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GEOLOGICAL SETTING OF THE APOLLO 14 AND APOLLO 15 LANDING SITES

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Lunar photogeologic mapping has shown that the multi-ringed circular basins are the dominant geologic features of the Moon's near side (Wilhelms and McCauley, 1971). These basins are the large members (larger than 250 km) of a size series of circular lunar features or craters believed to be produced by impact. Circular features in this series less than about 250 km diameter have one dominant raised encompassing ring or crater rim; larger circular structures are surrounded by two or more raised, roughly circular structures or rings.

In order to sample representatively, and thereby better understand lunar basins, one of the objectives of Apollo missions 14 and 15 was to investigate different parts of the most accessible, largest, and second youngest basin - Imbrium. Apollo 14 sampled radially textured basin ejecta (Fra Mauro Formation) at a point 500 km outside the main ring of mountains bordering the basin just north of the partly mantled pre-Imbrian crater Fra Mauro. Numerous studies of

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natural terrestrial impact craters and experimentally produced impact and explosion craters show that the outer radial ejecta consists of thoroughly broken pre-basin bed rock most of which was excavated from deep within the crater and deposited ballistically along low trajectories upon pre-basin terrain. The rugged raised rim, on the other hand, consists mainly of pre-crater rock, fractured and uplifted, but not grossly disaggregated and redistributed, and overlain by only a thin layer of ejecta. The bulk of the material returned by Apollo 14 should consist of complex finely fragmental debris produced directly during the Imbrium event.

Apollo 15 sampled materials from the foot of the steep inward facing scarp of the Apennine Mountains, which constitute the main mountain ring surrounding the Imbrium basin. Included in the Apollo 15 samples should be ejecta from the nearby Serenitatin basin and an indistinct basin, centered near the crater Copernicus, whose vaguely expressed rings trend toward Imbrium, but are truncated by it. In addition, volcanic rocks like those observed in all large lunar depressions as light-colored plains materials probably occupied parts of these old basins and these pre-mare but post-basin rocks may also be included in the samples from both missions.

Apollo 15 also sampled basalts of Palus Putredinus in which Hadley Rille is incised. These basalts flood the Imbrium basin, but clear stratigraphic relations in the Archimedes region west of the site show that they were emplaced in a considerable time after the basin formed and are not the direct product of the impact that formed the basin. These rocks should be similar in character to those returned by Apollo 11 and 12.

A complex record of multiple brecciation is, therefore, expected in both sample suites - some pre-Imbrian volcanic samples that have undergone only Imbrium-related brecciation and shock metamorphism may be present and if they can be identified, they should help establish the age of the Imbrium event. The samples from the base of the Apennines may be of deep-seated origin and show less fragmentation and shock metamorphism than the more far flung Apollo 14 materials. They may also better retain evidence of earlier basin-forming events. Some ejecta may have covered the uplifted Apennine ring and have found its way into the debris sampled at the base of the scarp, thereby making distinctions between specific basin-forming events difficult, if not impossible.

References

Wilhelms, D. E., and McCauley, J. F., 1971, Geologic map of the near side of the Moon: U.S. Geol. Survey Misc. Geol. Inv. Geol. Map I-703.