

GEOLOGY OF THE MAHUEA THOLUS QUADRANGLE, VENUS; H.J. Moore and S.T. Arriola, U.S. Geological Survey, Menlo Park, CA 94025, and E.J. Israel, Northwestern University, Evanston, IL 60208.

Preliminary geologic mapping of the (provisionally named) Mahuea Tholus quadrangle (V49) indicates the following generalized history. A period of intense deformation was followed by vast outpourings of mafic lava that produced the extensive plains of the region. Uplift in the northern and northwestern parts of the quadrangle and compression produced northeast-trending wrinkle ridges. Extrusions from local vents produced thick sialic flows from Mahuea Tholus [1] and a variety of non-contiguous mottled, domed, and smooth plains. Subsequently, at least seven coronae [2] formed, and extensional deformation [3] produced rifts in the northern parts of the quadrangle; local extrusions of lavas accompanied the formation of the coronae and the extensional deformation. The most recent events were impacts of bolides on the surface to produce craters and on the atmosphere to produce shock waves and splotches [4].

Distributions of backscatter, moderate-scale topography, and landforms portrayed by the Magellan synthetic aperture radar images are the principal sources of information for the definition, interpretation, and determination of relative ages of map units. Data on coarse-scale topography (altimetry) [5] and physical/electrical properties (emissivity, reflectivity, root-mean-square slope, and backscatter coefficient) [6,7] provide additional information on the map units. Coarse-scale topography is of particular importance because it reveals the locations of subtle circular structures (crests of annuli and moats of some coronae) and the net effect of complex deformation in areas with myriad faults and fissures.

Of twenty-seven map units recognized, four have a combination of physical/electrical property signatures (beyond  $\pm 1\sigma$ ; Table 1) that clearly separate them from the other units. These four are the lobate, smooth, and ridged mesa units of Mahuea Tholus (thick lava flows) and the highly fractured terrain unit; the four units have (1) average emissivities between 0.884 and 0.902, (2) average rms slopes between  $3.0^\circ$  and  $4.6^\circ$ , (3) average reflectivities between 0.062 and 0.099, and (4) average backscatter coefficients between -8.8 and -5.2 dB ( $\theta_i \sim 23-35^\circ$ ). The areal distributions of high emissivities, low reflectivities, and large rms slopes of Mahuea Tholus mimic those of the area of its mesa units. Among the crater units, the central-peak, wall, and rim materials have large backscatter coefficients (-7 to -6 dB), while some crater halos and splotches have small backscatter coefficients (-16.5 to -15.0 dB).

Table 1. Average physical/electrical properties of materials in quadrangle.

PROPERTY	MEAN	STD DEV ( $1\sigma$ )	MODE	RANGE
Topography (km)	6051.7	0.52	-	6048.6 - 6053.9
Rms slope (degrees)	2.11	0.81	1.9	0.4 - 9.7
Reflectivity (fraction)	0.118	0.019	0.115	0.045 - 0.425
Emissivity (fraction)	0.854	0.015	0.849	0.803 - 0.928
Backscatter Coefficient (dB) ( $\theta_i \sim 25-26^\circ$ )	-9.5 [8]	-	-	-

Nominal bulk densities inferred for the map units [9] (assuming no

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electrical conductors [10]) from reflectivities and emissivities range from 1,500 to 2,400 kg/m<sup>3</sup> and 2,000 to 2,600 kg/m<sup>3</sup>, respectively; the densities are higher than that of loose terrestrial soils (1,200 kg/m<sup>3</sup>), lower than that of dense lunar rocks (3,300 kg/m<sup>3</sup>), and consistent with those of moderately dense regoliths, porous to non-porous rocks, and mixtures of regoliths and rocks.

The relief of landforms was estimated by using parallax measurements on computer images of left- and right-looking (for craters, volcanic edifices, and a wrinkle ridge) and left- and left-looking pair (for flow lobes). The relief of a canyon was estimated by using hard copy left- and left-looking pairs. Results are shown in Table 2 (see also [11]). The consistent large thicknesses of three separate locations on the northwest flow lobe of Mahuea Tholus are compatible with north-south altimetry profiles [5] of Mahuea Tholus (relief ~0.515 km) and suggest the flow lobe is from an evolved magma [1].

Table 2. Dimensions of landforms in and near the Mahuea Tholus quadrangle.

FEATURE	LOCATION (degrees S.; E.)	RELIEF (km)	DIAMETER (km)	NOTES
Crater	20.0; 169.0	0.970*	11.1*	Floor-E. rim
		0.748*	-	Floor-N.W. rim
		1.053*	10.7*	Floor-E. rim
		0.716*	-	Floor-N.W. rim
		0.400	-	Floor-central peak
Crater	20.5; 183.1	1.602	16.4	Floor-rim; average
Crater	25.0; 168.4	1.287	52.3	Floor-rim; average
Crater	21.6; 176.4	0.193	5.6	Floor-rim; average
Edifice	40.0; 135.0	0.300*	2.7	Base-top
		0.347*	-	Base-top
Edifice	38.5; 136.0	0.779	11.2	Base-top; average
Edifice	40.2; 134.4	0.272	3.4	Base-top; average
Wrinkle ridge	21.6; 176.2	0.167	-	Flanks-crest; ave.
Flow lobe	37.5; 163.6	0.533*	-	Left-, left-look
		0.410*	-	Left-, right-look [1]
Flow lobe	37.5; 163.7	0.682*	-	Left-, left-look
		0.647*	-	Left-, right-look [1]
Flow lobe	37.4; 163.6	0.449*	-	Left-, left-look
		0.438*	-	Left-, right-look [1]
Canyon	25.7; 166.0	2.632	-	Parallax bar

\* Independent measurements of same crater, edifice, or same pairs of conjugate image points on and near the northwest flow lobe of Mahuea Tholus.

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