5216

HAMBLETON—A NEW SULFUR-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% sulfide. The phases are irregularly distributed and highly weathered. Here we present 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 sulfide. In metal-rich or sulfide-rich areas olivines are fragmented and angular to sub-angular and veined by metal or sulfide respectively. Some regions <5 cm 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 sulfide 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 sulfur-rich. Paucity of sulfide 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.

Conclusions: 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] Ulff-Møller et al. 1998. *Meteoritics & Planetary Science* 33:221–227.

5221

THE PETROGRAPHY AND GEOCHEMISTRY OF LUNAR REGOLITH BRECCIA MET 01210

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Introduction: MET 01210 [1] is an anorthosite bearing basaltic lunar regolith breccia [2] that is dominated by clast and mineral fragments consolidated in a predominately mare region of the Moon [3]. The MWG sections studied in this investigation (MET 01210,21 and MET 01210,27) have vesicular fusion crusts and are composed of an immature breccia sample with rock (<4 mm) and mineral fragments (<1 mm) fused in a fine grained crystalline and glass matrix.

Analytical Methods: Mineralogical analysis was done at the NHM using a WDS Cameca SX-50A and elemental mapping was performed using a LEO 1455VP EDS SEM fitted with Oxford Instrument's INCA analysis software.

Observations: Mare basalt fragments in MET 01210 have a range of textures. Examples of mare material include rapidly crystallized fine grained clasts that have a distinctive feathery or plumose texture with a low-Ti affinity. Holocrystalline, coarser grained ferro-basalt fragments have large zoned pyroxenes (<500 μm En_{1-47} Fs_{27-86} Wo_{10-30}), evolved Low-Ti-VLT bulk compositions and some examples include small fractionated mesostasis assemblages (silica, fayalite, K feldspar, glass, apatite, whitlockite). Additional clasts of very fine-grained/granular symplectites of silica, fayalite and hedenbergite are the collective breakdown products of pyroxferroite. Mineral fragments in the matrix are predominantly associated with a fractionated mare basalt parentage.

MET 01210 also contains a non-mare anorthositic component including fragments of anorthositic norite, feldspathic meta-igneous clasts and granulites with Mg-rich mafic phases. Additional material in our sections includes small fragments of feldspathic impact melt derived rocks, glass beads (20–100 μm: including one with a HASP composition [4, 5]) and small melt veins.

Discussion: The mineralogical and clast assemblage of MET 01210 is dominated by Fe-enriched, low-Ti mare basalt material with a minor anorthositic component. The bulk rock composition was reported by [3] and is similar to typical average mare soils with elevated Al_2O_3 and depleted MgO as a consequence of additional mixing with anorthositic material. Bulk rock Th (0.86 ppm [3]) is comparatively low for mare regolith breccia material [7] suggesting that the mare components in MET 01210 did not experience KREEP assimilation and are likely to have been emplaced distally to the PKT.

References: [1] Russell S. S. et al. 2004. The Meteoritical Bulletin No. 88. *Meteoritics & Planetary Science* 39:A215–A272. [2] Korotev R. L. 2005. *Chemie der Erde* 65:297–346. [3] Joy K. H. et al. 2006. Abstract #1247. 37th Lunar and Planetary Science Conference. [4] Kempa M. J. and Papike J. J. 1980. Abstract. 11th Lunar and Planetary Science Conference. pp. 609–610. [5] Huber H. and Warren P. H. 2005. Abstract #2401. 36th Lunar and Planetary Science Conference. [6] Heiken et al. 1991. *The lunar sourcebook*. New York: Cambridge University Press. pp. 450–451. [7] Korotev R. L. 2001. Abstract #1234. 32nd Lunar and Planetary Science Conference.