ALHA81005: A NEW SAMPLE FROM THE LUNAR HIGHLANDS? Gregory W. Kallemeyn. Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90024.

Evidence is mounting that the Antarctic meteorite find, ALHA81005, represents the first lunar sample recovered without the expenditure of a significant portion of a nation's GNP. This would make it the first meteorite whose actual parent body can be deduced with hard evidence - although this hard evidence required the technological recovery of lunar samples.

Petrographically, ALHA81005 appears to be a regolith breccia, notably low in metal, with troctolitic clasts and a matrix containing swirly glass (Warren et al., this volume). Our 113 mg sample contains an estimated 40% clast material and is currently being studied by instrumental neutron activation analysis.

Several points can be made from our preliminary compositional data. The Fe (45 mg/g) and Mn (0.58 mg/g) contents of our sample are similar to those of Apollo-16 soils and rocks, and the bulk Fe/Mn ratio of 77 is near the mean lunar value of ~80. This Fe/Mn ratio is distinct from those of known chondritic and achondritic meteorites and from the Earth's mantle; it provides strong evidence for a lunar origin. The bulk Mg/(Mg+Fe) (0.71) vs. Ca/(Ca+Na+K) (0.96) of the sample plots just above the region defined by lunar ferroan anorthosites. Incompatible elements are low, 0.01-0.02× those in incompatible-rich lunar KREEP. The REE pattern (3-5× CI) is typical of anorthosites, with a small light/heavy enrichment and a strong positive Eu anomaly. Siderophile element concentrations are very low (which correlates with the low observed metal contents), and the meteoritic fraction is <1%. The Ir/Au ratio is near the CI value, somewhat higher than typical values in mature Apollo-16 soils; this suggests that the sample is from a younger, less-mature regolith.

The petrographic and compositional data for ALHA81005 suggest a lunar highlands origin, so a comparison to the bulk chemistry of the Apollo-16 and Luna-20 sites seems appropriate. In Figs. 1 and 2 we plot lithophile, siderophile and incompatible elements normalized to mean Apollo-16 and Luna-20 soils. The Na content of ALHA81005 (2.2 mg/g) is notably low relative to both locations, especially Apollo-16. Since the variation of Na among Apollo-16 sampling sites is quite small, the difference seems significant. The difference with Na at the Luna-20 location is much smaller and may not be significant as the lowest Luna-20 values are near ALHA81005. There seems to be a general trend of decreasing Na and increasing Mg in highlands samples from the center to east limb of the nearside (Warren et al., 1981); the high Sc/Sm and Ti/Sm ratios for ALHA81005 also suggest a closer relationship to Luna-20, and a provenance well-away from the center of the nearside. Unfortunately, nothing is known regarding the nearside far west or the entire farside, but it seems likely that they are similar to the Luna-20 site. Titanium is also quite low in ALHA81005 relative to both Apollo-16 and Luna-20, although this element shows a greater range of variation than Na among the different Apollo-16 sampling stations. It has been previously noted that the Apollo-16 location appears to have a high-Ti component, possibly from KREEP having a higher local Ti concentration (Korotev, 1981). Scandium is also depleted along with Ti in ALHA81005 relative to the Luna-20 site, perhaps reflecting a lower SCCRV component in the sample (Wasson et al., 1977).

All compositional data are consistent with a lunar origin for ALHA81005. Its lunar location was probably well-away from the center of the nearside. Its composition is nearer that of the Luna-20 location than the Apollo-16 location, although there are sufficient differences to suggest a provenance

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remote from both both of these locations, including especially the far-eastern limb and the farside.

References: Korotev (1981) PLPSC 12th, 577. Warren et al. (1981) PLPSC 12th, 21. Wasson et al. (1977) PLSC 8th, 2237.