattern [2]. Here we report on a trace element study of sulfides and metal.

Results and Discussion: LA-ICP-MS analyses in the metal were performed adjoining the sulfide globule. The siderophile trace element concentrations (mean of six analyzed areas) are as follows (all concentrations in ppm, except Ni and Co: mg/g): Co: 4.6; Ni: 53.6; Ga: 73.4; As: 2.9; Mo: 5.9; Ru: 30; Rh: 3.8; Pd: 1.9; W: 3.7; Re: 4.9; Os: 66; Ir: 48; Pt: 36; Au: 0.77. The sulfide globule consists of Cr-bearing troilite (Fe: 58.5; Cr: 1.8; S: 39.4 wt%) and daubreelite (Fe: 18.5; Cr: 30.7; S: 48.4 wt%), each occupying half the globule area. The globule is enveloped by a thin rim of cohenite and schreibersite. Magnetite was also identified. The abundances of the siderophile trace elements in troilite are similar to those in daubreelite, varying from ~1 x CI (W, Mo, Fe, Au) to ~0.05 x CI (Os, Ni, Co, As). They differ, however, in their Ga contents (troilite: 0.1 x CI; daubreelite: 4 x CI).

The normalized abundance of siderophile elements in kamacite decreases smoothly from the refractory elements (Re, Os and Ir ~100 x CI) towards the moderately volatiles (As ~ 1.4 x CI), with increasing contents of the volatiles Au (~5.5 x CI) and Ga (~7 x CI). When compared to the IIAB irons [3], Patos de Minas matched those members (e.g., Negrillos, Bennet County) with the highest contents of Re, W, Ir and Ga. The negative anomalies of W (~35 x CI) and Mo (~ 5 x CI) may indicate oxidizing conditions that favor precipitation of Si. However, high S fugacity can provide e^--scavenging conditions which have the same effect. In kamacite we have observed the existence of strong decreasing gradients in Mo concentration (less for W and Ni) adjoining the globule. The contact between sulfides forming the globule is partly sharp, since narrow bars of troilite are present in the daubreelite and vice-versa. One such thin bar of troilite in daubreelite shows surprisingly high values of Co (1.5 x CI) and Ni (0.4 x CI). An ASEM map shows that both elements are concentrated along the edges and fractures of the bar. Our preliminary results show that Patos de Minas may have been formed under highly reducing conditions followed (at lower temperatures) by an oxidizing event with precipitation of Si and exsolution of both sulfides.

References: [1] Buchwald V.F. 1975. Handbook of Iron Meteorites, Univ. of California, p.965; [2] Varela M.E. et al. 2009. MAPS #5092; [4] Wasson J. et al. 2007. GCA 71, 760-781.