SEARCHING FOR ANTIPODAL BASIN EJECTA ON THE MOON Paul D. Spudis and Brian Fessler, Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston TX 77058-1113, spudis@lpi.usra.edu

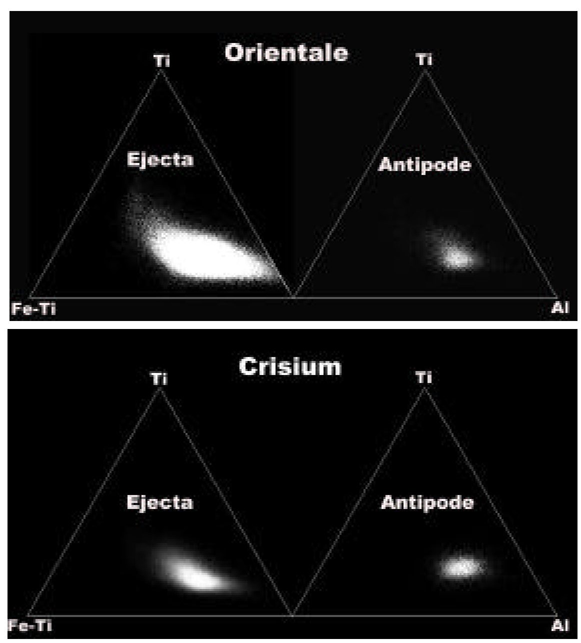
Multi-ring basins are the largest impact events in lunar history and have catastrophic, global effects on the Moon (e.g., [1]). Ejecta from these events may travel over great distances, but the thickness of the ensuing debris blanket thins quickly as one goes away from the basin rim [2,3]. Because impact events tend to (more or less) eject material equidistant from the point of impact, distal ejecta converge from all directions at the basin antipodes, possibly resulting in an anomalously large accumulation of ejecta at that point [e.g., 2]. Antipodal concentrations of ejecta may have resulted in both anomalous compositional [4] and geophysical [e.g.,5] relations seen in some regions of the Moon. This hypothesis has recently been revived, with the specific proposal that anomalously high contents of Th found near the far side crater Van De Graaf are concentrations of Imbrium basin ejecta, antipodal to that impact feature [6].

We have previously described techniques designed to map rock units on the Moon using Clementine and LP elemental data [e.g., 7,8]. These maps show how compositions vary regionally and allow us to directly compare regions distant from each other. We have used the petrologic maps of [8] to address the question of recognizable antipodal deposits of basin ejecta.

Method. As described by [9], we invert Fe data into "pseudo-aluminum" using the well-known inverse correlation between Fe and Al in lunar soils [10]. We then plot the parameters Ti, Fe-Ti, and "Al" on a ternary plot; each pixel in the Clementine image cube is assigned a value in this ternary space. The three apices are assigned the primary colors red (Ti), green (Fe-Ti), or blue ("Al"); compositions intermediate between these end members are rendered in intermediate colors. On this petrologic map, we trace the outline of areas dominated by ejecta from the Imbrium, Orientale, Nectaris, and Crisium basins. Except for Orientale, all basins are modified by other events and subsequent mare flooding [1], but recognizable deposits are extensive around these younger lunar basins. For each map of basin ejecta, a ternary plot is made, showing the composition of ejecta pixels in this space. This procedure is then repeated for the basin antipode; we drew a circle ~ 200 km in diameter, modified to avoid obvious mare deposits and other obscuring later deposits. The antipode compositions were then directly compared to the plots for the ejecta of their parent basins to determine compositional affinities.

Results. For the four basins studied, the range of compositions seen in the antipodes is much more restricted than the range seen in the near-rim deposits. However, in each case, the antipode compositions are a subset of the basin ejecta envelope. Orientale basin, which has a very feldspathic ejecta blanket, similarly shows a feldspathic, although more restricted, composition at its antipode (Figure), near the crater Goddard, north of Mare Marginis. In contrast, the Imbrium basin has a wide-ranging ejecta composition, with most pixels being highland basalt, but a minor trend towards feldspathic lithologies. Imbrium's antipode, near Mare Ingenii, is almost completely of highland basaltic composition. The Crisium basin shows an interesting departure from this pattern, in that the antipode deposits map a trend line towards the (Fe-Ti) apex, in contrast to the trend of Crisium ejecta towards the Ti apex. Although the antipode is contained within the basin ejecta envelope of Crisium (Figure), it appears that this deposit might have a different provenance.

Conclusions. Our initial results cannot rule out the hypothesis that distal basin ejecta may concentrate at the antipodes. We plan further work to refine this mapping, including study of additional basins and other compositional data sets (e.g., Th).



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