

PHOTOGEOLOGIC DETECTION OF SURFACES BURIED BY MARE BASALTS, R. E. Eggleton*, G. G. Schaber*, and R. J. Pike**; U. S. Geological Survey,*Flagstaff, Arizona 86001, **Menlo Park, California.

Lunar main-sequence craters are sufficiently abundant and geometrically systematic so that most of the geometric characteristics of an individual crater can be predicted fairly accurately from very limited observations of its geometry, e.g., a rim-crest diameter (e.g., 1). The predictions are based on statistical studies of crater morphology. An important application of this is the detection of surfaces covered by mare basalts (2). A surface exposed to the flux of interplanetary debris for a significant interval collects a substantial population of craters. For a given exposure interval there is a range of subsequently covering basalt thicknesses which will partially obscure the larger craters on the covered surface and completely obscure the smaller ones.

For example, in a 160,000 km² area of northern Oceanus Procellarum, Eggleton and Smith (3) mapped about 50 craters 1 to 20 km in diameter partly obscured by mare basalt. Schaber (4) (1969) mapped 14 similar craters in northwestern Mare Imbrium. The most thoroughly obscured craters on a covered surface, which are still detectable, are completely covered by basalt but produce a low raised ring on the mare surface (5) apparently formed by differential subsidence of the mare surface. The diameter of the crest of the raised ring can be measured and from it the height of the covered crater rim can be estimated from the morphologic statistics on non-covered craters. The rim heights are the order of 1/20 of the crater diameter or about 50 to 75 meters for the small, barely covered craters in northern Oceanus Procellarum and 75 to 100 meters in northwestern Mare Imbrium. The basalt covering the crater rim crest represents an uncertainty in the estimate of the total thickness of basalt covering the crater. The cover over the rim crest is probably only a few meters thick or about 5% or 10% of the total thickness. The relief on the telltale ridge on the mare surface is also of this order so that the thickness of basalt cover in intercrater areas is probably within one or a few percent of the original rim heights of the barely covered craters.

Two other types of covering, in slightly larger craters, also indicate intercrater depths of cover closely comparable to the rim height of the partly obscured craters. Craters that are barely larger than those described above have their rims entirely covered but their interiors only partially filled in with basalt; for example, to 1/3 to 2/3 their original depths. The flooding of the interiors probably took place locally at one or more low places in the rim crest, perhaps only during a flood stage of the flow of lava, and ceased before filling of the interior was completed. Slightly larger craters show no apparent filling by basalt but also lack any rim that remains uncovered.

All larger craters have some fraction of their rim height covered. Statistical knowledge of the radial crater-rim profiles permits estimation of thickness of covering basalt in these cases.

Probably the simplest model for interpretation of the data is that in a local region such as a mare basin, Serenitatis, for example, the partly obscured craters were all formed on the same surface and then were rapidly

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covered to some higher level so that few craters (or none) which formed at intervening levels will be detected. Areal systematic patterns of thickness variation may then be expected. More than one buried, long-exposed surface in an area may be searched for. Buried surfaces of mare basalt and terra plains rubble and/or breccia deposits will be fairly flat and level, but ultimately the essentially plane-layered sequences will lie on an irregular, rough, highly cratered terra "basement" surface.

Where there is sufficient data for the estimation of the crater population on the buried surface, the thickness of the associated regolith may also be estimated. Simple populations of individual lunar craters may be interpreted as composed of impact craters possessing a range of large sizes dominated by primary impact craters, an intermediate size range dominated by dispersed secondary impact craters, and a range of small sizes in a steady state in which craters are destroyed at the same rate at which they are produced. In the large and intermediate ranges, the population density increases with time. An observation of part of the population in the large or intermediate size range, for instance in a population of mare-flooded craters, permits the estimation of the completely buried remainder of the population. Furthermore the characteristics of the associated regolith may be estimated--in particular the thickness, which is especially significant for the development of models of stratigraphic sequences.

Table 1 gives a listing of preliminary results.

Table 1. Preliminary depths to some planar surfaces buried by mare basalts.

<u>Locality</u>	<u>Depth</u>
Mare Serenitatis	
Central plain	200 m (in southwest) to 100 m (in northeast)
Mare Imbrium	
Northwestern	75 to 100 m
Central	75 to 100 m
Oceanus Procellarum	
Northeastern	50 to 75 m
West-central	100 m
Southeastern	
near Maestlin	50 to 150 m
near Flamsteed	25 to 60 m

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