This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

DEPARTMENT OF THE SPEERSON UNITED STATES GEOLOGICAL SURVEY

ort

OPEN FILE REPORT

Site III P-11 is in the southern portion of Oceanus Procellarum, approximately 320 km south of the crater Kepler.

The site is within moderately cratered gently undulating mare, presumably Eratosthenian and (or) Imbrian in age. Pre-Imbrian material has been recognized in the immediate vicinity of the site. Craters are commonly randomly distributed and range in size from tens of meters to 3 km. Northwest-trending crater clusters occur in a few places; they have been interpreted as secondary impacts from Tycho. An east-west trending cluster (Ccc3) is of unknown origin. Mare ridges are superposed on the mare. Although there is no obvious geologic or topographic division between the eastern and western halves of the mapped area, and no obvious criteria for differentiating mare units, the oldest craters (Cc<sub>1</sub>) are apparently much more numerous in the western half, suggesting that it may be slightly older. The reason for this age difference is unknown.

Superposition relations indicate that craters are degraded with time. Relative ages (higher numbers for younger craters) are assigned according to the apparent freshness of craters with respect to their size; small craters are degraded faster than large ones so that a small subdued crater may be of the same age as a large sharper one. Figure 1 shows the general

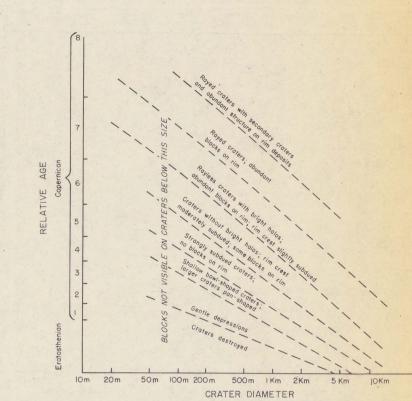


Figure 1 morphological criteria used to assign relative ages. The more detailed descriptions in the chronologic column apply specifically to site III P-11. Categories are gradational. Diameters given in figure 1 are from rim crest to rim crest, whereas the cutoff limits for labeling craters refer to the limits of continuous deposit related to the crater. Only those craters whose associated deposits exceed 400 meters in diameter, and those that are not members of a crater cluster,

are labeled. Those deposits exceeding 800 meters in diameter

Lineaments, possible evidence of faulting, are not dis-

Because of the proximity of Surveyor I to site III P-11, the data received from Surveyor I may be extrapolated to site

III P-11. The static bearing strength of the surface at the

(5 psi) (Natl. Aeronautics and Space Adm., 1966, p. 20). The

mechanical properties of the lunar surface at the Surveyor I landing site appear to be similar to those at the Surveyor landing site (Natl. Aeronautics and Space Adm., 1967, p. The static bearing strength for the surface at the Surveyor site is also about 3 x  $10^5$  dynes per cm<sup>2</sup> (5 psi). The crush ing strength of a block picked up by the Surveyor III soil sampler is about 2 x 10<sup>7</sup> dynes per cm<sup>2</sup> (100 psi). Similar

materials at site III P-11 may have similar properties.

3 - mare ridges, their origin and morphology

Impact metamorphism and mechanics, crater morphology.

Perhaps the most fruitful area for this study would be

site. The ejecta blankets of these craters are pre-

in and around the largest fresh crater (Cc4) in the nort ern part and a Cc7 crater in the central portion of the

served, and blocks several meters in diameter are strewn

on the surface. These blocks may exhibit shock features

and the ejecta may contain pieces from the impacting mate rial. The most highly shocked material may be present on

2. Secondary impact fields. Scattered patches of crater clusters, interpreted as secondary impact fields from the

pect of these areas is that they probably contain mate-

rial derived from Tycho--a distance of several thousand

. Mare ridges. Excellent examples of mare ridges occur in this site. Study of these ridges should lead to an under

where on the moon. Several types of mare ridges appear to be present elsewhere on the moon, and each type may have a different origin. The following discussion and interpretation refer only to that type found in site I

P-11. Several features of the mare ridges have been ma

ably consist of the same material. The interrelationsh of these topographic elements are similar to those exships are distinct in the S. P. Crater flow, part of the San Francisco volcanic field north of Flagstaff, Ariz

ped separately--plateau (p), spine (s), and lobe (1)

If the analogy is valid, the mare ridges in this site

ridges elsewhere on the moon are not visible in the

not be related to these ridges and should be sampled.

Mare ridges of three ages have been recognized; the two

REFERENCES CITED

National Aeronautics and Space Administration, 1966, Surveyor I, a preliminary report: NASA Spec. Pub. 126.
1967, Surveyor III, a preliminary report: NASA Spec. Pub.

formation in regard to their origin.

oungest, mr3 and mr2, would probably yield the most in-

are probably lava flows. Block fields on or around mar

photographs used to map the site. Such fields may or may

kilometers--and from the southern lunar highlands.

crater Tycho, have been mapped. The most significant as

yielding geologic information of various kinds:

A discussion of each kind follows:

Surveyor I landing site is approximately 3 x 10<sup>5</sup> dynes per cm<sup>2</sup>

l - impact metamorphism and mechanics, crater morphology 2 - secondary impact fields, together with allochthonous material derived from thousands of kilometers away

are outlined, and those with deposits between 400 and 800 meters in diameter are numbered. A thin blanket of material may cover much of the area. Whether this material is ejecta from meteorite impacts or volcanic debris such as ash fall tuff is debatable

Crater materials, undivided. No blocks present; crater density on rim material same as the of surroundings; associated crater has

Crater materials

NOTE: Crater materials occupying areas larger than 800 meters in lateral extent, including deposits outside the rim crest, are outlined by geologic contacts; materials occupying areas between 400 and 800 meters

in lateral extent are assigned numbers only; materials within areas of less than 400 meters are unmapped.

7, crater materials undivided. Includes bright-halo material; abundant blocks present; crater density on rim mate-

ter rim crest slightly subdued. Ccr<sub>7</sub>, rim and wall, undivided. Rim de-

rial lower than that of surroundings;

subdued ray material; abundant blocks present; crater density on rim mate-

rial lower than on surroundings; cra-

posits bright and hummocky.
Crr7, radial rim. Continuous ejecta facies

of dunelike or elongate hummocks.

6, crater materials, undivided. Includes bright halo material; abundant blocks present; crater density on rim material lower than on surroundings; crater rim crest slightly subdued. Cc6, crater materials, undivided. Includes ray material; abundant blocks present in rim deposits; crater rim crest

5, crater materials, undivided. Unit not bright; abundant blocks present; crater density on rim material lower than that of surroundings; crater rim crest

Cc5, crater materials, undivided. Includes bright-halo material; abundant blocks present; crater rim crest sharply

4, crater materials, undivided. Crater density on rim material moderate; crater rim crest

bright-halo material; abundant blocks pre-

Ccr4, rim and wall, undivided. Abundant blocks

Crr4, radial rim. Continuous ejecta facies of

Crater materials, undivided. Crater density

on rim material same as that of surroundings associated crater is pan-shaped depression.

moderately subdued. Cc<sub>4</sub>, crater materials, undivided. Includes

sent; crater rim crest subdued.

dunelike or elongate hummocks

slightly subdued.

crater rim crest slightly subdued. Cc7, crater materials, undivided. Includes

Characteristics

Crater materials, undivided. No blocks present; crater density on rim material moderate; crater rim crest strongly subdued.

Interpretation

Materials of craters that are probably mostly
of impact origin. Numbers from 1 to 7 indicate decreasing relative age of materials. Interior slope of youngest craters is probably fragmental and brecciated debris. (Interior slope of many of the oldest craters may have a blanket of material deposited over the oriably would not yield significant geologic information in regard to impact crater mechanics or metamorphism but samples should be collected from these old craters to compare with samples collected from young craters.) Slope in young craters approximately at the angle of repose

for fragmental and brecciated material. May

include blocks of highly shocked rock. Rim

material is impact ejecta of finely pulverized

Mare ridge material

and brecciated rock.

Characteristics

Distinct spines and plateau clearly visible. Crater density on ridge approximately the same as on mare material (unit EIm). Craters older than Cc<sub>3</sub> more than 400 meters in diameter not seen on ridge; albedo low.

Distinct spines and plateau visible. Crater density on ridge approximately the same as on mare (unit EIm). Craters older than  ${\rm Cc_2}$  not seen on ridge; albedo low.

Ridges are subdued and sinuous. Spines and plateau indistinguishable. Crater density on ridge approximately same as on mare (unit EIm). Craters older than Cc<sub>2</sub> above 400 meters in dia-meter not seen on ridge; albedo low.

EIm

Mare material

Probably volcanic flows.

geol. 1:100,000. 1967.

Ring material

Subdued hummocky topography outlining circular to irregular depressions 500 to 1,300 meters in diameter. Some have slightly raised floors and are partly surrounded by

Buried contact

Lineament

-----

Ridge crest of dome

Subdued old craters probably of different episodes of mare material emplacement. I the craters were fresh when buried by mare, probably depth-diameter ratios would suggest 100 to 250 meters thickness of mare material; if the craters were markedly subdued prior to burial, 50 to 125 meters

thickness of mare material is likely.

Dome material

Ray material

Material in and around clusters of elongate

craters approximately 50 meters in diameter that have the same characteristics as Cc6-

type craters; albedo high. Queried where

Crater-cluster material

Materials in and around clusters of nearly circular craters approximately 50 meters

in diameter that have the same characteristics as Cc<sub>3</sub>-type craters; albedo moderately

Interpretation
Material of secondary impact craters and

Interpretation
Material of secondary impact craters and

ejecta from the crater Tycho.

high; oriented east-west.

ejecta. Origin unknown.

Structural features in

mare ridge material

Mare ridge spine

Spines are narrow ridges topographically higher

lar to natural levees of terrestrial lava flows

and are morphologically very similar; occur

only on Emra and Emra.

than plateau p. Appear to occupy positions simi-

Mare ridge plateau

Broad, generally undulatory surface bounded by

than mare surface. Major part of lava flow on

Mare ridge lobe Lobate features at base of spines, s, and outside of mare ridge. May represent subsidiary flows which broke through base of levee or may represent debris from levee; occurs only on Emr<sub>2</sub>.

Moon (Orbsite). sheet 3P-11,

Circular domal features 150-700 meters in diameter that rise slightly above level of surrounding mare surface, commonly surrounded by shallow trench. Flanks commonly slope more than 21°. Some are doughnut shaped; in these, center is slightly lower than rim and occupied by small pit. A few are partly encircled by

Interpretation Possibly the surface expression of small pluglike intrusives. Those with incomplete outer rings may be old craters whose rims have been preferentially subdued to the level of raised Albedo predominantly low. Generally flat to very gently undulatory surface. Craters superposed on surface. Lineaments in mare not obvious. No ghost craters or partially buried craters can be seen through the mare.

Probably volcanic tuffs or flows. Area appears to be covered by a single mare unit. Based on the age and distribution of craters on the mare, the mare is approximately the same age (Eratosthenian and (or) Imbrian) throughout the area. The uniform appearance of the surface may in part be the result of a blanket material which mantles different mare units, if any are present.

USGS LIBRARY - RESTON 3 1818 00143512 0