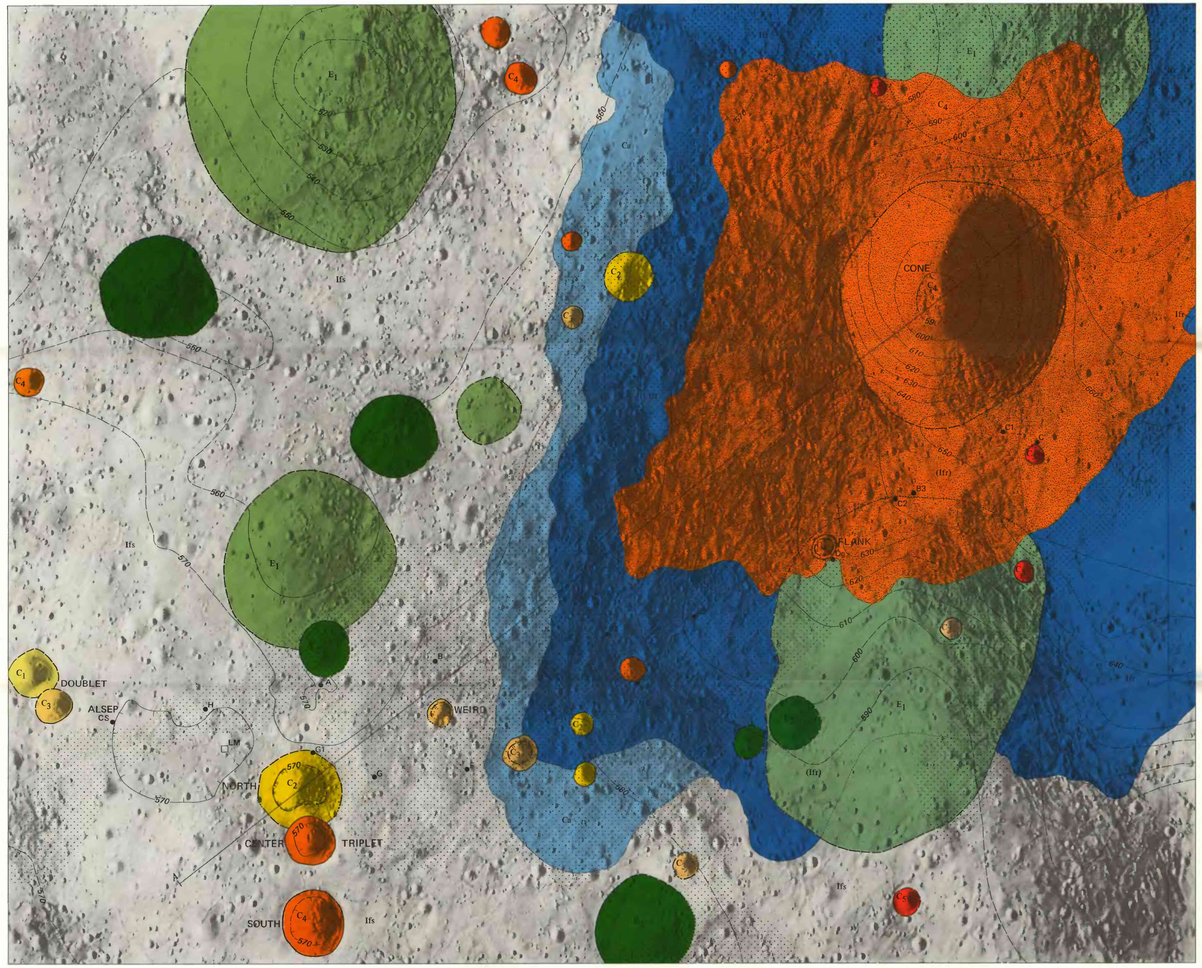
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared on behalf of the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROFESSIONAL PAPER 880
PLATE 1



This map was compiled from Lunar Orbiter 3 frame H-133, transformed to an approximate orthographic view by displacing feature images as a function of known camera tilt and topography as portrayed on a small-scale topographic map (Lunar Topographic Photomap, Fra Mauro, by Mapping Sciences Laboratory, NASA MSC, 3d edition, November, 1970). Contour lines in the vicinity of the traverse were controlled by spot elevations computed from coordinates of features identified on H-133 and on photographic panoramas taken on the surface and are shown as solid lines. Estimated relative accuracy of the control points is ±1 m. Dashed contour lines were transferred from the NASA photomap with some modification for reasonable join to controlled contour lines. Their estimated relative accuracy is ±10 m. No attempt was made to fit contour lines precisely to topographic images

Shaded relief portrayal by Patricia M. Bridges

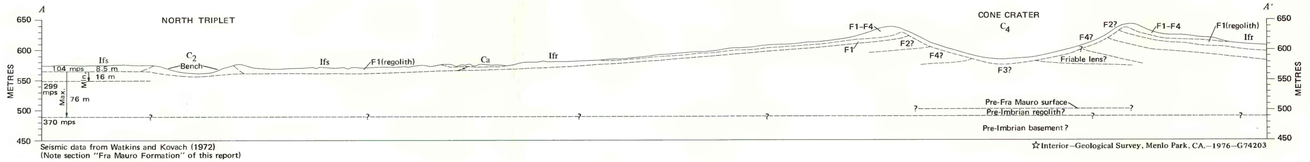
N

SCALE 1:5 000

100 0 100 200 300 400 500 METRES

CONTOUR INTERVAL 10 METRES

Prepared under NASA contract T-5874A



Seismic data from Watkins and Kovach (1972)
(Note section "Fra Mauro Formation" of this report)

☆Interior—Geological Survey, Menlo Park, CA.—1976—G74203

GEOLOGIC MAP AND SCHEMATIC SECTION OF THE APOLLO 14 LANDING SITE

EXPLANATION

CRATER MATERIALS

Crater materials are mapped inside rim-crest lines only. An exception is Cone crater, which has mappable ejecta and ray deposits based on Lunar Orbiter III photograph H-133 and photographic panoramas by the Apollo 14 crew. Relative ages of smaller craters down to 30 m in diameter are based on rim morphology and shadow sharpness at 22° sun elevation; they represent the materials of underlying geologic units reworked by the processes of impact crater formation. Some large subdued Eratosthenian and Imbrian craters shown on premission maps are deleted here in order to clarify primary geologic relationships

C_5

Craters having slightly subdued rim crests and sharp floor shadows

Block density around rims is locally high. C′ crater, on the continuous rim deposits of Cone crater, is the type example. Four craters, 30-40 m in diameter, are mapped; they are inferred to be the youngest features in the area

C_4

Craters having moderately subdued rims and slightly diffuse but distinctive floor shadows

Rims have distinct raised relief and are modified by a few small unmapped sharp craters. Locally one or two metre-size blocks occur on rims and floors. South and Central Triplet craters and Flank crater are examples in the 30- to 100-m-diameter range mapped as C_4. Cone crater, 370 m in diameter, is also assigned this age. The surface material on the crater wall, mapped at C_4, obscures the contacts inferred in schematic cross section and in Ifr below

C_3

Craters having moderately to strongly subdued rim crests and diffuse floor shadows

Wall slopes are smooth but remain steeper than 22°. Rounded rims are slightly raised or may have no relief. Blocks are sparse or absent. Crater density is about the same as that of C_4 craters. Weird crater is an example of this age group, which ranges from 30 to 60 m in diameter in the mapped area

C_2

Craters having very subdued rims and diffuse floor shadows indicating low-sloping walls

Blocks are characteristically absent. Type example of larger craters in this group is North Triplet, 130 m in diameter, which has nearly flat floor and well-developed patterned ground on wall. Subtle bench mapped in wall may reflect base of regolith at 5- to 10-m depth. Three other craters, 30-80 m in diameter, are mapped in this age group

C_1

Gentle depression having extremely subdued rim and almost no floor shadow, indicating wall slopes below 22°

Flat floor and absence of blocks is notable in north Doublet, 80 m in diameter, the only example in the area mapped

Craters having very subdued topographic expression

Broad, rimless, pan-shaped depressions, 50-180 m in diameter. Moderate density of small fresh craters is superposed on entire crater

E_1

Craters having the most subtle morphology still recognizable at this scale of mapping

Characteristically form broad, irregular, rimless depressions, 100-450 m in diameter. High density of small craters similar to those found elsewhere on the Fra Mauro Formation throughout the area mapped

CONE CRATER EJECTA

Continuous hummocky rim materials characterized by generally smooth and gently rolling surface

Unit is modified by relatively few small fresh craters and is locally lobe shaped at outer margins. Gradational with discontinuous blocky ray material; boundary obscured in places by downslope movement of regolith and crater ejecta. The unit comprises a mixture of materials from 50-60 m depth beneath Cone crater and overlies the regolith-covered surface of the Fra Mauro Formation (Ifr)

Discontinuous blocky ray material distributed radially outward from Cone crater rim

Unit extends asymmetrically southwestward more than four crater diameters. Indefinite boundary is based on block distribution shown on plate 7. Not mapped within area of continuous hummocky rim materials

COPERNICAN

C_a

Apronlike deposit at west and southwest base of Fra Mauro ridge (Ifr)

Unit is bounded by slight changes in slope between it and Ifr above and Ifs below. Its surface characteristics are otherwise very similar to the smooth, extensively cratered surface of the smooth Fra Mauro material (Ifs). It includes material older (perhaps much older) than the C_2 craters that appear to be superposed on it. It is interpreted to be material mass-wasted from the slopes of the ridge during Copernican time. The most recent movement may have been caused by the impact that formed Cone crater, thus giving the unit an age, in places, equivalent to that of C_4 craters

ERATOSTHENIAN

IMBRIAN

Fra Mauro Formation

Ifs

Smooth material

Material of relatively smooth, broadly undulating surface, found primarily in topographically low areas west and south of Cone crater. Albedo range, 8.2 to 9.1 percent, is lower than that of adjacent ridgy material (Ifr) but contact between these units is very gradational and differences probably stem from variation in surface processes rather than composition. Covered everywhere by a regolith of reworked materials derived from underlying Fra Mauro deposits and, to a lesser extent, from crater ejecta transported from outside the area mapped

Ifr

Ridgy material

Material of the north-trending ridge having topographic relief of about 80 m above the adjacent surface of the smooth material (Ifs) to the west. The albedo, 9.0 to 15 percent, is higher than that of Ifs, probably owing to the presence of ejecta from Cone crater and the more rapid downslope movement of surface materials. Composition of the "bedrock" down to 50-60 m below the surface, excavated by Cone crater, is inferred to be a sequence, from the top down, of friable light-clast soil breccias (F1 of Wilshire and Jackson, 1972); coherent light-clast-dominant breccias (F2); moderately coherent to coherent dark-clast-dominant breccias (F4 and F3). Inferred to extend outward beneath the smooth material with about the same stratigraphic sequence, and thus the differences (albedo and surface morphology) between these units result from (1) regolith-forming processes on varying slopes and (2) the modes of deposition of Fra Mauro Formation rather than from differences in composition or geologic origin

(Ifr)
Contact

Solid line, sharp contact or morphologic boundary; dashed line, approximate or gradational boundary; dotted line, buried or inferred contact. Buried unit shown in parentheses

Crater rim crest and topographic bench (hachured) on crater wall

Dashed where approximately located; dotted where concealed or inferred

B1
Traverse station located from surface photographic panoramas

610
Topographic contour

Solid line where photographic control is best; dashed line where approximate