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UTILIZATION OF UNIQUE MARE STRATIGRAPHY FOR DETERMINATION OF LUNAR SURFACE MATERIAL PROPERTIES AND LOCATION OF SUBSURFACE OPERATIONS FACILITIES;
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Detailed studies of mare crater size-frequency distributions in the diameter range from 100m to 600m have demonstrated a distinct inverse relation between total numbers of craters and surface ages in the diameter interval below 300m (1). This relationship indicates that caution must be exercised in any theoretical calculations of the particle size distributions of regolith fragments based on models using measured crater size distributions. Because the disappearance of small craters in this size interval (<300m) is considered to be caused by the cumulative effects of seismic vibrations, as well as impact gardening in the thickening regolith, further studies are needed to estimate the effect of prolonged impact gardening on the physical nature of the regolith. The buffering effect of the growth-regulated regolith has been discussed by Quaide and Oberbeck (2), but additional factors may be of importance. For example, the subsurface stratigraphy of Mare Serenitatis (3,4) has produced a conspicuous increase in the size and number of ejecta fragments around small craters. Additional studies (5) have shown that both crater-size frequency distributions and crater morphology for craters up to 700m in diameter are measurably affected by the magnitude of impact gardening and the nature of subsurface discontinuities in individual mare regions.

It would be advantageous to attempt calculations of probable regolith fragment size distributions for a number of theoretical ages and simple layered models to explore the economics of various surface mining, stripping, construction, or processing operations. In this regard, each mare basin or subregion is probably unique.

Southern Mare Serenitatis (inside the dark annulus) is the most obvious of those regions where a number of orbital and remote sensing experiments indicate an older regolith in a widespread subsurface layer that is probably 100 to 200m beneath relatively coherent surface lavas (4,5). The evidence for this buried zone can be seen in crater-size frequency distributions, the morphology of craters ≤700m in diameter, infrared spectral reflectance data(6), Lunar Sounder data (7), the ejecta of large craters such as Bessel (4), and rim height/diameter ratios of partially flooded craters (Fig. 1).

The presence of this buried zone of regolith and dark mantle (?) material provides a unique situation for combined subsurface construction, natural shielding, and access to large quantities of fragmental lunar materials. In addition, it is possible that the voids in the buried regolith contain mineralized zones, intrusive veins, or vapor phase mineral deposits from events associated with the emplacement of the younger surface flows and intrusive mare ridges.

Access to this buried regolith zone is readily provided by fresh craters less than one km in diameter (Fig. 1). The mineralogy of ejecta from these craters can be studied by remote spectral reflectance from earth or lunar orbit (6,8). Fresh craters with progressively larger diameters could be examined by infrared reflectance to explore below the surface and detect mineralogical differences, regolith, or dark mantle zones.

Mare Serenitatis has the additional advantage of containing some of the youngest intrusive mare ridges (4) as demonstrated by flow into numerous postmare impact craters. These ridges are probably the most coherent surface exposures of lunar bedrock with a minimum of regolith cover and could provide solid foundations on the surface for related engineering, scientific, or launch facilities. The ridges may also represent late-stage differentiation of magmas injected as residual melts from the earlier widespread mare flooding. For this reason, they might be the best candidates in the maria for mineral "prospecting".

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DIAGRAMMATIC CROSS SECTIONS

MARE SERENITATIS

(NOT TO SCALE)

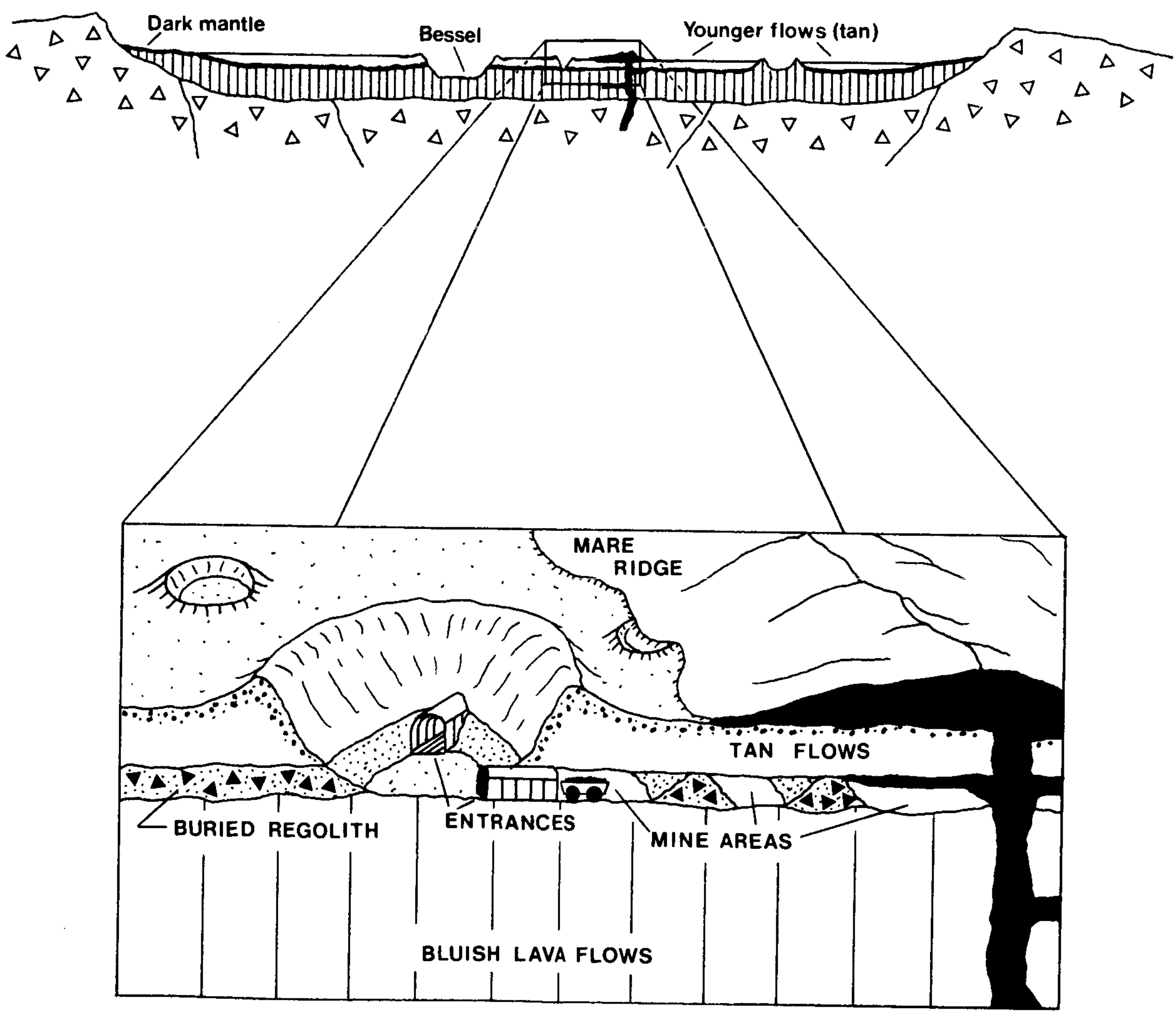

FIGURE 1