SIMS STUDY OF AN UNKNOWN SILICATE PHASE FROM THE PATOS DE MINAS IIA IRON.

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Introduction: Patos de Minas is a normal hexahedrite that contains a few angular nodules of troilite with daubreelite exsolution lamellae [1-2]. Here we report on a chemical study of the first silicate phase observed in this meteorite.

Results: The polished section of Patos de Minas from the Museu Nacional du UFRJ, Brazil contains a perfectly round silicate inclusion within an almost perfectly round sulfide inclusion imbedded in the metal. The sulfide is decorated by a thin rim of metallic-looking phases [3]. It consists of two phases: 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 of it. Bars of troilite are present in the daubreelite and vice-versa. The spherical silicate inclusion (400 μm in diameter) is surrounded by both sulfides, is isotropic, indicating a glass, and has a major element composition that varies widely from: SiO_2: 38.3 - 73, FeO: 1.7 - 47.4, CaO: 0.04 - 17, Na_2O: 3.7 – 0.03 wt%. The low totals of the analyses (80 – 93 wt%) could be indicative of an alteration by (partial) hydration of an unknown precursor phase. The whole object (silicate and sulfides) is thinly enveloped (~100 - 200 μm) by cohenite (Fe: 90, Ni: 1.6 wt%) and schreibersite (Fe: 53.6; Ni: 30.6; P: 15 wt%).

Trace element abundances in the Fe-rich silicate phase (FeO: 33.6 – 47.4 wt%) as determined by SIMS show a peculiar pattern, with the heavy REEs (~0.6 x CI abundances) depleted with respect to the light REEs (~6 x CI). This REE pattern, with a weak Tm+ and a strong Eu+ anomaly, is reminiscent of the group II CAI REE abundance pattern. It is a strong indication that the silicate (or its precursor) has formed from a vapor, which was depleted in the super-refractory elements.

The Nb abundance is extremely high (~300 x CI), and abundances of moderately volatile and volatile elements are also high (5 – 20 x CI). The very high Nb content suggests that the silicate had a sulfide precursor, which was subsequently oxidized. Metasomatic processes probably added the moderately volatile and volatile elements from a reservoir with chondritic relative abundances as indicated by the Fe/Mn ratio. The missing volatile phase, possibly (OH), could be terrestrial. However, the trace element abundances do not show any terrestrial contamination. Further studies are needed.

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References: [1] Buchwald, (1975), Handbook of Iron Meteorites, Univ. of California, p.965.; [2] Kracher et al., (1980) Geochimica et Cosmochimica Acta, 44, 773-787.; [3] Zucolotto et al., (2006) V Encontro da SBPMat.