DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AND
THE USAF AERONAUTICAL CHART AND INFORMATION CENTER

GEOLOGIC ATLAS OF THE MOON
EUDOXUS QUADRANGLE
I-705 (LAC-26)

NOTES ON BASE

The base chart was prepared by ACIC with advisory assistance from Dr. Gerard P. Kuiper and his collaborators, D. W. G. Arthur and E. A. Whitaker.

DATUM

The horizontal and vertical positions of features on this chart are based on selenocentric measurements made by ACIC and published in ACIC Technical Paper No. 15, "Coordinates of Lunar Features", March 1965. The assumed lunar figure is that of a sphere corresponding to the mean lunar radius of 1738 kilometers. Supplementary positions are developed in the chart area as an extension of the primary control.

Primary Control Positions .... ⊕
Supplementary Control Positions .... △

ELEVATIONS

Radius vector lengths are the distances from the geometrical center of the moon to the plane of the crater rim or the designated position of the feature measured. The lengths of the radius vectors are expressed in kilometers.

The relative elevations of crater rims and other prominences above the surrounding terrain and depths of craters are in meters. They were determined by the shadow measuring techniques as refined by the Department of Astronomy, Manchester University, under the direction of professor Zdeněk Kopal. The probable error of the localized relative elevations is 100 meters in the vicinity of the center of the moon with the magnitude increasing to 300 meters at 70° from the center due to foreshortening.

Lengths of Radius Vectors to control points ...... ⊕ or △ 1737.9
Depths of craters (rim to floor) ...... (540)
Relative Elevations (referenced to surrounding terrain) with direction and extent of measured slope indicated 800

NAMES

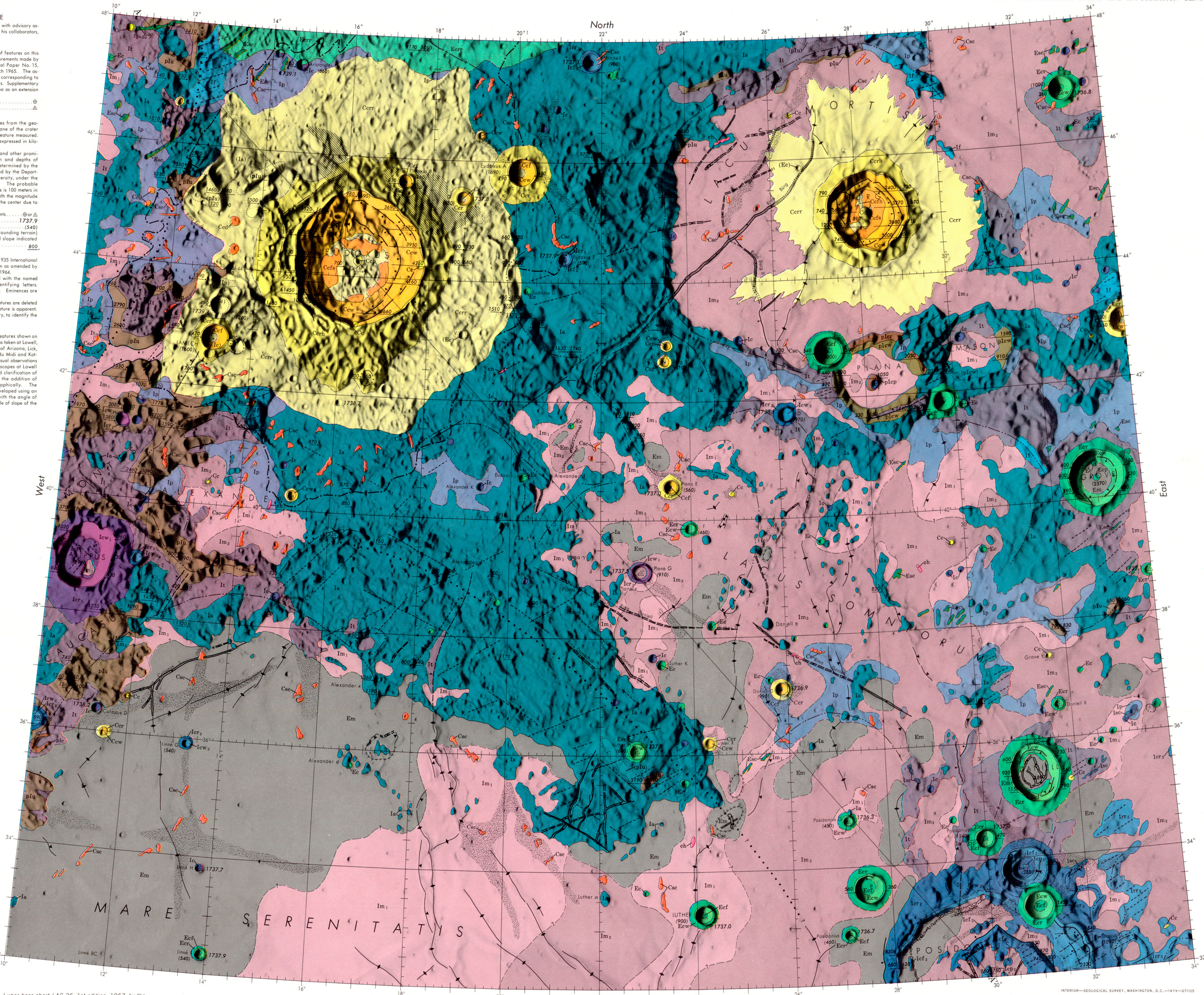
Feature names were adopted from the 1935 International Astronomical Union nomenclature system as amended by Commission 16 of the I.A.U., 1961 and 1964.

Supplementary features are associated with the named features through the addition of identifying letters. Craters are identified by capital letters. Eminences are identified by Greek letters.

Names of the supplementary lettered features are deleted when the association with the named feature is apparent. A black dot is included, where necessary, to identify the exact feature or features named.

PORTRAYAL

The configuration of the lunar surface features shown on this chart is interpreted from photographs taken at Lowell, U.S. Navy, Catalina Station-University of Arizona, Lick, McDonald, Mount Wilson, Yerkes, Pic du Midi and Kottomia Observatories. Supplementary visual observations with the 20 and 24 inch refracting telescopes at Lowell Observatory provide identification and clarification of indistinct photographic imagery and the addition of minute details not recorded photographically. The pictorial portrayal of relief forms is developed using an assumed light source from the West with the angle of illumination maintained equal to the angle of slope of the features portrayed.



Lunar base chart LAC 26, 1st edition, 1967, by the USAF Aeronautical Chart and Information Center, St. Louis, Missouri 63118

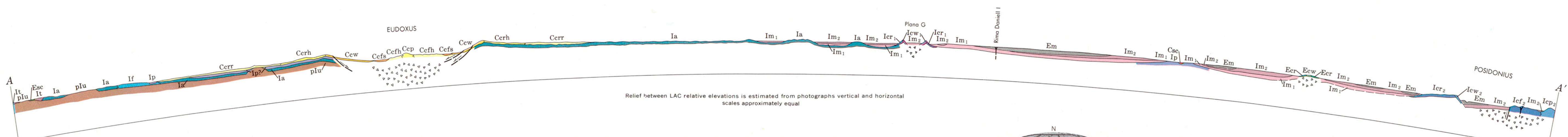
SCALE 1:1 000 000
LAMBERT CONFORMAL PROJECTION
STANDARD PARALLELS 21°20' AND 42°40'

STATUTE MILES
KILOMETERS

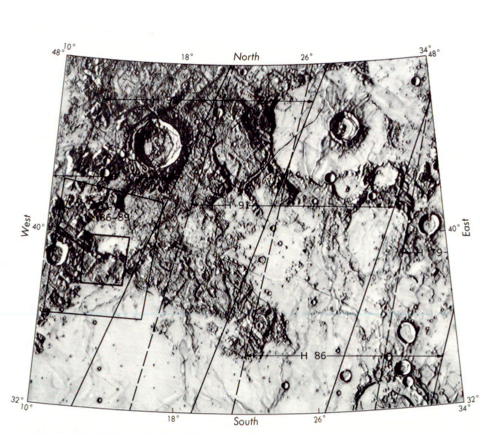
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973—G71105

Principal sources of geologic information: Lunar Orbiter IV high-resolution (identification resolution, 100 m) photographs, frames 79, 86, 91, 98, and 103 (see index map); low-illumination and full-Moon photographs from Lick Observatory and full-Moon photograph 5818 from U.S. Naval Observatory, Flagstaff, Arizona. Mapped 1970. A preliminary map of the area was made by Page (1967)

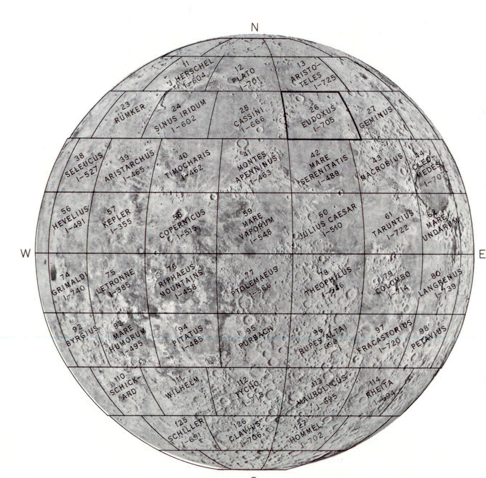
Prepared on behalf of the National Aeronautics and Space Administration under contract No. W-13, 130



Relief between LAC relative elevations is estimated from photographs vertical and horizontal scales approximately equal



LUNAR ORBITER PHOTOGRAPHIC COVERAGE OF EUDOXUS QUADRANGLE
All numbers refer to high-resolution frames of Orbiter IV except LO-V M 86–89, Orbiter V medium resolution. Solid black is Orbiter V high-resolution coverage



INDEX MAP OF THE EARTHSIDE HEMISPHERE OF THE MOON
Number above quadrangle name refers to lunar base chart (LAC series); number below refers to published geologic map

GEOLOGIC MAP OF THE EUDOXUS QUADRANGLE OF THE MOON

By
David H. Scott
1972

EXPLANATION

COPERNICAN SYSTEM

Ccd — Dark-halo crater material

Characteristics
Dark material around small craters (1-2 km rim-crest diameter) west of Eudoxus; clearly visible as patches of low albedo on full-Moon photographs
Interpretation
Probably impact ejecta from substratum of dark mare material; possibly volcanic ejecta

Cc — Crater material, undivided

Characteristics
Small (<4 km), circular, sharp, bright craters whose units are too small for subdivision
Interpretation
Impact crater material

Ccr, Ccrh, Ccrr, Ccw, Ccf, Ccfs, Ccfh, Ccp — Materials of rayed craters

Characteristics
Have distinct rays or bright halos on full-Moon photographs and most of following: sharp rim crest, high local relief, hummocky rim and floor material, and high thermal anomaly
Ccr, *rim material, undivided. Smooth surface, concave upward, culminating in prominent rim crest around small (<15 km) near-circular craters. Around Eudoxus (65 km) and Bürg (43 km) divided into:*
Ccrh, *rim material, hummocky. Rough, blocky, elevated surface having irregular ridges and troughs generally paralleling subcircular and polygonal rim crest outlines. Topographically distinct from adjacent terrain but texturally grades outward into radial facies. Fine radial lineations occur around Eudoxus*
Ccrr, *rim material, radial. Subdued blanket exterior to hummocky facies; has low-relief radial ridges which obscure underlying material. Toward outer margin unit merges with a third facies, irregular fields of satellitic crater clusters which do not obscure underlying material; outer boundary of dense crater field shown by special line symbol (see below)*
Ccw, *wall material. Smooth in small craters. Smooth and massive to hummocky and terraced in Eudoxus and Bürg. Albedo high to intermediate (previously shown on lunar geologic maps as "bright slope material")*
Ccf, *floor material, undivided. Blocky to smooth and gently domed in craters 7-15 km rim crest diameter. In smaller craters merges with wall material. Subdivided in Eudoxus and Bürg into:*
Ccfh, *floor material, hummocky. Irregular humps and ridges between crater peak and wall materials*
Ccfs, *floor material, smooth. Flat to gently rolling surface. In places resembles Eratosthenian mare material but has higher albedo*
Ccp, *peak material. Forms prominent, steep, sharply outlined central hill in Bürg but is only slightly elevated above hummocky floor in Eudoxus*
Interpretation
Morphology of all units characteristic of impact craters. Hummocky rim material comprised of large, fractured blocks and bedrock ridges and troughs faulted along lunar-grid systems. Small scale lineaments developed along tension fractures radial to Eudoxus. Radial member made up of relatively fine-textured impact ejecta; fragment size and blanket thickness decrease outward but secondary craters produced by impacts of large blocks increase and are preferentially located in an outermost, overlapping zone. Wall material comprises fractured and faulted bedrock, talus, and slumped materials. Floor material includes fallback and brecciated bedrock, domed and faulted by readjustment to compressive stress following impact; hummocky floor unit probably highly fractured and faulted bedrock mostly in place; smooth member mostly comminuted fallback and materials fluidized by impact. Peak material similar to hummocky floor material but has greater relief over impact shock center

Ray material

Characteristics
Bright, diffuse streaks, shown best on full-Moon photographs, forming intersecting network patterns across mare and upland areas. Radial to Eudoxus and Bürg within quadrangle and Aristillus (34° N., 1° E.), Thales (62° N., 50° E.), and Tycho (43° S., 11° W.) outside quadrangle. Includes bright halos around small craters
Interpretation
Fresh rock particles ejected by impact along ballistic trajectories. Major sources are craters listed above

Csc — Satellitic crater material

Characteristics
Shallow, circular to elongate craters, generally <3 km in diameter; may be bright or dull; sharp to moderately subdued rims. Commonly in linear or irregular clusters and associated with ray material; most linear clusters radial to Eudoxus or Bürg
Interpretation
Secondary impact craters formed mainly by ejecta from Eudoxus and Bürg

ERATOSTHENIAN SYSTEM

Ec — Crater material, undivided

Characteristics
Craters <4 km. Similar to small Copernican craters but without bright halos
Interpretation
Impact crater material

Ecrr — Radial rim material of crater Aristoteles

Characteristics
Similar to radial rim material of Copernican craters; mapped north of Eudoxus surrounding crater Aristoteles; partly covered by radial rim material of Eudoxus
Interpretation
Fine-textured impact ejecta from Aristoteles

Ecr, Ecw, Ecf, Ecp — Materials of sharp-rimmed rayless craters

Characteristics
Craters <15 km; units similar to corresponding units in Copernican craters of same size except walls less bright and floors smoother; terraced wall in Posidonius P. In larger craters, units as follows:
Ecr, *rim material. Generally smooth without hummocky and radial rim facies or fields of secondary craters. High rim crest; outlines polygonal to slightly oblong*
Ecw, *wall material. Smooth with subdued benches. Albedo high*
Ecf, *floor material. Occurs only in small patches; floors of Grove and Daniell mostly covered by unit Em*
Ecp, *peak material. Small hill in Grove*
Interpretation
Impact craters. Grove and Daniell modified by volcanism

Em — Mare material

Characteristics
Smooth, flat, dark surfaces locally wrinkled by ridges and cut by linear rilles. Occurs around edges of Mare Serenitatis and Lacus Somniorum and on floors of craters Daniell, Grove, and Posidonius. Albedo and density of small craters (<1 km) lower than for all other units in quadrangle. Eratosthenian craters both embayed by and superposed on unit; Copernican satellitic craters superposed on unit
Interpretation
Mostly volcanic flows. Eratosthenian age shown by occurrence on floors of Daniell and Grove and by embayment of rim material of Daniell and Linné F

Esc — Satellitic crater material

Characteristics
Similar to Copernican secondary craters but outlines less sharp. Linear clusters subradial to Hercules (47° N., 40° E.) in east part of map area and to Aristoteles (50° N., 18° E.) in north; both craters outside quadrangle
Interpretation
Secondary impact craters of Hercules and Aristoteles

IMBRIAN SYSTEM

Upper Imbrian

Im₂, Im₁ — Mare materials

Characteristics
Im_2, *most extensive mare unit. Similar to Eratosthenian mare material but has higher albedo and density of craters. Occurs within upper Imbrian crater Posidonius; elsewhere Eratosthenian and Copernican craters are superposed. Gradational with older Imbrian mare material*
Im_1, *similar to unit* Im_2 *but albedo and density of small craters slightly higher. Embays upper Imbrian craters. Gradational with Imbrian plains material*
Interpretation
Mostly volcanic flows. Late Imbrian age shown by stratigraphic relations with upper Imbrian and Eratosthenian craters

Icr₂, Irr₂, Icw₂, Icf₂, Icp₂ — Materials of slightly subdued craters

Characteristics
All craters small (5-20 km) except Posidonius; materials similar to corresponding units of younger craters, but rim crests less sharp and slightly crenulated; floors smaller and continuous with wall material. Crater rim, wall, floor, and peak materials of Posidonius similar to those of Eudoxus and Bürg but more subdued; part of east wall and floor raised and inclined toward the west. Radial facies present on east side of crater. Floor, wall, and rim units on west side of Posidonius mostly buried by younger mare materials
Interpretation
Impact crater materials. Posidonius tilted westward, probably as result of regional subsidence along margin of Serenitatis basin due to lack of crustal support following extrusion of younger mare materials. Floor and rim of Posidonius covered in part by upper Imbrian mare material. Additional depression of crater floor to west accompanied by partial flooding of floor, wall, and rim by Eratosthenian mare material

Ip — Plains material

Characteristics
Similar to Imbrian mare material but has higher albedo and density of small craters; surfaces flat to gently rolling. Fills depressions but generally occurs at higher elevations than mare material; embays materials of some small Imbrian craters but secondary craters from Hercules and possibly Posidonius superposed on unit
Interpretation
Volcanic flows similar to mare materials; possibly extends under mare surfaces. Especially difficult to distinguish from older mare material where bright rays are superposed

Isc — Satellitic crater material

Characteristics
Small, highly subdued, circular and elongate craters occurring in clusters radial to Posidonius. Not present on rim of Daniell or on younger mare material around Posidonius; abundant southeast of Posidonius (outside quadrangle)
Interpretation
Secondary impact craters formed by ejecta from Posidonius

Ic — Crater material, undivided

Characteristics
Craters <5 km. Age classification within Imbrian system unknown. Similar to younger craters of equal size but rim crests more rounded and floors continuous with crater walls. Albedo intermediate, and therefore difficult to distinguish on full-Moon photographs
Interpretation
Impact crater material

It — Terra material

Characteristics
Smooth and undulating to gently ridged and hummocky. In places covered by plains material but superposed on Alpes and Fra Mauro Formations. Not mapped where thin or in small discontinuous patches. Albedo intermediate
Interpretation
Mixture of volcanic materials, impact ejecta, and materials eroded from older topographic forms

Lower Imbrian

Icr₁, Icw₁, Icf₁ — Materials of moderately subdued craters

Characteristics
Materials similar to corresponding units of upper Imbrian craters but more subdued. Rim material more extensive around parts of Calippus than around upper Imbrian and Eratosthenian craters, but lacks radial structures and appears smoothly draped over topography. Ridged, hummocky floor present but no peak material
Interpretation
Impact craters. Rim of Calippus anomously wide and may include volcanic materials possibly extruded subsequent to formation by impact

Ia, If — Alpes and Fra Mauro Formations

Characteristics
Formations apparently intergradational and similar on large scale to hummocky rim (Alpes) and radial rim (Fra Mauro) units of some large craters
Ia, *Alpes Formation. Irregular to subround, domical hills generally <5 km in long dimension. Size of hills and apparent thickness of unit decrease outward from Imbrium basin where intergradational with Fra Mauro. Hills have high albedo and specular appearance; others more subdued and less bright. Buries or partly covers pre-Imbrian craters but Imbrian craters superposed on formation. Northwest and northeast lineaments of lunar-grid system visible on Earth-based photographs*
If, *Fra Mauro Formation. Smooth, undulating to hilly material having faint ridges and grooves radial to Imbrium basin. Albedo intermediate. Partly covers pre-Imbrian craters*
Interpretation
Materials ejected from Imbrium basin at time of impact. Size distribution of hills in Alpes Formation with respect to Imbrium basin suggests depositional analog with hummocky rim facies around large craters such as Eudoxus. Darker, more subdued parts of Alpes Formation mantled by terra materials. Radial structures in Fra Mauro Formation probably originate from high lateral velocity component of ejecta and (or) fractures induced by impact during formation of Imbrium basin

PRE-IMBRIAN

pIc, pIcr, pIcw, pIcp — Materials of subdued to highly subdued craters

Characteristics
Materials much more subdued than corresponding units of younger craters. Not divided where individual units indistinct or too small to map. Walls channeled and terraces partly preserved but rims, walls, and floors largely covered by younger regional units
Interpretation
Impact crater materials; erosionally degraded and partly buried

pIu — Undivided material

Characteristics
Rugged topography and smooth scarps of Montes Caucasus, steep ridge faces northwest of Lacus Mortis, and isolated occurrences in Lacus Somniorum. In places similar to large hills of Alpes Formation but generally more massive. Underlies all other units. Albedo high
Interpretation
Crustal material, uplifted and exposed by faulting along margin of Imbrium basin and by cratering at Lacus Mortis and in Lacus Somniorum

ch — Chain-crater material

Characteristics
Linear groups of three or more adjacent or partly overlapping circular craters; small (<5 km) individual craters distinguished from secondary craters by circular shape, greater depth relative to width, and location of some along rilles or nonradial lineaments
Interpretation
Volcanic craters along fractures

Dark material

Occurs on northern rim of Eudoxus and appears to subdue underlying topography
Interpretation: *Dark mantle of volcanic ash possibly extruded from fissures or small young craters on flank of Eudoxus*

Contact
Long dashed where approximately located or gradational; queried where doubtful

Buried contact (Ia)
Topographic limit of buried unit indicated by symbol in parentheses

Outer limit of dense satellitic crater field around Eudoxus
Symbol used because underlying geologic units not obscured

Fault
Dashed where approximately located. Bar and ball on downthrown side. Indicates offset unit or scarp against which younger rocks deposited

Lineament
Slight linear depression or ridge; may include chains of small craters only partly visible on Orbiter IV high-resolution photographs
Interpretation: *Fractures, faults, and volcanic depressions along major lunar grid and basin-radial systems*

Sinuous rille
Narrow meandering trough resembling terrestrial stream channel; exemplified in Posidonius, extending across mare materials near crater wall and joining small crater in floor material at upper end
Interpretation: *Collapsed lava tunnels or channels made by flows of volcanic material*

Linear rille
Long dashed where discontinuous, dotted where buried. Straight to curved, steep sided, narrow depressions, in mare and plains materials and Alpes Formation; generally alined with lunar lineament systems
Interpretation: *Graben, probably controlled by major lunar fracture systems*

Mare ridge
Line marks ridge crest, generally parallel with radial and nonradial lunar grid systems
Interpretation: *Volcanic extrusions from large fractures*

Mare scarp
Line at base of scarp, barb points down slope
Interpretation: *Flow front or fault*

Mare dome
Occurs with youngest mare material (Em). In places, linear trough or depression occurs on summit
Interpretation: *volcano*

Highland ridge
Line along crest of buried and unburied ridges
Interpretation: *Formed by faulting; orientation controlled by lunar grid systems*

Trough
Line along axis
Interpretation: *Graben or depression of unknown origin*

Concealed crater
Rim-crest outline; used where crater subunits not distinguished

Mare basin rim
Dots along approximate or inferred position of main rims of Imbrium and Serenitatis basins. Queried where projected beneath mare material

Breccia lens
Shown on cross section beneath crater floors
Interpretation: *Fractured bedrock produced by impact*

GENERAL INFORMATION

The Eudoxus quadrangle is in the northeastern part of the Moon's nearside hemisphere. It is bordered on the west by Montes Caucasus, which form part of the main rim of the multi-ringed Imbrium basin (Hartmann and Kuiper, 1962), and on the south side by Mare Serenitatis, which occupies another large multi-ringed basin. South and east of the prominent crater Eudoxus elevations decrease and the rugged highland terrain becomes more subdued and covered by mare materials in the Serenitatis basin, Lacus Somniorum, and Lacus Mortis.

The classification of lunar materials into time-stratigraphic units follows the work of Shoemaker and Hackman (1962) and Wilhelms (1970). Where crater ages could not be established by superposition relations, they were estimated from morphologic variations (Pohn and Offield, 1970). These relative crater ages have been correlated, by means of a numerical scale, with the units which define the lunar time-stratigraphic systems (Offield, 1971). Additional age criteria include infrared eclipse thermal anomalies (Shorthill and Saari, 1969), which are usually associated with younger craters, and variations in albedo and crater density between mare materials and mare and plains materials.

STRATIGRAPHY

Major stratigraphic units consist of pre-Imbrian undivided material, the Alpes and Fra Mauro Formations of early Imbrian age, terra and plains materials which may have been formed throughout the Imbrian Period, and mare materials of late Imbrian and Eratosthenian age. Crater materials make up all other units and range from pre-Imbrian to Copernican in age.

MAJOR STRATIGRAPHIC UNITS

Pre-Imbrian material forms mountains bounded by high, steep, smooth-appearing cliffs along Montes Caucasus and in a few places around large mare-filled craters such as Alexander and the crater surrounding Lacus Mortis. The mountains presumably are faulted crustal blocks uplifted as a consequence of the impacts which produced the Imbrium basin and the craters. The Alpes and Fra Mauro Formations are believed to be impact ejecta from the Imbrium basin, and their materials generally appear to be intergradational. Near Montes Caucasus the Alpes Formation is a complex of large subround to irregular nearly equidimensional hills. The hills become more subdued eastward across the quadrangle, probably because the formation thins outward from the Imbrium basin. Genetically, the Alpes Formation and pre-Imbrian material are probably distinct units; morphologically, they are not always separable, and some large hilly features mapped as Alpes may be uplifted and eroded fault blocks of pre-Imbrian material, rather than large ejecta fragments. Along the eastern edge of Lacus Mortis the Alpes Formation is difficult to distinguish from the undulating and lineated but smooth-appearing Fra Mauro Formation. The lateral transition of these units is similar to that of hummocky and radial rim facies around large impact craters. Hills and ridges in the Alpes Formation are several kilometers long and have a random to subradial orientation to the Imbrium basin. Blocks in the hummocky rim facies of large craters may have dimensions exceeding a hundred meters and form ridges subradial and concentric to crater rims. In this respect, hummocky rim facies resemble both the Alpes Formation in this quadrangle and materials of Montes Apenninus mapped elsewhere around the Imbrium basin (Wilhelms and McCauley, 1971). Ridges and grooves in the Fra Mauro Formation resemble those in radial rim facies around craters, both in form and orientation. In other regions around the Imbrium basin (Wilhelms and McCauley, 1971) the Fra Mauro Formation extends far beyond the Alpes Formation; thus, the distribution of the two formations is analogous to that of radial rim and hummocky rim facies.

Imbrian terra and plains materials occupy relatively small areas throughout the quadrangle. They have an intermediate albedo and are partly intergradational in appearance; generally, however, the terra is hummocky and reflects subjacent topography, whereas plains material is flat to gently undulating and has a smooth surface which conceals underlying landforms. Terra material probably has diverse origins and consists mainly of volcanic flows and pyroclastic materials, impact ejecta, and eroded materials deposited throughout the Imbrian Period. Plains material has the appearance of volcanic flows, and its embayment by mare materials in craters and basins suggests that it represents an earlier filling of these structures. Superposition relations between plains and other units are not clear in all places; but, as elsewhere on the Moon, plains material appears to be mostly upper Imbrian and thus more restricted in age range than Imbrian terra material.

Mare materials cover a large part of the quadrangle and are individually distinguished by albedo, density of small craters, and, in places, by superposition with respect to craters whose relative ages have been established by comparative morphology (Pohn and Offield, 1970). Imbrian mare materials have a low density of small craters and low albedos which increase with progressive apparent maturity of the units, so that older mare surfaces resemble those of the plains. Differences between Imbrian mare materials are small, however, and boundaries between them are highly subjective. They embay rims and cover floors of upper Imbrian craters, but Eratosthenian crater materials are superposed upon them. A greater contrast in albedo and number of small craters exists between Imbrian mare and the dark, relatively uncratered, Eratosthenian mare. This material covers the floors of the craters Grove and Daniell, as well as much of the margins of Mare Serenitatis, but rays and secondary impacts from Copernican craters are superposed on the unit. Mare materials, like plains material, are probably mostly made up of successive and partly overlapping volcanic flows.

CRATER MATERIALS

Many craters of pre-Imbrian age are completely buried by the Alpes and Fra Mauro Formations in the highland regions and by mare material in Lacus Somniorum, but their outlines are discernible by the low relief of their rims. The large crater around Lacus Mortis appears to be younger than the depression occupied by Lacus Somniorum but is older than the craters Plana and Mason, which are superposed on its rim. Plana and Mason are largely buried by regional units, and morphological clues to their origins, whether impact or volcanic, are obscure. Craters of Imbrian, Eratosthenian, and Copernican age show a progressive change in morphology from slightly subdued to fresh with sharp rims and bright rays. The character and distribution of most crater materials suggest impact origins (Shoemaker, 1962). High thermal anomalies (Shorthill and Saari, 1969) are associated with most Copernican and Eratosthenian craters larger than 10 km in rim crest diameter. The craters Grove and Daniell are unlike many lunar craters of comparable size and age in that they have lava-like floors and smooth rims, and lack secondary craters; in these respects they resemble some terrestrial volcanic craters. Both craters may have been modified by volcanism, but their high rims and deep floors suggest an impact origin.

STRUCTURE

Major structures include fault scarps of Montes Caucasus along the east edge of the Imbrium basin, the northern part of the Serenitatis basin, and the polygonal rim of the large Lacus Mortis crater. Regional structural trends are marked by numerous lineaments, faults, ridges, linear rilles, and polygonal crater rim crests.

Montes Caucasus are not as closely concentric with the Imbrium basin as the Apennines, which are south of the quadrangle. The Caucasus diverge from the Imbrium basin in a northeast direction to the vicinity of Eudoxus and thus form a spur tangential to the Imbrium basin rim. This departure from the usual position of lunar mountain ranges around large basins may be influenced by the combination of Imbrium basin structure with that of the pre-existing Serenitatis basin. Fault scarps along Montes Caucasus appear both fresh and subdued, suggesting that the outer rim of the Imbrium basin was uplifted episodically and did not completely develop immediately after impact.

The controlling influence of large pre-Imbrian craters on the distribution of mare and plains materials is evident in the Lacus Mortis crater, Alexander, and other buried and partly buried crater rims which enclose smaller patches of these materials. Old crater outlines in Lacas Somniorum are less clear but visible on Earth-based photographs (Kuiper and others, 1967). Mare ridges form a large polygonal outline within the central part of the Serenitatis basin south of the quadrangle (Carr, 1966). In position and geometry, the ridges are similar to faults, fractures, and ridges around the polygonal rim crests of many large lunar craters presumed to be of impact origin. The mare ridges, like the crater rims and ridges, generally are alined with major lunar lineament systems (Strom, 1964). It is probable that such faults and fractures originated from impact and that the ridged structures were formed by volcanic materials extruded from fissures. A smaller polygonal ridge pattern occurs in the northwest part of Mare Serenitatis, where a buried partial crater rim, exterior to the mare ridges, is recognizable in adjacent highland topography and suggests that this part of the Serenitatis basin was formed by a separate impact.

The east margin of the Serenitatis basin appears to have subsided and to have been tilted westward, as shown by the burial and partial flooding by mare material of the western rims, walls, and floors of the large craters Posidonius and Le Monnier (south of the quadrangle). This apparent regional subsidence may be due to lack of crustal support following the extrusion of a large volume of mare material along the east side of the basin. Parts of Posidonius have been uplifted and tilted along faults. Vertical displacements along faults concentric with the basin margin may have contributed to the structural picture which developed during late Imbrian time. North of Posidonius, the rim of the Serenitatis basin loses identity in Lacus Somniorum—a complex of pre-Imbrian craters buried by mare materials. The northwest part of the basin rim probably lies within the peninsula-like extension of the Alpes Formation. It may join southeasterly with the large mare ridge which encompasses the inner part of the Serenitatis basin, but this conjecture is based only on the extended curvature of the presumed rim.

Linear rilles, ridges, polygonal crater rims and other lineaments show two dominant structural trends oriented approximately N. 60° W. and N. 65° E. The northwest alinements appear to belong to the lunar nonradial grid system (Strom, 1964), whereas the northeast set are radial and subradial to the Imbrium basin. North-south trends are well developed along the western rims of Lacus Mortis, Eudoxus, and Bürg, and along the normal fault which extends from the large peninsula of Alpes Formation into the northern part of Mare Serenitatis.

GEOLOGIC HISTORY

Unlike the southern highlands and other regions of the Moon remote from large multi-ringed basins, the Eudoxus quadrangle shows little evidence of pre-Imbrian cratering. Impacts which formed the Serenitatis basin, Lacus Mortis crater, and buried craters of Lacus Somniorum undoubtedly excavated large amounts of material and spread them widely over this part of the lunar surface during pre-Imbrian time. Most of the pre-existing craters were probably buried by these ejecta blankets, the earlier counterparts of the Alpes and Fra Mauro Formations from the Imbrium basin. Lower pre-Imbrian craters were formed in Lacus Somniorum and west of it in the present highland region. Many of these craters were large, but their rims were subsequently covered by the Fra Mauro and Alpes Formations and(or) mare materials.

After the Imbrium basin formed and the Imbrian Period had begun, impacts producing large craters decreased in frequency. Terra material composed of mass-wasted debris and impact ejecta accumulated and was interspersed with volcanic flows, which increased in volume during the late stages of the Imbrian Period. Basins and large craters were flooded by plains and mare materials extruded from fractures and faults which remained active long after their initial formation by impact. Volcanism waned during the Eratosthenian Period, and the youngest mare material is generally restricted to tectonically active areas along basin margins. The large craters Eudoxus and Bürg were formed by impact during the Copernican Period.

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