Hambleton – a new sulphur rich pallasite

HAMBLETON - A NEW SULPHUR RICH PALLASITE

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Introduction: A new pallasite, a single mass of 17.6 kg, was found south of Hambleton, North Yorkshire, by R and I Elliott in August 2005. The mass is composed of ~60 vol % olivine, ~25 vol% metal and ~15 vol% sulphide. The phases are irregularly distributed and highly weathered. There follow the results of a study by optical and analytical scanning electron microscopy.

Observations: Olivine occurs as cm-sized sub-rounded crystals in a granular mosaic. Many contain sub-parallel sets of fractures, some of which are annealed, while others are filled with metal or sulphide. In metal-rich or sulphide-rich areas olivines are fragmented and angular to sub-angular and veined by metal or sulphide respectively. Some regions <5cm in size are composed entirely of olivine crystals enclosed within troilite. Olivine is $Fo_{88.3}$, and together with the oxygen isotopic ratios: $\delta^{17}O$ = +1.383‰; $\delta^{18}O$ = +3.029‰; $\delta^{17}O$ = -0.187‰, indicate that the meteorite is a main group pallasite. From the olivine-rich exterior, weathering has penetrated for 4-5 cm towards the interior of the mass. The weathered, olivine-rich outer portion is brittle and prone to disintegration. A blue secondary mineral rich in Mg, P and Fe was shown by XRD to be baricite $(Mg, Fe)_3(PO_4)_2.8H_2O$. Much of the metal has succumbed to terrestrial oxidiation, especially low-Ni phases such as kamacite, cloudy taenite or plessite. The sulphide is more susceptible to terrestrial alteration than the metal.

Discussion: Metal rich regions are consistent with the view of Scott [1] that pallasites formed by the injection of metallic liquid into dunite. Evolved metallic melts, related to IIIAB irons, should be sulphur-rich. Paucity of sulphide in pallasites led Ulff-Moller et al [2] to suggest that either FeS-rich liquid was lost or formed pallasites that are underrepresented in our samples.

Conclusion: With Phillips County (pallasite), Hambleton is a rare FeS-rich pallasite.

References:

[1] Scott E.R.D. 1977. *Geochimica et Cosmochimica Acta* 47: 693-710. [2] Űlff-M¢ller et al. 1998. *Meteoritics & Planetary Science* 33: 221-227.