



# COLONIZATION

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## A PERMANENT HABITAT FOR THE COLONIZATION OF MARS

*A thesis submitted in fulfilment of the requirements of the degree of Master in Engineering Science (Research) in  
Mechanical Engineering*

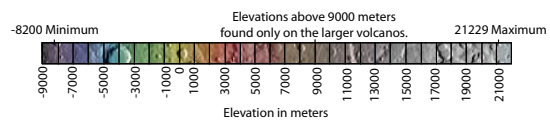
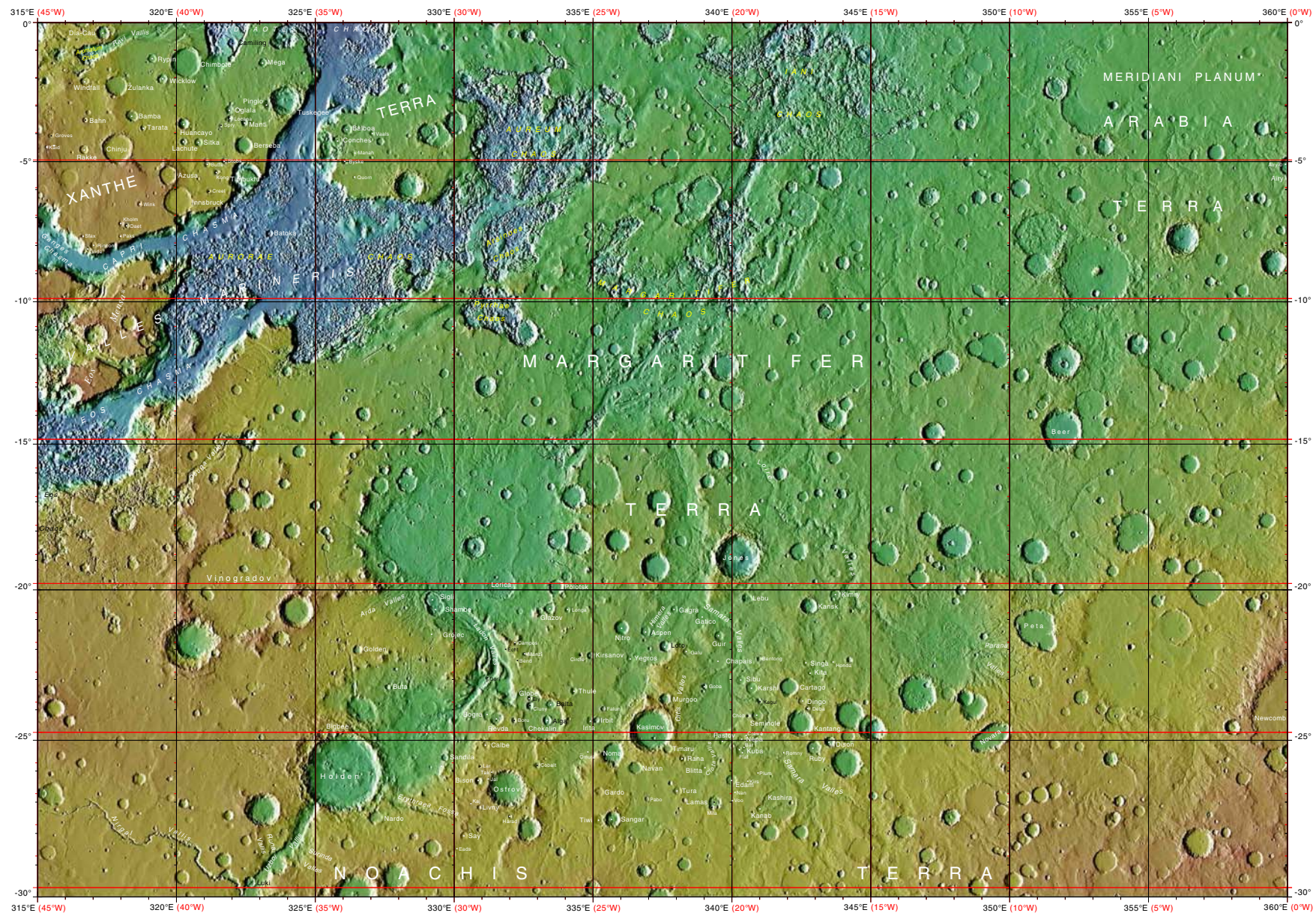
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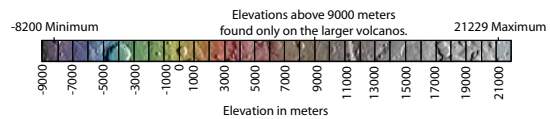
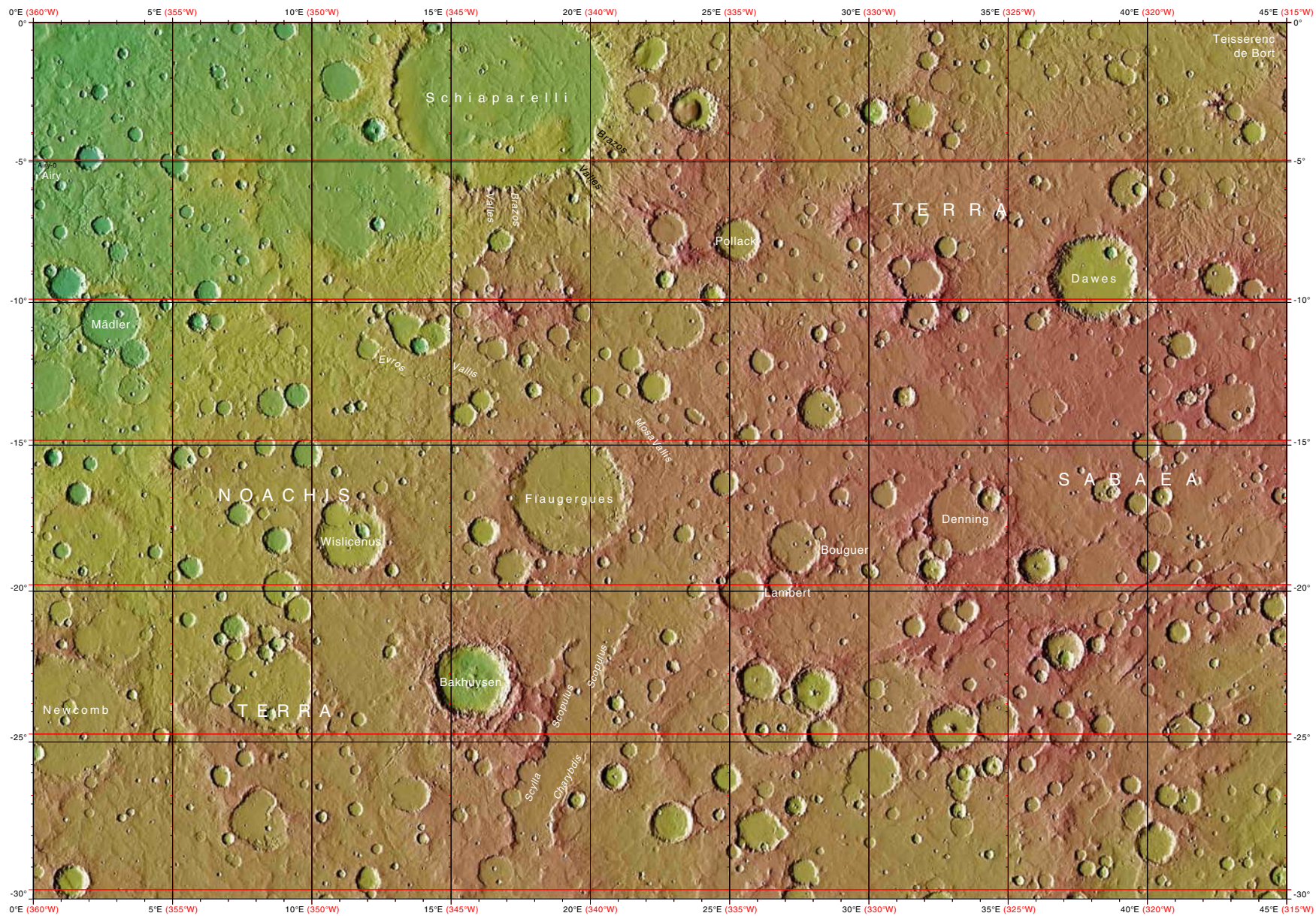
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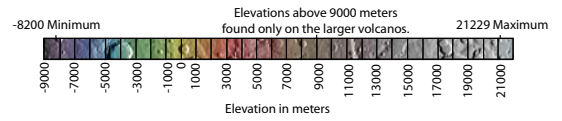
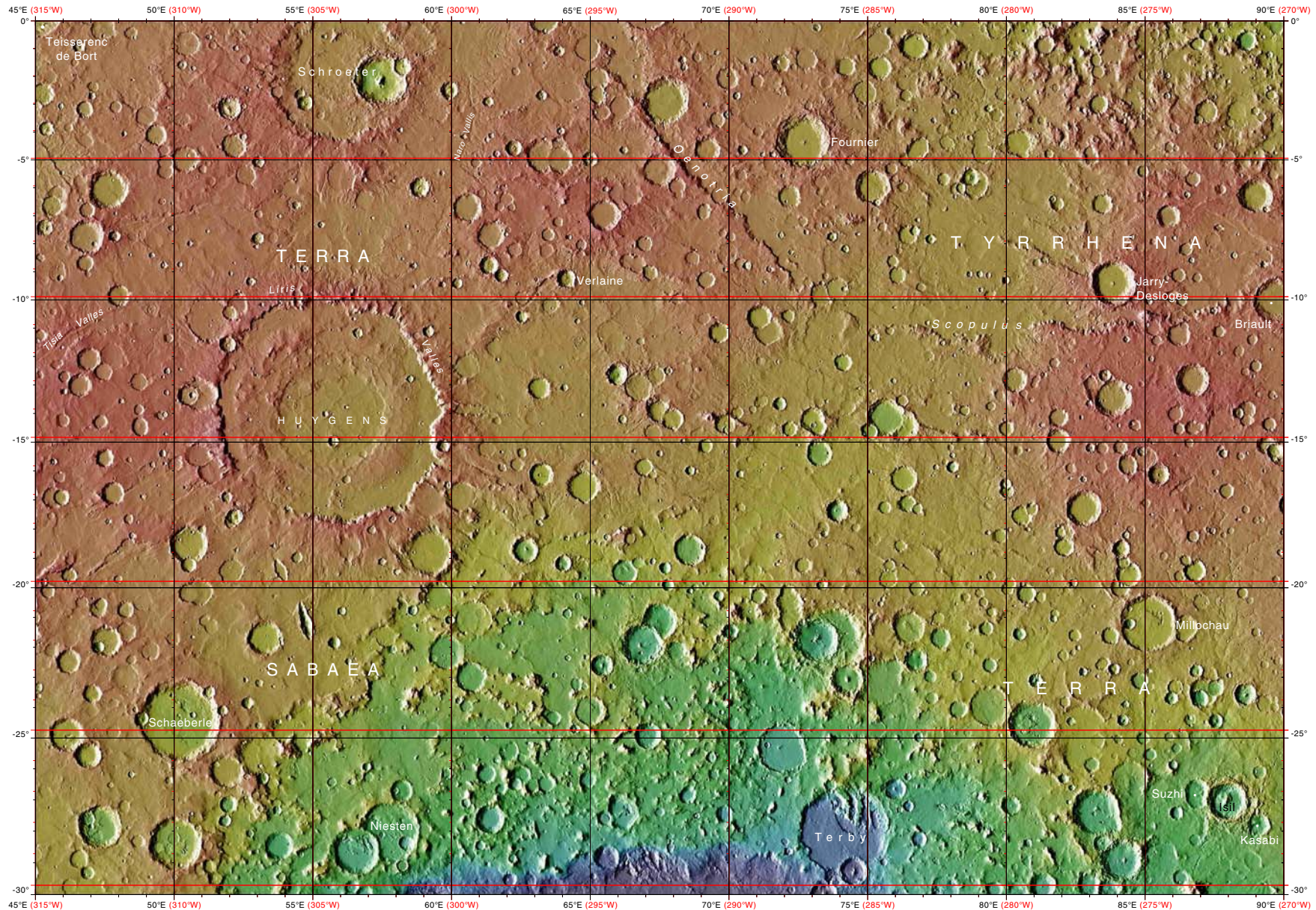
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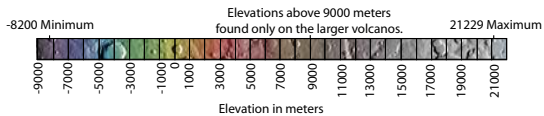
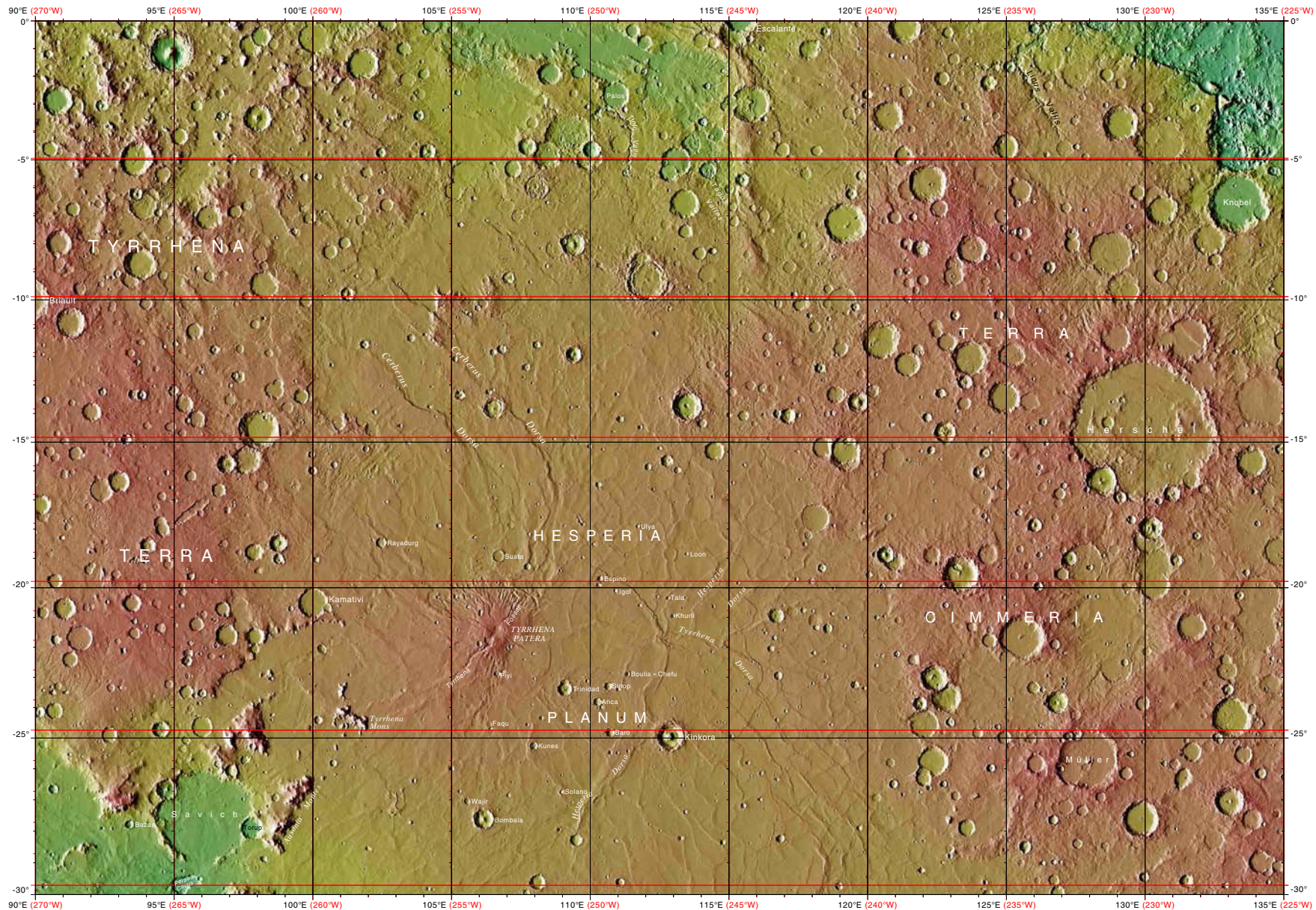
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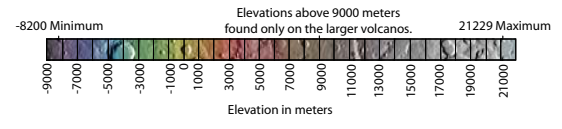
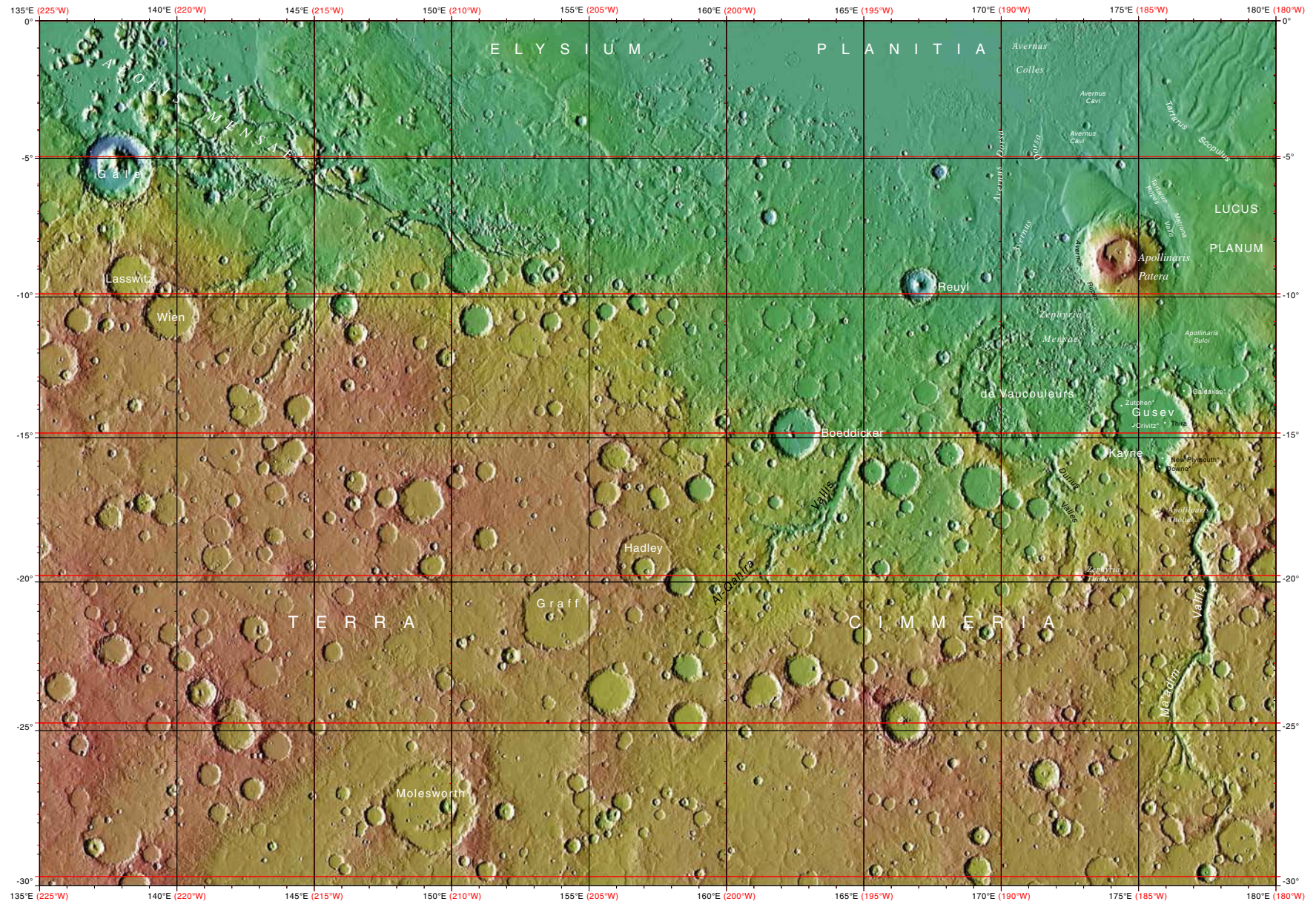
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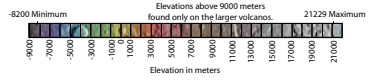
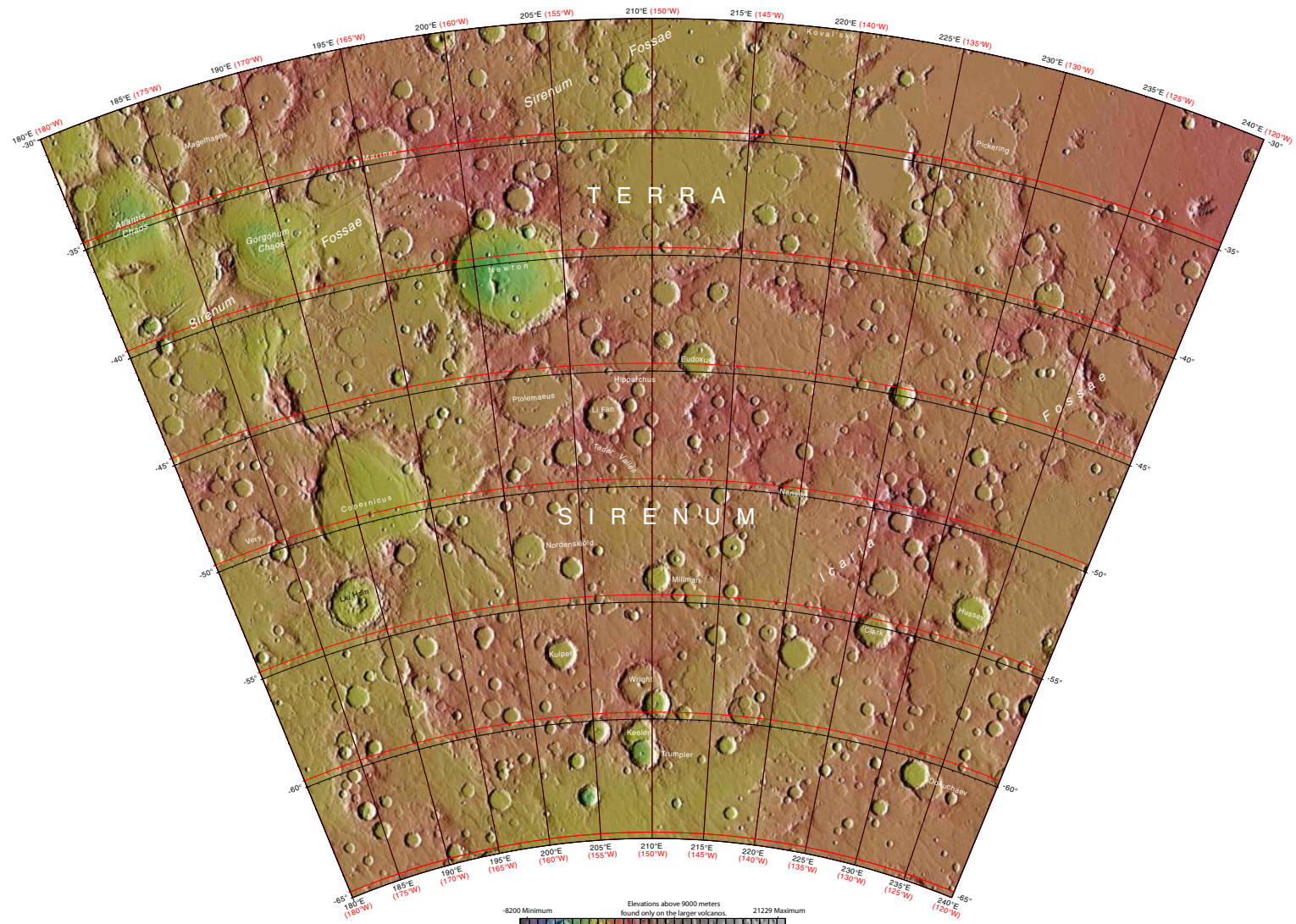


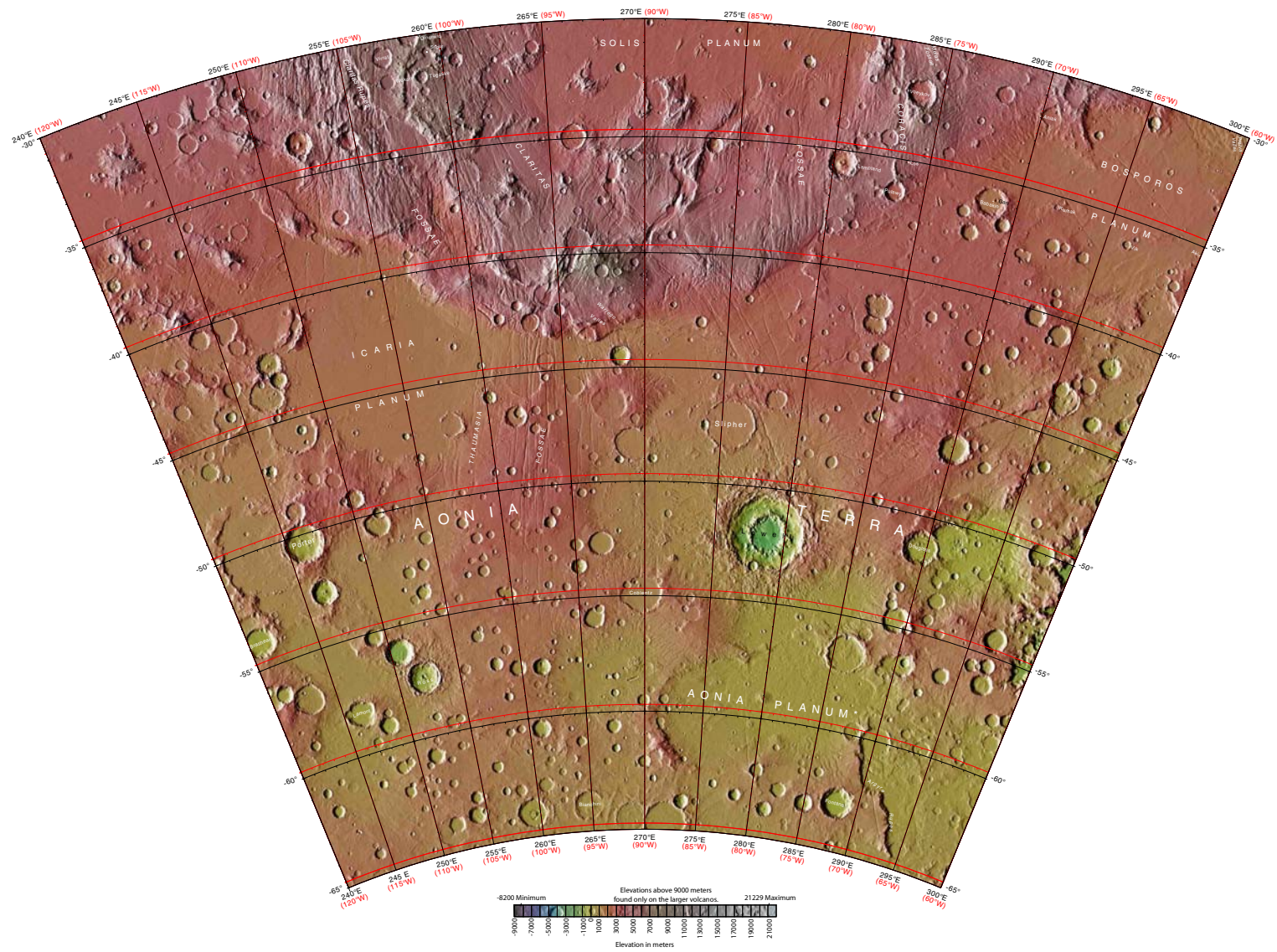




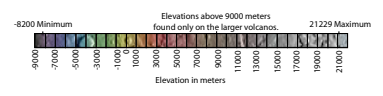
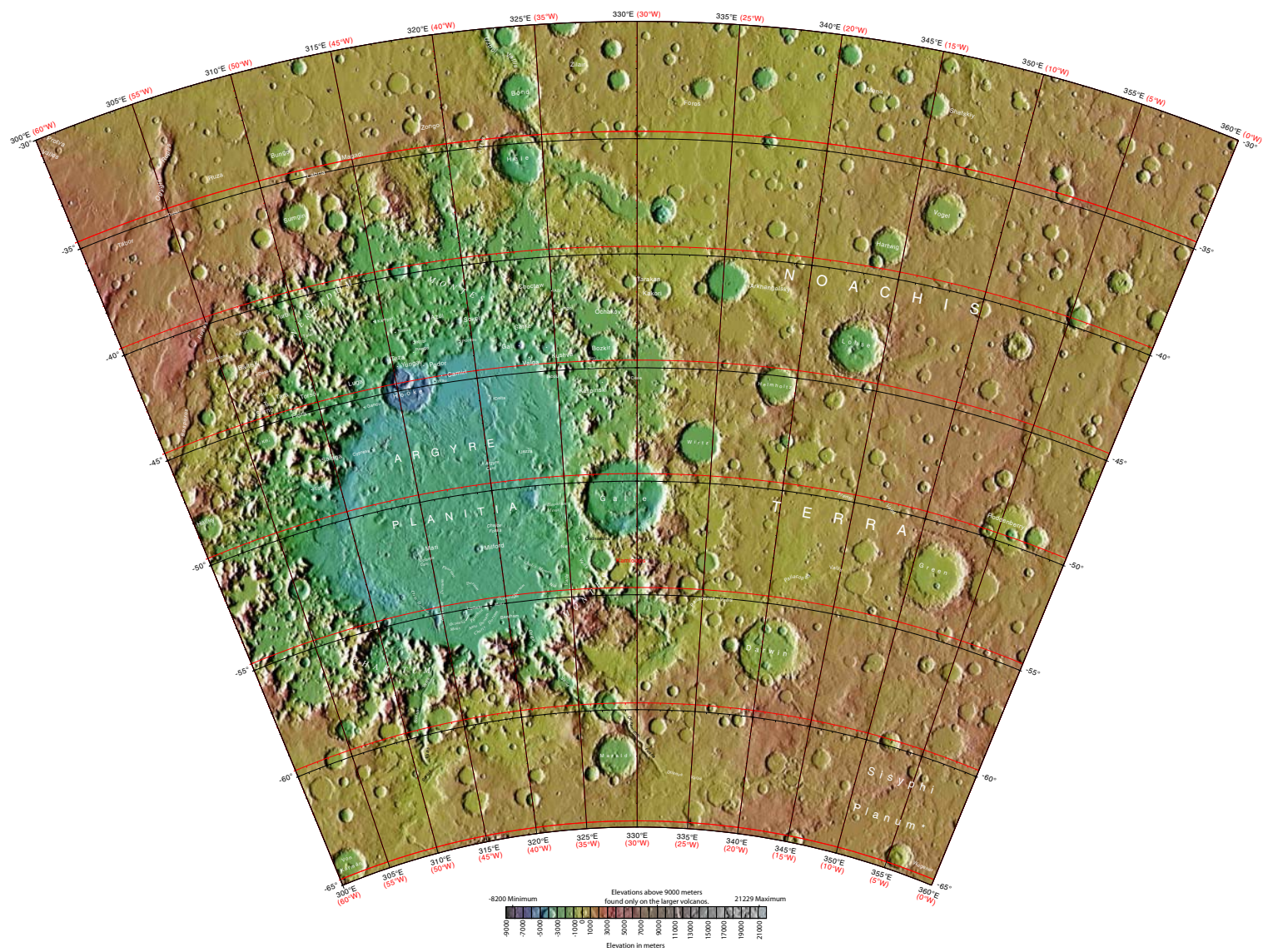


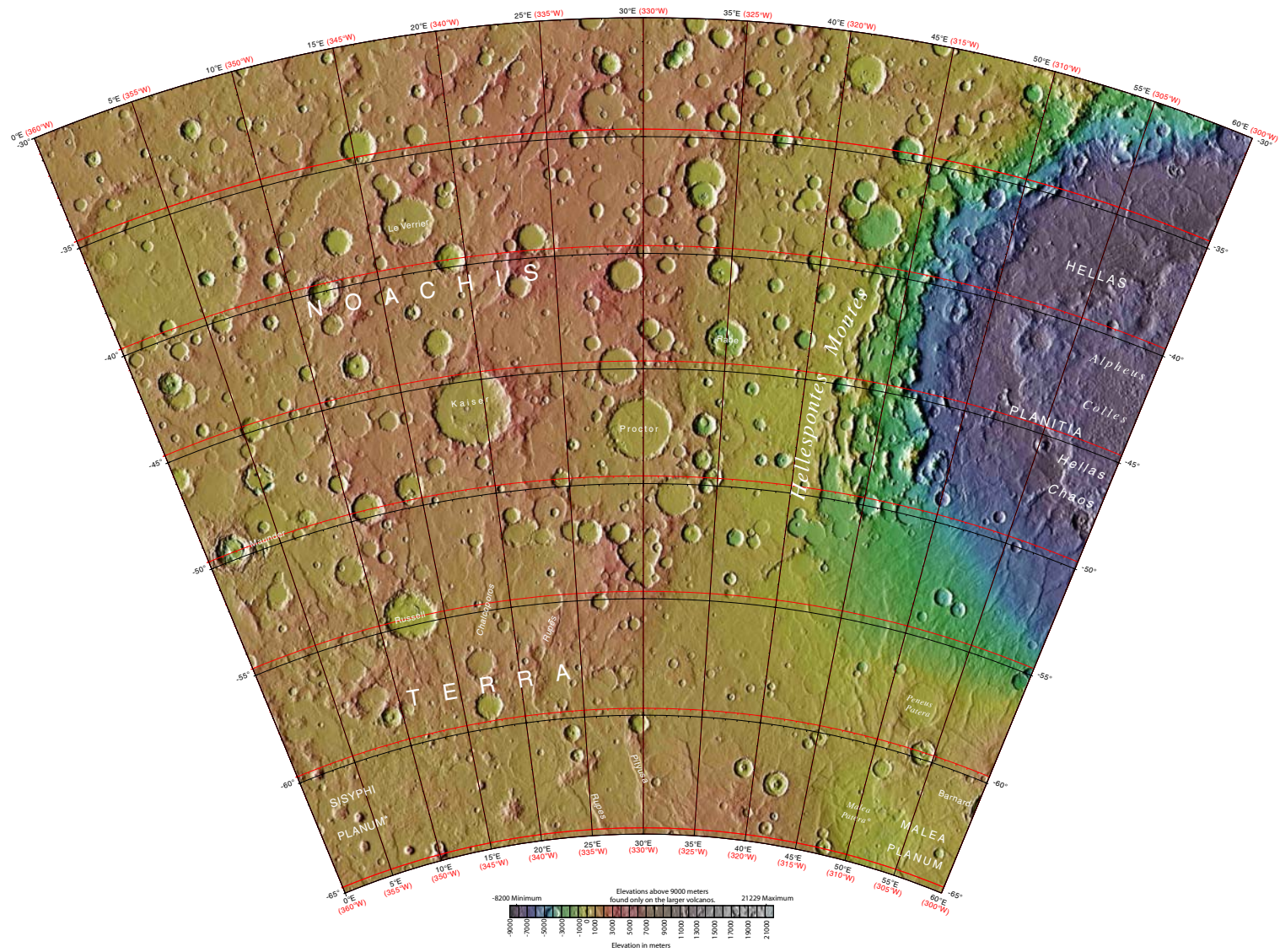


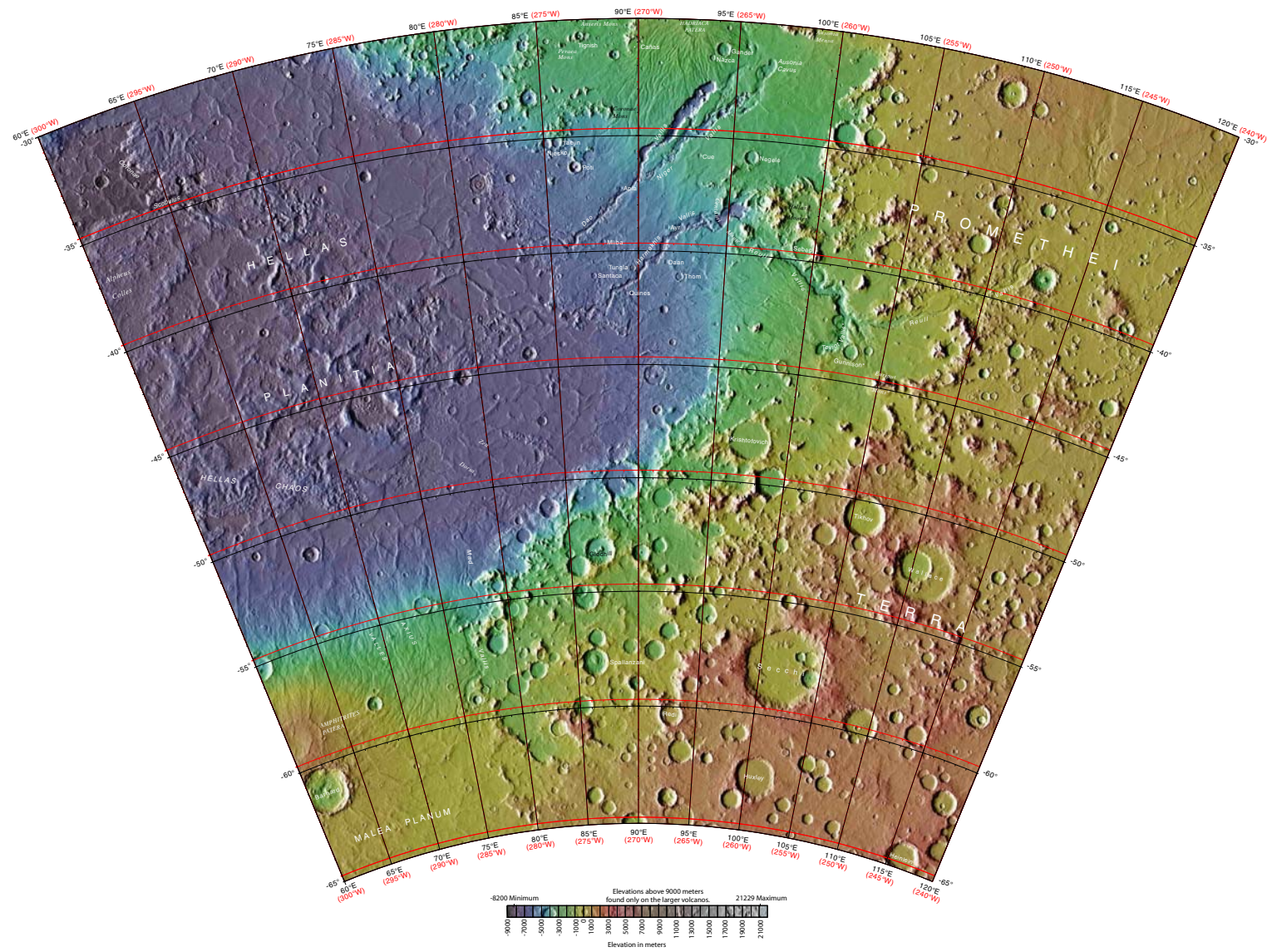


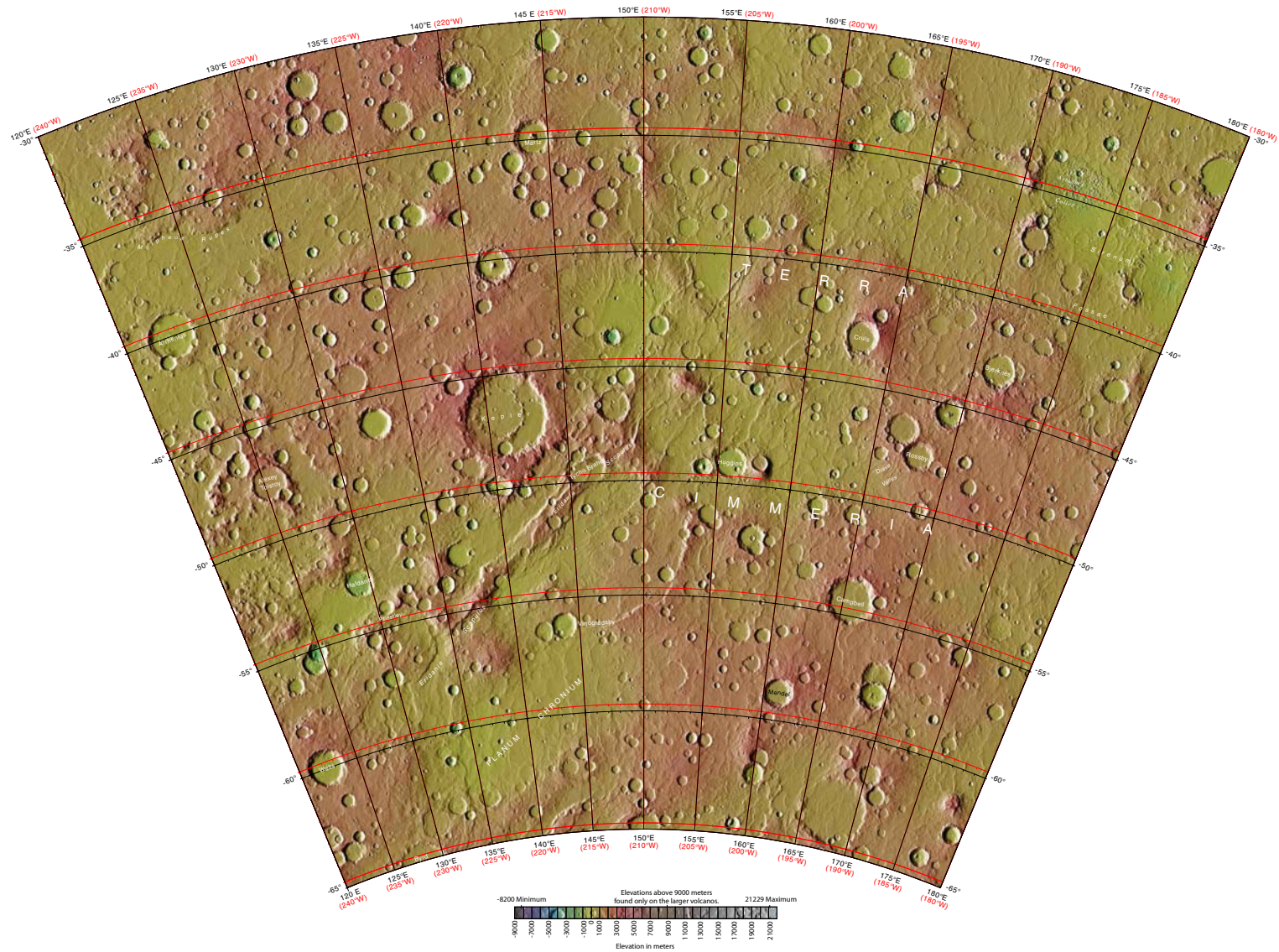


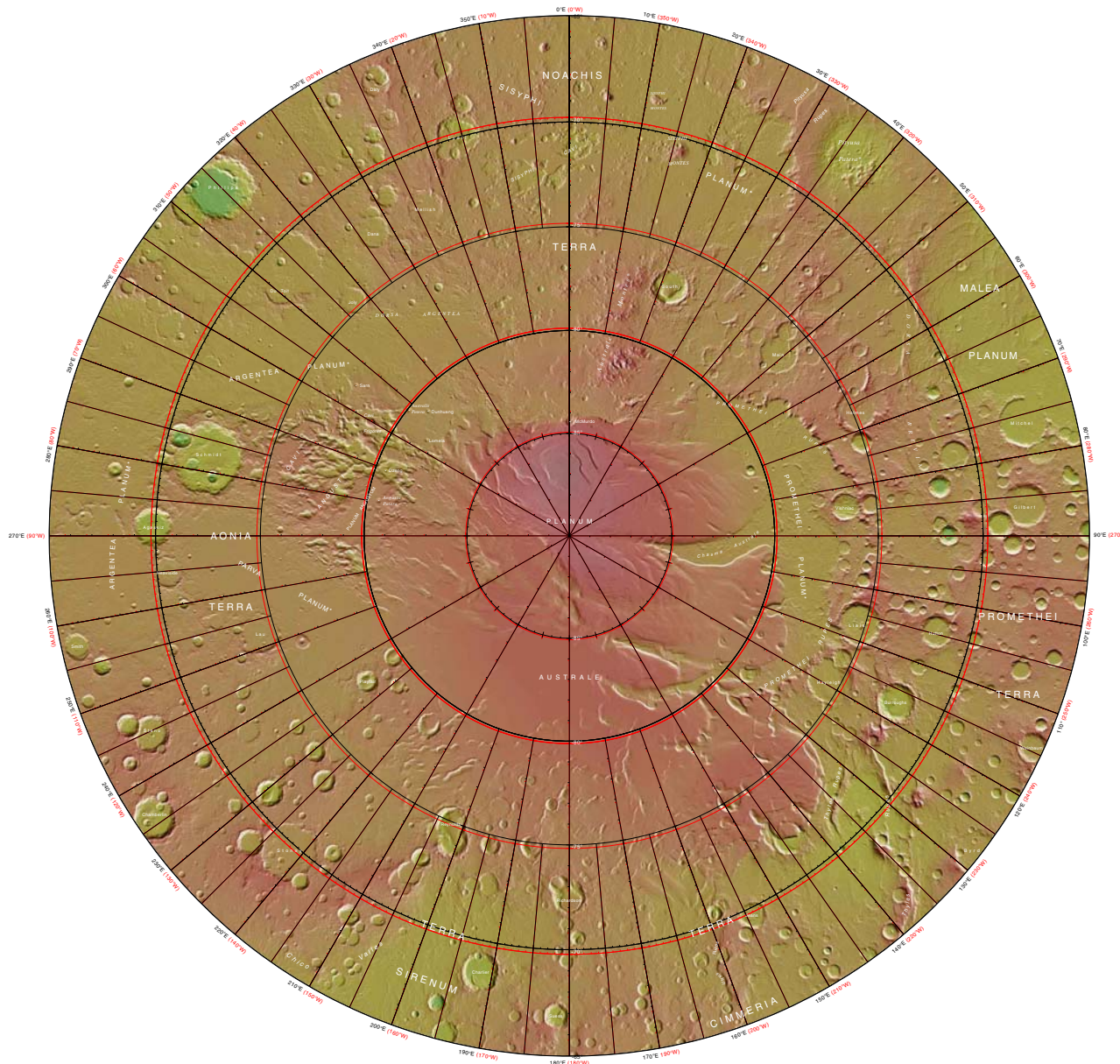












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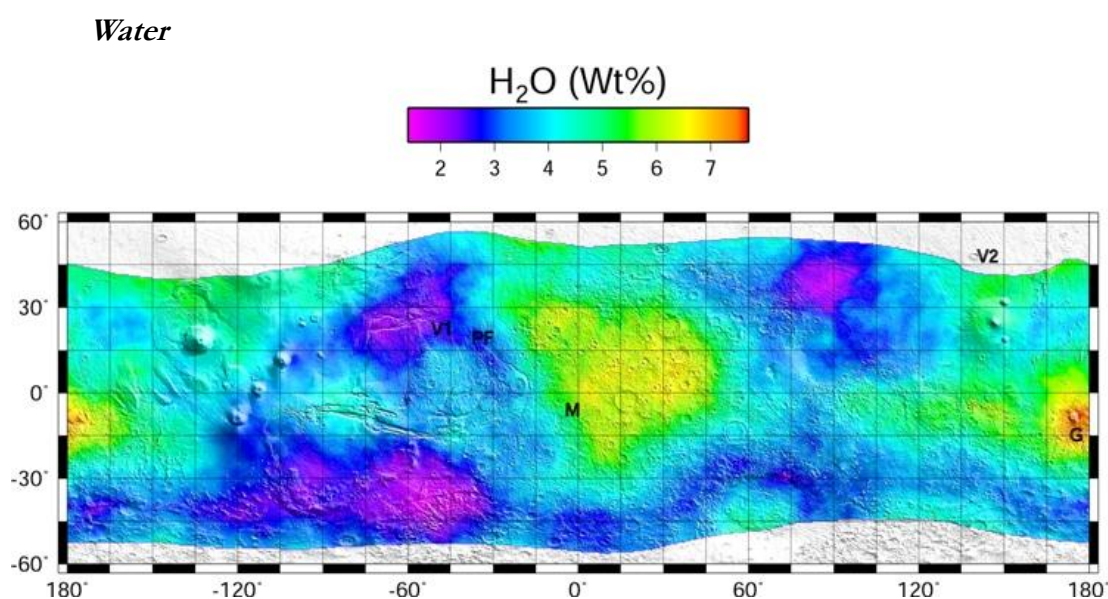
## APPENDIX B – ELEMENTAL COMPOSITION MAPS OF THE MARTIAN SURFACE

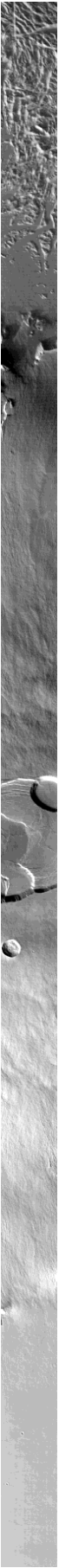
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Some of the maps of the elemental composition of the Mars surface layer are included below (more are expected to become available in the future). They are created from data acquired by the Gamma-ray Spectrometer (GRS) aboard the 2001 Mars Odyssey orbiter. The GRS instrument is a collaboration between the University of Arizona's Lunar and Planetary Laboratory, the Los Alamos National Laboratory and Russia's Space Research Institute. The GRS consists of three instruments, a gamma-ray spectrometer, a neutron spectrometer and a high energy neutron detector.

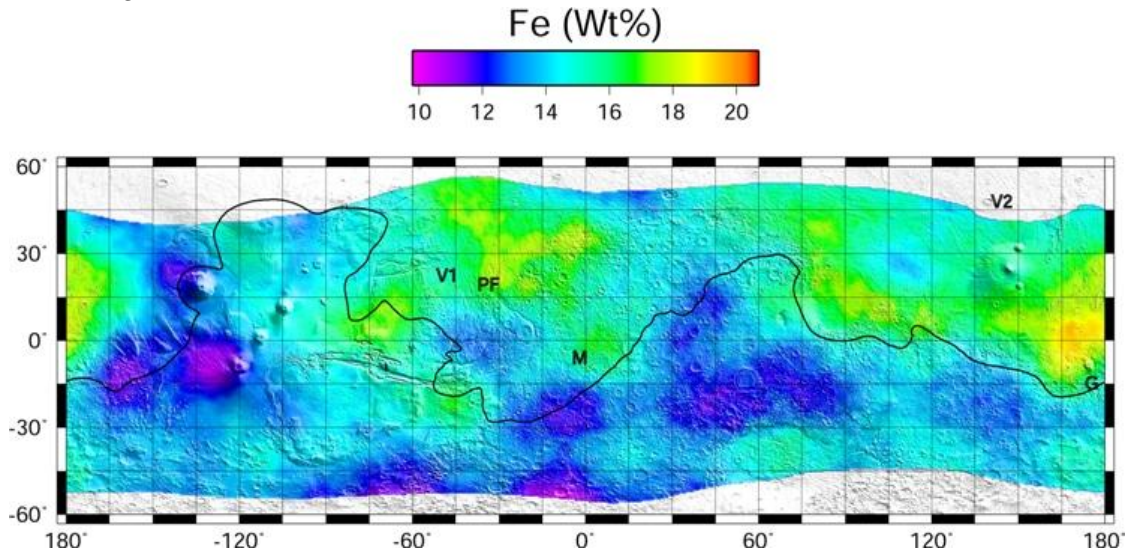
Each map represents the fully corrected, CO<sub>2</sub> frost free elemental concentrations. Data for all non-radioactive species have been masked to exclude polar regions where it is not currently possible to adequately deal with dilution by the large amounts of water ice.

The letters on the maps indicate the landing sites of various landers (V1 and V2 – the Viking landers; PF – Pathfinder; M – Opportunity, at Meridiani; and G – Spirit, at Gusev Crater).

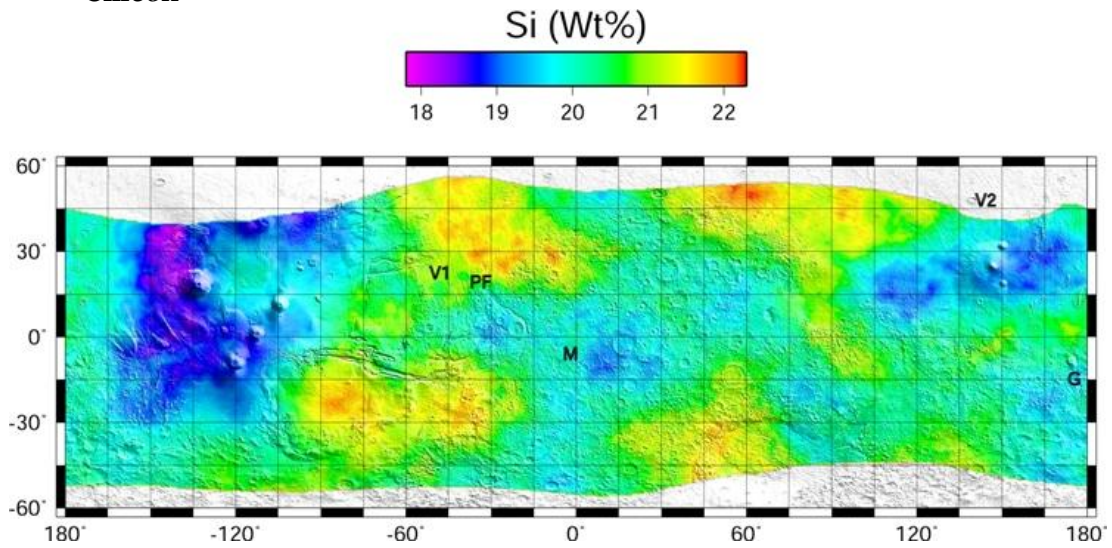




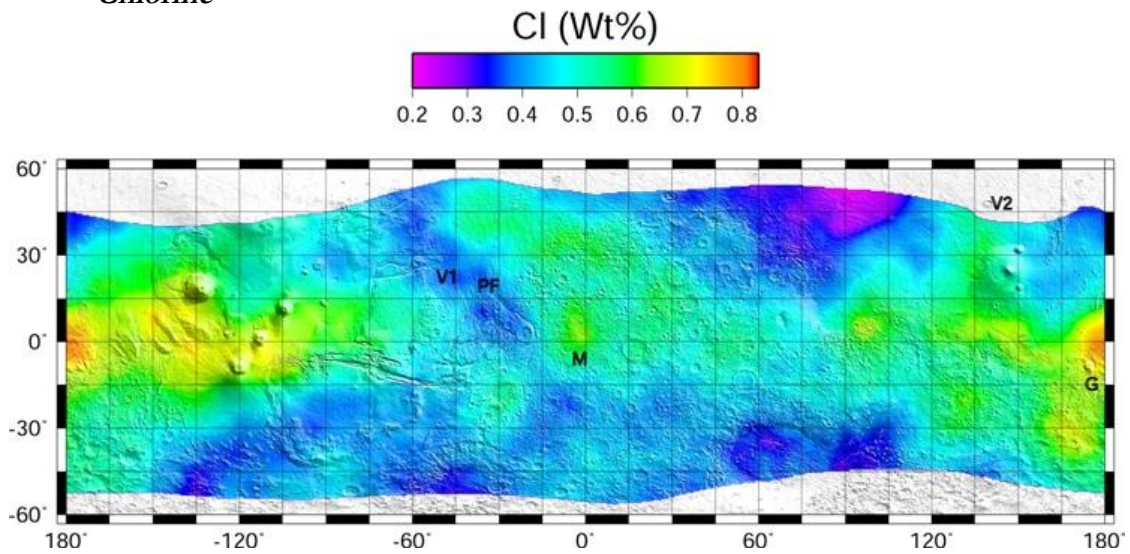
*Iron*



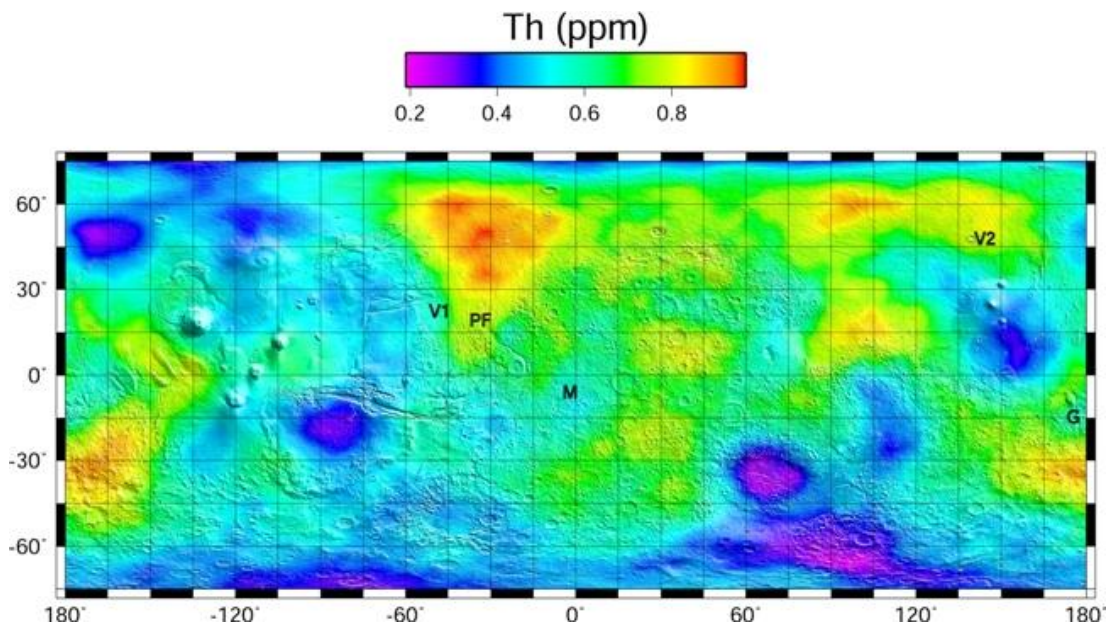
*Silicon*



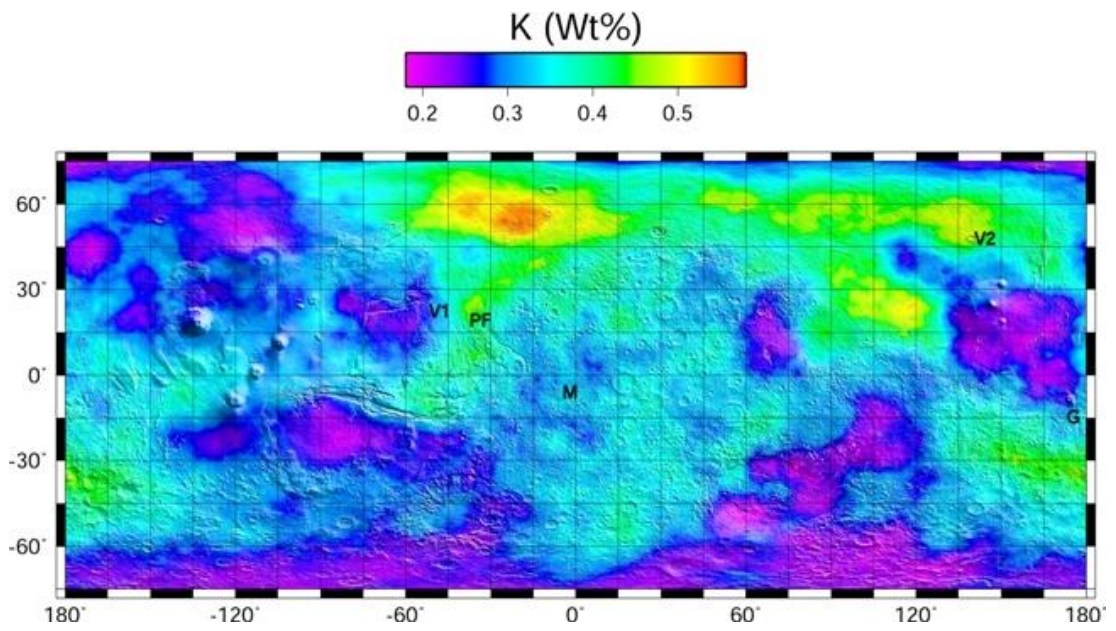
*Chlorine*



*Thorium*



*Potassium*





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## GLOSSARY

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Albedo – The fraction of incident solar radiation reflected back into space without absorption.

Aphelion – The point of a planet's orbit at which it is furthest from the sun.

C3 – A grouping of plants that produce a molecule containing three carbon atoms as the first product of photosynthesis.

C4 – A grouping of plants that produce a molecule containing four carbon atoms as the first product of photosynthesis.

Diurnal Temperature Range – The temperature range over an average day.

Extra Vehicular Activity (EVA) – activities undertaken in the external environment to the vehicle or habitat (such as in space or on the Martian surface).

ISRU – in-situ resource utilisation – the use of local resources (typically as opposed to importing resources from elsewhere).

Opposition – when two planets are on opposite sides of the sun.

Optical Depth – A measure of how much light is absorbed in travelling through a medium, such as the atmosphere of a star, from the source of light to a given point. A completely transparent medium has an optical depth of zero.  $>1$  indicates opacity.

Rectenna – a rectifying antenna, a special type of antenna used to convert microwave energy into electricity.

rem – The measure of radiation used in the United States of America (100 rem equals one Sievert).

Rhizosphere – the region of soil in the vicinity of plant roots.

Smectite – a type of clay characterised by their one-directional swelling with changes in moisture content.

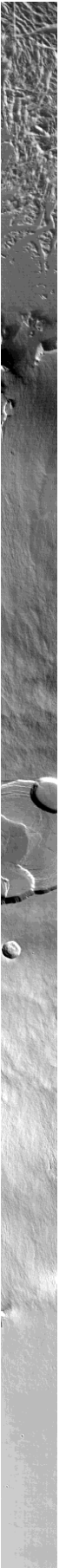
Specific Impulse ( $I_{sp}$ ) – a measure of the acceleration of a rocket or other spacecraft engine.

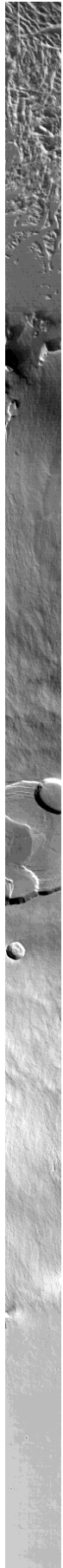
Sievert (Sv) – The SI unit for the measure of radiation dose (one Sievert equals 100 rem).

Perihelion – The point of a planet's orbit at which it is closest to the sun.

Descriptions of nomenclature used in describing Martian surface features, including some examples and locations.

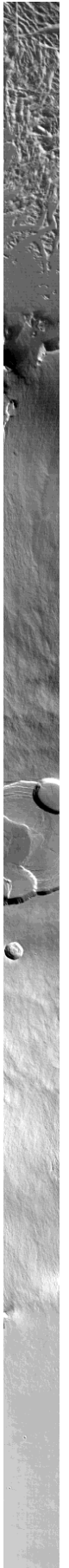
ALBEDO feature	Geographic area distinguished by amount of reflected light
ARCUS	Arc-shaped feature
ASTRUM	Radial-patterned features on Venus
CATENA	Crater chain. Mostly not secondary impact craters but rather features which resemble collapsed lava tubes. Acheron Catena (38°N, 101°W)
CAVUS	Irregular, steep-sided depressions not of impact origin. Cavi Augusti (4°S, 187°W)
CHAOS	Distinctively broken or jumbled terrain. Aureum Chaos (4°S, 27°W)
CHASMA	A steep-walled trough or a large canyon. Condor Chasma (6°S, 71°W)
COLLIS	Hill or knob. Scandia Colles (65°N, 153°W)
CORONA	Ovoid-shaped feature
CRATER	A circular depression
DORSUM	A ridge or other elongate, raised structure. Cerberus Dorsa (16°S, 255°W)
FACULA	Bright spot
FARRUM	Pancake-like structure, or a row of such structures
FLEXUS	A very low curvilinear ridge with a scalloped pattern
FLUCTUS	Terrain which resembles flows. Only Galaxias Fluctus (32°N, 217°W)
FOSSA	Long, narrow, shallow depression or a narrow linear trench, ditch. Tatalus Fossae (44°N, 102°W)
LABES	Landslide. Coprates Labes, Melas Labes in the Vallis Marineris complex





LABYRINTHUS	Valley network, intersecting canyons. Noctis Labyrinthus (7°S, 101°W)
LINEA	A dark or bright elongate marking, may be curved or straight
LINGULA	Extension of plateau having rounded lobate or tongue-like boundaries
MACULA	Dark spot, may be irregular
MARE	"Sea"; large circular plain
MENSA	Flat-topped, steep-sided elevated feature. Aeolis Mensae (3°S, 218°W)
MONS	Mountain. Highlands surrounding impact basin (Nereidum Montes; 41°S, 43°W), ridges in Valles Marineris or large volcanoes (Olympus Mons; 18°N, 133°W)
PALUS	"Swamp"; small plain
PATERA	Shallow crater with scalloped complex walls or edges. Either craters which don't resemble impact craters (Orcus Patera; 14°N, 181°W) or those of volcanic origin (Tyrrhena Patera; 21°S, 253°W)
PLANITIA	Low plain or large level lowlands without features. Elysium Planitia (20°N, 230°W)
PLANUM	Large high plateau. Sinai Planum (15°S, 87°W)
REGIO	A large area marked by reflectivity or colour distinctions from adjacent areas, or a broad geographic region
RIMA	Fissure
RUPES	Linear scarp or cliff face. Bosphoros Rupes (42°S, 58°W)
SCOPULUS	Irregular scarp or cliff. Coronae Scopulus (33°S, 295°W)
SINUS	"Bay"; small plain
SULCUS	Parallel furrows and ridges which make up wrinkled terrain, semi-parallel ridges and troughs. Memnonia Sulci (5°S, 176°W)
TERRA	Heavily cratered highlands. Noachis Terra (35°S, 335°W)

TESSERA	Tile-like, polygonal terrain
THOLUS	Isolated somical mountain or hill, usually of volcanic origin. Tharsis Tholus (14°N, 91°W)
UNDA	Undulatory features. Only Abalos Undae (81°N, 83°W) and Hyperboreae Undae (77°N, 46°W)
VALLIS	Basically a valley, but on Mars a variety of shapes. From gigantic Valles Marineris to topographically ill-defined Simud Vallis. Large ones named after names of Mars in other languages, smaller ones named after terrestrial rivers.
VASTITAS	Extensive plain, widespread lowlands. Only Vastitas Borealis.
VIRGA	A streak or stripe of color



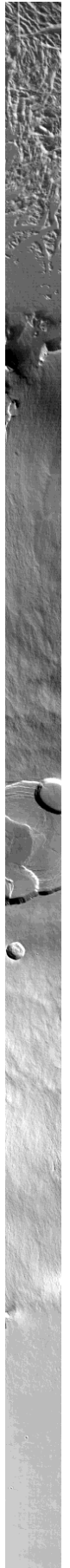
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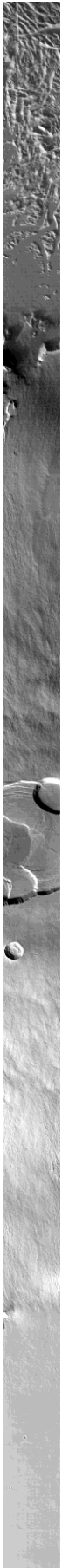
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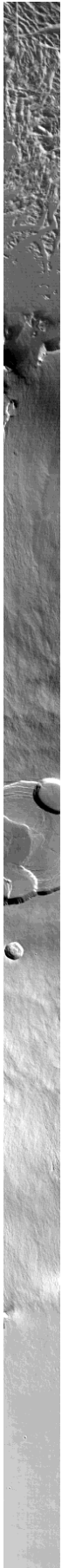


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