LUNAR METEORITE YAMATO-983885: A RELATIVELY KREEPY REGOLITH BRECCIA *NOT* PAIRED WITH Y-791197

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Lunar meteorite Yamato-983885 is a 288 g highland regolith breccia [1] with mineral compositions similar to those of another Yamato lunaite regolith breccia, Y-791197. We have studied it petrographically and analyzed a 220-mg bulk-rock chip.

Our bulk-analysis results agree with those of [1] in indicating a relatively low-Al_2O_3 (22.3 wt%) variety of lunar highland material. Ratios such as Fe/Mn and especially Ga/Al further confirm the stone's lunar origin. Concentrations of siderophile elements Ni, Ir and Au are exceptionally high (e.g., Ir = 22 ng/g) and in approximately chondritic proportions to one another. In a ~1 cm^2 thin section, we identified ~15 glassy regolith spherules and spherule fragments. These spherule-abundance and siderophile results imply at least moderate regolith maturity, for a lunar regolith breccia, i.e., that the material is probably well mixed, with a bulk composition fairly representative of the terrain where the rock originally formed. Noble gas data [e.g., 2] indicate that Y-791197 is also relatively mature. Thus, if Y-983885 and Y-791197 were paired, we would not expect to find a very high degree of compositional-petrologic disparity between them.

Most significant for testing the Y-983885 - Y-791197 pairing hypothesis is a whopping disparity in the levels of incompatible (KREEP-associated) trace elements. Like most lunaite highland regolith breccias, Y-791197 is very KREEP-poor, with a mass-weighted literature mean Th concentration of just 0.33 μg/g. The five literature analyses averaged [3] are relatively uniform, with a range for Th of 0.27 to 0.40 μg/g. Yet the incompatible elements are consistently ~5 times more enriched in Y-983885 than in the Y-791197 average. The greatest of these disparities are by factors of 5.8-6.1, for the two most extremely incompatible elements, U and Th. This degree of compositional disparity greatly exceeds what could reasonably be expected from heterogeneity within a single moderately mature lunar regolith breccia.

In terms of incompatible trace elements, a very close precedent for the composition of Y-983885 is the average soil [3] from the prototypical nearside highland site, Apollo 16. However, the Y-983885 regolith is significantly less anorthositic than that at Apollo 16 (Al_2O_3 consistently ~ 27.1 wt%). Y-983885 is many respects similar to the KREEPy Calcalong Creek regolith breccia lunaite [4], especially in terms of major elements and mafic-associated elements such as Mn, Cr, Sc and V (our results in μg/g: 950, 1430, 19.8 and 45, respectively).

An evolved (KREEP?) component is also evident in the petrography of Y-983885. For example, one of the largest clasts found (~400 × 200 μm) consists of roughly (in vol%) 40% ilmenite, 25% mesostasis, 20% Na-rich plag (An_{51-62}), 10% K-feldspar, ~4% intergrowth of K-spar with silica, and ~2% merrillite.

We will also discuss implications of these and other recent results for lunaites, for issues such as calibration of the bulk-Moon Th map and estimation of the bulk-Moon composition.

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