AN UNUSUAL METEORITE CLAST IN LUNAR REGOLITH BRECCIA, PCA 02-007.

Lawrence A. Taylor[1], Allan Patchen[1], Christine Floss[2], and Dawn Taylor[1]; [1] Planetary Geosciences Institute, Earth & Planetary Sci., Univ. of Tennessee, Knoxville, TN 37996; [2] Lab for Space Science, Washington Univ., St. Louis, MO 63130.

Introduction Fragments of meteorites have been reported from virtually all lunar soils, albeit these are almost exclusively pieces of kamacite-taenite metal containing troilite + schreibersite. However, a relatively large >1mm clast of the silicate portion of a meteorite was recently discovered in a lunar regolith breccia that fell to Earth as a meteorite and recovered in Antarctica – PCA 02-007 [1-2]. This clast does not resemble any 'normal' chondrite or achondrite; instead, we have focused our attention on its being a chip of an unusual chondrule.

PCA 02-007, a lunar meteorite from the Antarctic, is a feldspathic regolith breccia, consisting of a large highland component, with a small but significant contribution of VLT basalt clasts and minerals [1-3]. This lunar breccia contains an especially large meteorite signature, both in its numerous FeNi grains and a meteorite fragment, but also in its siderophile (e.g., Ir) contents [1-2}.

Meteorite Clast: The texture of this clast consists of 5-30 μm angular chips and fragments of olivine (46.5 vol%) with interstitial plagioclase (19.9%), glass (28.8%), and 2-80 μm grains of sulfides and FeNi metal (4.8%). The cores of the olivines are Fo 98.7, with large rims of Fo ~82, with the most Fe-rich being Fo 44.6. It appears that the initial olivines were subjected to a metasomatic fluid, extremely rich in Fe that has begun the modification of the almost pure forsterite into more Fe-rich variations. However, the cooling rate associated with this process was relatively rapid (e.g., 5-10 ^{0}C/hr), based upon the olivine speedometer of Taylor et al. [4]. The glass may be representative of this Fe source, with its composition of 43% SiO_2; 23% FeO; 0.9% MgO; 19% CaO; 8.2% Al_2O_3; 0.8% Na_2O; and 1.2% P_2O_5. Specks of Cr <1μm were seen in the glass by X-ray mapping (=chromite?). Plagioclase is consistently AN80.

The FeNi metal in the olivine contains ~6% Ni, whereas the taenite associated with the sulfides contains 46-50%, with a maximum of 51.4% Ni, tetrataenite. The sulfide phases consist of pyrrhotite, not troilite, with 3.7% Ni, and pentlandite, with 0.5% Co and 0.13% Cu. It would appear that the sulfide was originally present as Fe-Ni-S monosulfide solid solution, which underwent exsolution upon cooling.

Origin: A plausible explanation for this meteorite fragment appears to be as a portion of a larger chondrule, such as the plagioclase ones recently described by Krot et al. [5]. However, this remains an open subject at present.

References: [1] Taylor, L.A. et al., 2004, LPSC XXXV, CD-Rom #1755; [2] Korotev, R. et al., 2004, LPSC XXXV, CD-Rom # 1416; [3] Ziegler et al., 2004, LPSC XXXV, CD-Rom #1978; [4] Taylor, L.A. et al., 1977, PLSC 8th, 1581-1592; [5] Krot, A.N. et al., 2002, *Meteor. Planet. Sci.* 37: 155-182.