NEW RADAR-DERIVED TOPOGRAPHY FOR THE EQUATORIAL BELT OF MARS


Earth-based radar measurements of the topography of Mars have been made over the last decade at the Jet Propulsion Laboratory's Goldstone Facility. Using the JPL ephemeris DE-114, these measurements have recently been reduced to the elevation datum corresponding to the 6.1 mb pressure surface (1). Here we present a revised topographic map of the martian equatorial regions based on these data (Fig. 1) and present some features that are now apparent.

Tharsis: Earlier estimates of the Tharsis Dome (2,3) gave a mean elevation of 5-8 km for this 4000 km wide topographic rise. Our data show it to be 2-3 km lower, with the greatest disparity between data sets occurring at 11°N, 110°W where the lava plains surrounding Ascraeus Mons are 6 km lower than previously believed. All four of the large Tharsis shield volcanoes are found to be on a sloping plain which dips down toward the northwest (Fig. 2). A topographic high (5 km above the datum) is associated with Cerranuimius Fossae (20°N, 102°W), while there is also evidence for a peripheral trough around Olympus Mons (1).

Lunae Planum: Rather than being a plateau at an elevation of 4-5 km above the datum (3), Lunae Planum now seems to have an altitude of 1-2 km above the 6.1 mb surface. Interestingly, the plains materials in this area are elevated 1-1.5 km above the adjacent heavily cratered terrain; equivalent thickness estimates for the Lunae Planum lava flows have been derived (4), suggesting that these flows may have been simply emplaced on top of pre-existing cratered terrain.

Chryse Planitia: The southern portion of the basin has an elevation of -2 km, or about 1 km lower than reported earlier. The channels within Simud and Tiu Valles appear to have carved channels to about the same level as Chryse. The closest radar data to Viking Lander 1 (at 22.71°N, 46-48°W) gives a mean elevation of -1.77 km, approximately 700 meters higher than parts of Simud Vallis.

Noctis Labyrinthus: The lava plains surrounding the western end of Valles Marineris represent the highest area of the planet except for the volcanic constructs. Elevations in excess of 9 km are found in Sinai Planum and the relief correlates well with the source region for lava flows (5). The rim material at the western end of the canyon is found to be more than 7 km higher than the equivalent units to the east such as the rim of Eos Chasma (Figs. 1 & 2).

Northern Plains: Extensive plains materials in Elysium, Amazonia, Isidis and Chryse Planitia all have a common elevation of about -2 km. Such an attribute may be coincidental, but it might also be the result of large-scale (low-harmonic) isostatic readjustment after initial emplacement of the plains units.

North-South Hemispheric Asymmetry: Previous generalizations that this subdivision can be made purely on the basis of absolute relief need revision. Parts of the "southern highlands" in the Oxia Palus Quadrangle (MC-11) are 1500 meters below datum, while parts of the "northern lowlands" in Sinai Planum rise to 9 km. A slight topographic high (4 km above datum) can be recognized to the north of Hellas Basin (270-320°W; Fig. 1), but it is unclear if these two features are related. We are currently working on a more detailed analysis of the data to resolve this and other characteristics of the data set.

Figure 1 (above): Radar-derived topographic map of Mars for the regions between 23°N-22°S. Data were acquired during Mars oppositions in 1971, 1973, 1975/6, 1978 and 1980. Contours were hand-drawn (by PMM) at 1 km intervals and are referenced to the 6.1 mb pressure surface. Data gap within the central portion of Tharsis is probably due to scattering of the signal from the young lava flows. No relief information is shown for the floor of Valles Marineris.

Figure 2 (below): Three-dimensional representation of the radar topography shown in Fig. 1. The topographic net is constructed from nine profiles spaced at 5° intervals in latitude and gives the slope characteristics of the surface rather than the elevations. Note that the relief associated with the shield volcanoes within Tharsis has been omitted for clarity. Viewing direction is from the north and overlap appears at both edges of the diagram. Scale bar for each axis is given at the lower left.