THE GEOLOGY OF THE LUNAR MARE FECUNDITATIS:

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Mare Fecunditatis is located toward the southeast limb of the near side of the Moon and contains basaltic material covering an area of approximately 220,000 km^2 (1). The mare is irregular in outline, elongate in a north-south direction, causing parts of it to be present on several geologic quadrangle maps of the Moon (2-7). An analysis by De Hon (8) showed the mare to be deepest (approximately 1.5 km) in the central-northwest area and relatively shallow (< 500m) over the remainder.

The Luna 16 spacecraft landed in and returned samples from northeastern Fecunditatis (9). The basalts are of two types (10); one contains a high iron content and the other has been designated as a high alumina basalt. The high alumina basalts have radiometric ages of approximately 3.41 b.y. (11). The landing site falls within an area given the spectral classification of hDWA by Pieters (12) where h refers to a medium-high UV/visible ratio, D indicates a dark albedo, W designates a weak 1 micron band response, and A denotes an attenuated 2 micron band. The remainder of the northern part of the mare has been assigned a spectral classification of mIG_ and the southern part of the mare as mBG_ where m denotes medium, I and G indicate intermediate and bright and G is gentle.

The present analysis represents an attempt to outline the evolution of the mare infilling by employing Lunar Orbiter and Apollo photography, earth-based photography, color-difference photography, and multispectral ratio images and to integrate the data obtained by the various geochemical and geophysical instruments.

Of the most recent events affecting the mare, the two most significant were the formation of the large impact craters Langrenus and Taruntius in northern Fecunditatis. The effect of these impacts was to redistribute surface materials over a large part of the mare, thereby obscuring the nature of the underlying basaltic terrain. Also prominent in northern Fecunditatis is the elongate crater Messier with its spectacular ray system.

The sources of the majority of the volcanic materials within Fecunditatis are not prominent. Among those that are prominent are two steep-sided domes approximately 85 km to the west of the Luna 16 landing site. These are similar to domes in the Marius Hills volcanic complex of Oceanus Procellarum. Another source lies to the southeast of Messier crater and appears, on the basis of stereographic photo interpretation, to be a pair of cinder or spatter cones. A flat-floored crater with a surrounding dark halo of probable volcanic origin is located near the western shore of northern Fecunditatis. This crater appears to be intimately associated with a series of graben and fractures along western

Fecunditatis and may be of comparable age to the dark halo crater found within the nearby crater Goclenius (13). The spatial distribution oof some of the spectrally defined units suggests that a number of the surface lavas may have been derived from vents located near the edges of the mare, in particular in northeastern Fecunditatis and to the south of the crater Goclenius. Wilhelms (14) has also suggested that some of the lavas within northwestern Fecunditatis were derived from sources in the adjacent highlands and possibly from southeastern Tranquillitatis.

The mare ridge system within Fecunditatis is extremely well-defined in the eastern and northern parts and is dominated by NE and NW-trending elements. In the western part of the mare the mare ridge system is composed of a number of circular elements, these may reflect the presence of relatively shallowly buried impact craters.

The exact size and location of the impact basin that has been infilled by the Fecunditatis lavas is poorly defined. Wilhelms (11) indicates that it was centered on the northern portion of the area where the basalt infilling is thickest and he assigned it a pre-Nectarian age.

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