TRACE ELEMENT ABUNDANCES IN ST. AUBIN (UNGR IRON) GIANT CHROMITE AND ASSOCIATED PHASES.

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Introduction: Chromite crystals of up to 3 cm in size were recently described from the fine octahedrite St. Aubin [1]. The crystals are euhedral exhibiting triangular and hexagonal cross sections and are incompletely covered by schreibersite, troilite and swathing kamacite. They are accompanied by schreibersite, troilite, hibbingite and euhedral Fe-phosphate (sarcopside or graftonite). We have analyzed the non-metallic phases for their major, minor and trace element contents with an EMP and an IMS-3f ion probe, which was also utilized to search for extinct ^{53}Mn in the Fe-phosphates – all following routine procedures.

Results: Chromite is pure $FeCr_2O_4$ containing (in ppm) ~8000 V, ~4700 Mn (but only ~600 Mg and ~0.4 Al), 0.15 Nb, 0.02 Sc and <0.003 Ce. The Fe-phosphate is also pure $(Fe,Mn)_3(PO_4)_3$ with (in ppm) ~18000 Mn, ~2000 Mg, ~270 Zn, 12.5 Cr, ~ 6 Co, 4.2 Ni, 0.01 Nb, 0.0017 Sc and ~0.0003 Ce. Hibbingite, $Fe_2(OH)_3Cl$ (~18 wt% Cl), contains (in ppm) 6200 Ni, 2500 Co, 292 Mn, 0.0003 Sc and 0.0005 Ce. Fe-phosphates have excesses in ^{53}Cr with an initial ratio of $^{53}Mn/^{55}Mn = (1.5+/-0.3)x10^{-6}$.

Discussion: All non-metallic phases in St. Aubin are extremely poor in lithophile elements. Particularly striking are the very low contents of Al, Mg, Sc and Ti in chromite as compared to those reported by, e.g., [2]. Also, the contents of Zr and the REE are very low, all <0.01xCI. We interpret this to indicate derivation of the chromite from an environment that was very poor in all these elements. The same holds for the Fe-phosphate. Chromite and phosphate are also very poor in Ni, less so in the less siderophile Co, indicating equilibration with metal. On the other hand, chromite and phosphate are enriched in V and Nb and also Zn and Mn with respect to the common lithophile elements, indicating an elevated siderophile behavior of V and Nb – as was predicted by [3] - and formation of chromite and phosphate from reduced precursor phases. Hiddingite likely is a secondary phase after lawrencite and indicates also low abundances of lithophile elements during formation of the latter in the presence of metal.

Conclusion: All non-metallic phases in St. Aubin indicate formation in an environment that was very poor in lithophile elements. The abundance anomalies in V and Nb indicate reduced precursor phases (metals, carbides, etc.), which subsequently were oxidized to form chromite and Fe-phosphate early in the history, about contemporaneously with the Mn-Fe metasomatism event experienced by the angrites [4], while some ^{53}Mn still was alive. Thereafter, troilite and schreibersite formed, followed by lawrencite and final metal which preserved all phases.

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