Petrography, Geochemistry, and Pairing Relationships of Lunar Meteorite Miller Range 13317

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Miller Range (MIL) 13317 is a 32-g lunar meteorite collected during the 2013-2014 ANSMET (Antarctic Search for Meteorites) field season. It is the seventh lunar meteorite to be recovered from the Miller Range icefields: MIL 05035, MIL 07006, MIL 090034, MIL 090036, MIL 090070, and MIL 090075. Here we present the detailed petrography and geochemistry of MIL13317, and examine its pairing relationships with other MIL stones and the lunar meteorite collection as a whole.

MIL 13317 has a fine-grained glassy matrix containing abundant lithic and mineral clasts. Basalt clasts are the most common lithic clast, but large feldspathic impact-melt breccia clasts and small granulitic and symplectite clasts are also found. The most common mineral clasts are pyroxene and plagioclase, with less abundant olivine, ilmenite, silica, and glass clasts. FeNi metal and FeS clasts are rarely observed. A HASP glass clast (up to 55 wt% Al2O3) was found. Shock-melt veins are observed within the sample; much of the plagioclase has been partially or completely shocked into maskelynite. Vesicular glassy fusion crust is observed (0.8 wt% TiO_2, 10.5 wt% FeO, Mg' = 52, 0.5 wt% Na_2O).

Compositionally, MIL 13317 is distinct from any other lunar meteorite [1], making it the fifth distint lunar meteorite from MIL (only MIL 090034/70/75 are paired). Unlike Calcalong Creek and NWA 4472/4485 (which have broadly similar compositions), subsamples of MIL 13317 increase in Sm and Na concentration with increasing Sc and Fe. This suggests that MIL 13317 it is a mixture of (1) a regolith which itself is a mixture of mare basalt and some KREEPy lithology (similar to the Apollo 12 soils), and (2) a feldspathic material (e.g., the observed melt breccia and granulite clasts) with compositions similar to MIL 07006 and paired stones MIL 090034/70/75. The mafic component cannot be just mare basalt because extrapolation of the FeO-Na_2O trend in MIL 13317 subsamples to 20% FeO (typical of lunar basalt) leads to a absurdly high Na_2O concentrations (>1.0%).

[1] Korotev RL and Irving AJ (2016), *LPSC*, **abstract # 1358**.