U.S. DEPARTMENT OF THE INTERIOR
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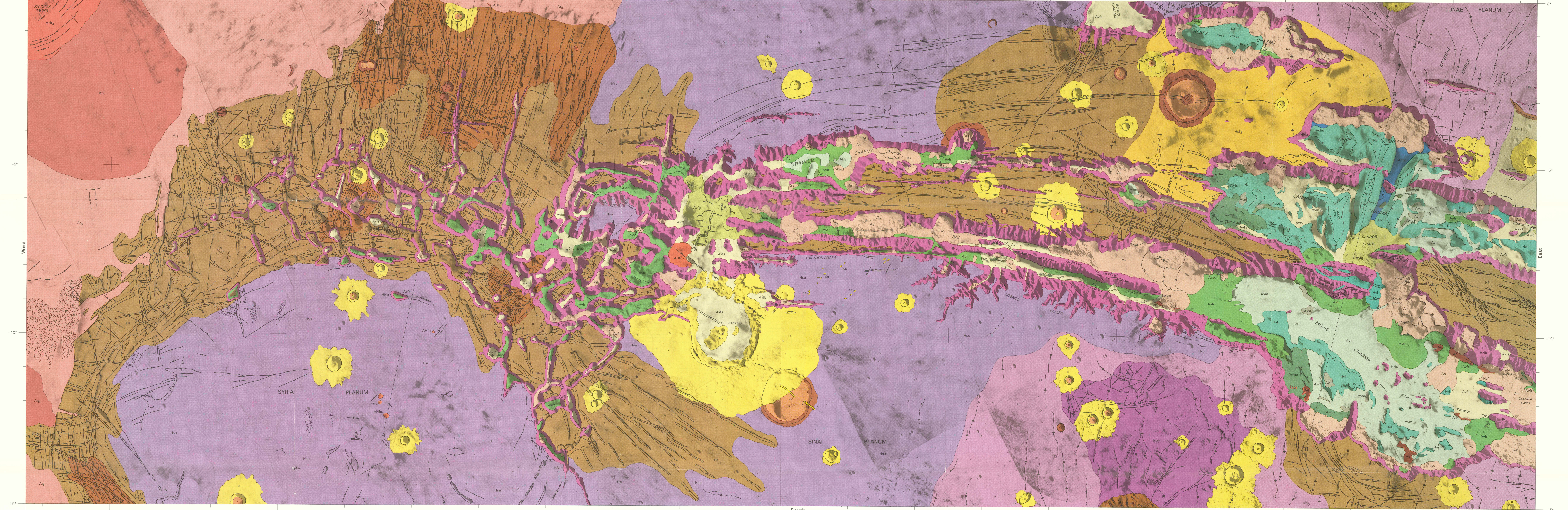
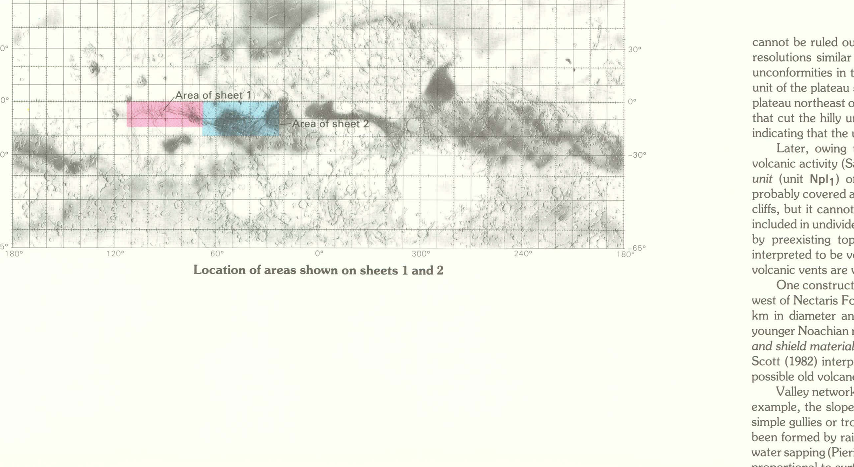
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ATLAS OF MARS
1:2,000,000 GEOLOGIC SERIES
VALLES MARINERIS REGION
M2M -7/90 G, 1991
MAP I-2010 (SHEET 1 OF 2)





Location of areas shown on sheets 1 and 2

Description of map units, chart showing map units and crater densities, and cross sections are shown on sheet 2

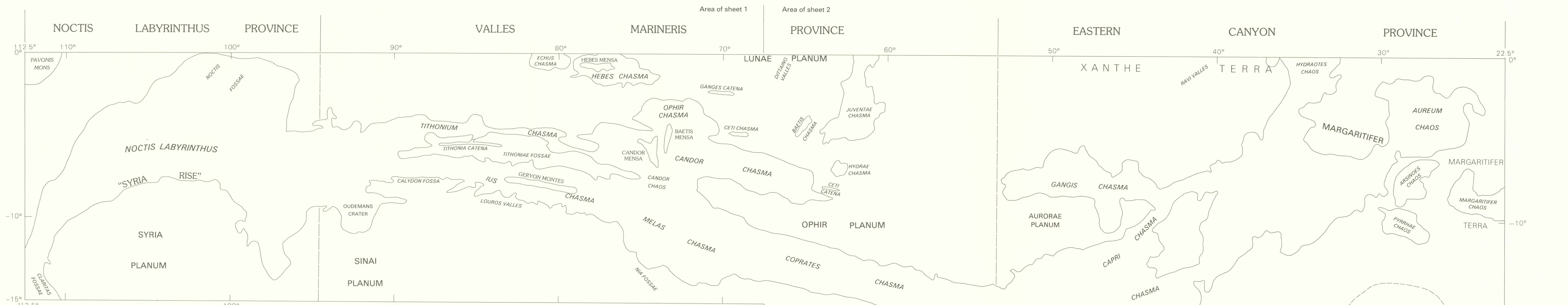


Figure 1. Physiographic provinces (dashed lines are boundaries) and major geographic features of Valles Marineris region.

INTRODUCTION

VALLES MARINERIS SYSTEM

The Valles Marineris system is characterized by west-northwest-trending fractures and linear valleys that connect with broad, irregular depressions. Local fault sets of varied orientations are also common. Grabens crossing the plateau and paralleling the main chasmata are generally a few kilometers wide, tens to hundreds of kilometers long, and perhaps hundreds of meters deep. They are locally segmented into chains, en echelon, or widened into elongate depressions and pit-crater chains (for

As subsidence proceeded and the canyons formed, deformation of the plateau surface and canyon walls and floors was locally complex, as illustrated in the following areas: (1) southwest of Echus Chasma, west of Candor Chasma, and inside the west edge of Ophir Chasma, buried north-northeast-trending faults were apparently rejuvenated. Such faults may also control the linearity of canyon walls along the west edges of Echus, Candor, Ophir, and Gangis Chasmata. Frey (1979b) attributed the initial formation of these faults to uplift of the Thaumasia region to the southwest, which may have predated the major tectonic episodes of Tharsis. (2) In Ius Chasma, Geryon Montes forms a long ridge that is segmented by several northwest-trending saddles. The ridge trends from due west north of Louros Valles to west-northwest near the west edge of Melas Chasma. Adjacent ridge segments are offset along the saddles by as much as 10 km in a left-lateral sense. The offsets may have been formed by wrench faulting along older faults, as suggested by northwest trends of some valleys in Louros Valles and in the north wall of Ius Chasma. If the ridge segments of Geryon Montes are small crustal blocks, left-lateral offsets may have occurred by clockwise rotation during the collapse of Ius Chasma. (3) Along the south rim of Melas Chasma, the arcuate fractures of Nia Fossae, roughly concentric to the canyon, cut wrinkle ridges. They probably formed by incipient gravity sliding of the plateau edge into the canyon. (4) Along the southwest edge of Ophir Planum, densely spaced fractures trend northwest, parallel with and close to

GEOLOGIC SUMMARY

1. Early Noachian—Period of intense meteorite bombardment; "Ladon basin" forms.
2. Middle Noachian—Cratering rate remains fairly high; widespread volcanic and impact-breccia materials of plateau sequence emplaced; intense faulting in Claritas and Nectaris Fossae; shield volcano forms west of Nectaris Fossae.
3. Late Noachian—Decline in cratering rate; intercrater areas resurfaced; small channels dissect highland terrain; ridged unit of plateau sequence emplaced; faulting radial to Syria Planum forms Noctis Fossae.
4. Early Hesperian—Cratering rate continues to decline; extensive areas of Noachian materials resurfaced by smooth and ridged plains materials.
5. Early to Late Hesperian—Main uplift and rifting at Valles Marineris and Noctis Labyrinthus; volcanism at Syria Planum and beginning of lava flows from Tharsis Montes; release of ground water causes two stages of chaotic-terrain and channel development in eastern canyon province;
6. Early Amazonian—Continued extrusion of lava flows from Tharsis Montes; sapping of south wall of Ius Chasma produces Louros Valles; minor tectonic activity includes subsidence of canyon floors in places; canyon walls erode throughout Amazonian time.
7. Middle Amazonian—Tharsis Montes volcanism continues; layered material reworked into massive deposits; huge landslides from canyon walls expanded on chasma floors.

deposits small dune fields; landslides continue.

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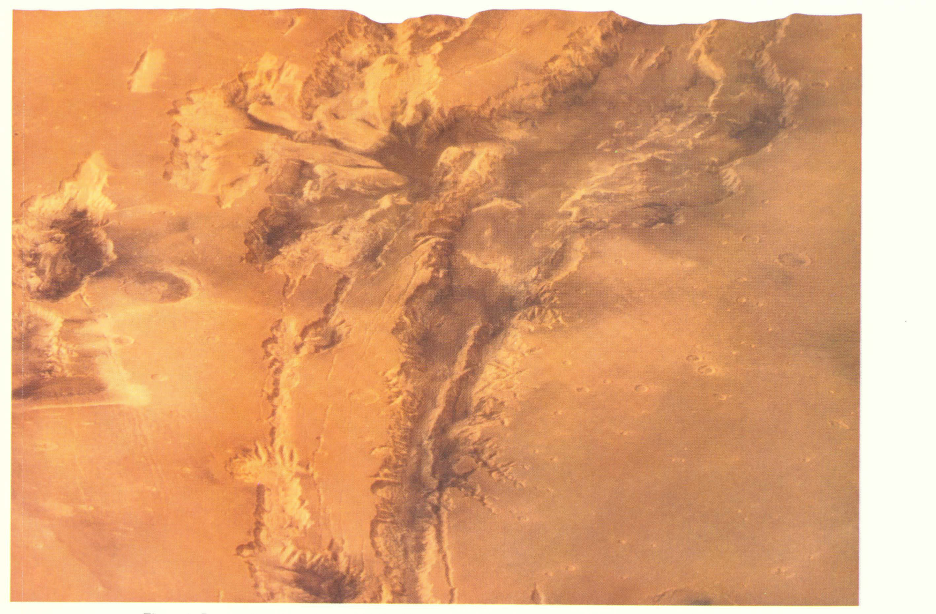

Figure 2. Perspective view of central Valles Marineris looking due east at 30° above horizon. Canyon system cuts the crest of a high, broad ridge. Ius Chasma in center, widening eastward into Melas Chasma at top. Vertical exaggeration 5X. Produced from digital elevation data from stereogrammetry by S.S.C. Wu and natural-color Viking image processing by A.S. McEwen.

Table 1. *Crater densities of selected map units*

[Counting areas grouped by location on 1:2,000,000-scale subquadrangles (see Introduction). Only superposed craters counted except in counting areas of units marked by asterisk, where all observed craters were counted]

Unit symbol	Location	Area (km^2)	Density (No. craters>diameter per 10^6 km^2) 1 km	2 km	5 km	16 km
	MC-17NE					
At_5	Tharsis Montes	612,492	---	90± 12	10± 4	---
Hsu	Syria Planum	315,537	---	434± 37	76± 15	11± 6
Hf	Noctis Labyrinthus	71,904	---	737±101	70± 31	---
Nf	Noctis Fossae	61,396	---	684±105	162± 51	---
	MC-18NW					
Hsu	W. Sinai Planum	189,728	---	627± 58	121± 25	---
Hf	N. of Tithonium Chasma	87,808	1,116±113	774± 94	216± 50	34±20
Hr	E. Sinai Planum	113,902	1,993±132	852± 86	167± 38	44±20
Hr	E. Sinai Planum	59,512	2,151±190	958±127	185± 56	50±30
Nplr	E. Sinai Planum	44,512	1,595±189	1,101±157	225± 71	62±37
	MC-18NE, northern third of 18SE					
Hr	Ophir Planum	106,260	---	1,167±105	273± 50	28±16
Hr	E. Coprates Chasma	96,940	---	1,083±106	289± 55	47±22
Hpl_3	Aurorae Planum	33,816	---	1,745±227	562±129	59±42
Nf	S. Coprates Chasma	48,090	---	977±143	374± 88	57±34
Npl_1	N. Gangis Chasma	106,920	---	1,038± 99	215± 45	51±21
Npl_1*	N. Gangis Chasma	106,920	---	1,291±110	468± 66	159±39
	MC-19NW, northern third of 19SW					
Npl_2	N. Capri Chasma	110,798	---	1,282±108	235± 46	36±18
Npl_2*	N. Capri Chasma	110,798	---	1,598±120	551± 70	162±38
Npl_2	S. Pyrrhae Chaos	77,686	---	1,068±117	245± 56	32±19
Npl_2*	S. Pyrrhae Chaos	77,686	---	1,416±135	592± 87	180±48

GEOLOGIC MAP OF THE VALLES MARINERIS REGION, MARS
(WEST HALF)

By
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1991