NEW RADAR-DERIVED TOPOGRAPHY FOR TYRRHENA PATERA, MARS; S. H. Zisk & P. J. Mouginis-Mark, Planetary Geosciences Divn., Dept. Geology & Geophysics, SOEST, Univ. Hawaii Honolulu, HI 96822; J. Goldspiel, Dept. Astronomy, Cornell Univ., Ithaca NY 14853; M. A. Slade & R. M. Jurgens, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109.

Tyrrhena Patera (21.5°S, 253.2°W) is one of several heavily dissected volcanoes in the southern highlands of Mars (1). Recent geologic mapping (2) has confirmed that it is a broad volcano possibly composed of four or five principal units, the oldest and most extensive of which are thought to be ash units on the basis of their morphology and erosional characteristics. Tyrrhena Patera represents the earliest central vent volcanism identified on Mars and may reflect a transition from flood-style eruptions (which dominated early Martian history) to subsequent central-vent activity.

Because the currently favored models for the formation of the flank units on Tyrrhena Patera involve the emplacement of gravity-driven pyroclastic flows (2), we have made use of new Earth-based radar topographic data taken during the 1988 Mars Opposition in order to help refine our knowledge of the volcano's height and slope characteristics. Radar ranging observations were made at the JPL Goldstone DSN Radar Facility on about 30 days between July 23rd - November 13th 1988. Data were collected at X-band (3 cm) and S-band (12 cm), and included seven new topographic profiles over Tyrrhena Patera at latitudes 20.0°, 20.2°, 20.7°, 21.7°, 21.9°, 22.3°, 22.4° and 25.1°S. These radar profiles augment the topographic information obtained by Downs et al. (3) in 1971 and 1973, which were located at 17.26°, 18.19°, 18.33°, 19.82° and 20.40°S. Examples of our new radar-derived profiles for longitudes between 248 - 258°W are presented in Fig. 1.

NEW TOPOGRAPHY OBSERVATIONS:

The maximum measured height of Tyrrhena Patera is 4.71 km above the 6.1 mb datum at 21.9°S. Slopes for the upper flanks of the volcano are ~1.18° for ~40 km east of the summit, and 0.64° for ~60 km west of the summit. The basal plain east of the volcano is ~400 m lower in altitude than the plain on the western side of the volcano: ~3,100 m above datum compared to 3,500 m above datum. The maximum height variation as one ascends the volcano is about 1.5 km along a profile at 21.9°S between 250 - 254°W. This gives an average flank slope of 0.43° over a distance of 220 km. To the west of the summit, the change in elevation is 1.05 km over 220 km (average slope 0.30°) between 254 - 258°W. The volcano has an inferred height-to-basal diameter ratio of ~0.003.

North and south of the volcano, the ridged plains materials of Hesperia Planum are almost flat in an east - west direction at a mean elevation of ~3,250 m to the north (at 18.19°S) and 2,900 m to the south (at 25.1°S). This means that the north-south gradient from the volcano summit to the north is 0.42°, and 0.60° from the summit to the south. These values can be compared directly to two slope estimates of Greeley and Crown (ref. 2; their slope "C", which they estimate to be 0.21° and we measure to be 0.42°, and their slope "D", which was estimated to be 0.37° and we measure as 0.60°). We can also approximate the measurement of slope "F" (ref. 2), which was estimated to be 0.19° and is indicated by the radar data to be 0.21°.

EROSIONAL SURFACES ON TYRRHENA PATERA

Use of four closely-spaced radar profiles between 19.82° - 20.40°S, and three profiles between 21.90° - 22.40°S enables us to investigate the slopes of the deeply dissected flanks of Tyrrhena Patera. Slopes for the erosional valleys (Fig. 2) vary from 0.23° - 0.67° over horizontal distances of 25 - 50 km. The steepest slope measured is 3.03° for a 13 km segment of the northern flanks ("4" in Fig. 2). These slopes compare to the 0.09° - 0.37° slopes estimated for Tyrrhena Patera over distances varying from 304 - 634 km (2). From the radar data, we find no obvious difference in the slopes of valleys that are deeply incised compared to those that are relatively shallow, suggesting that variation in the slope of the flanks did not play an important

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role in the degree of dissection of the surface. Our data do, however, confirm earlier stereogrammetric measurements of the volcano (4), which suggested that the highland patera are indeed very low-relief and broad features constructed upon relatively flat plains materials. Detailed modeling (such as ref. 2) of the flow characteristics of various volcanic materials using these new radar topographic data may further constrain the mode of origin and evolution of this type of volcano.

REFERENCES: 1) Greeley R. and Spudis, P. D. (1981). *Rev. Geophys.*, **19**, 13 - 41. 2) Greeley R. and Crown, D. A. (1990). *J. Geophys. Res.*, **95**, 7133 - 7149. 3) Downs G. S. et al. (1975), *Icarus*, **26**, 273 - 312. 4) U.S. Geological Survey (1987). Topographic Map of Mars-Eastern region, scale 1:15M, Reston, Va.

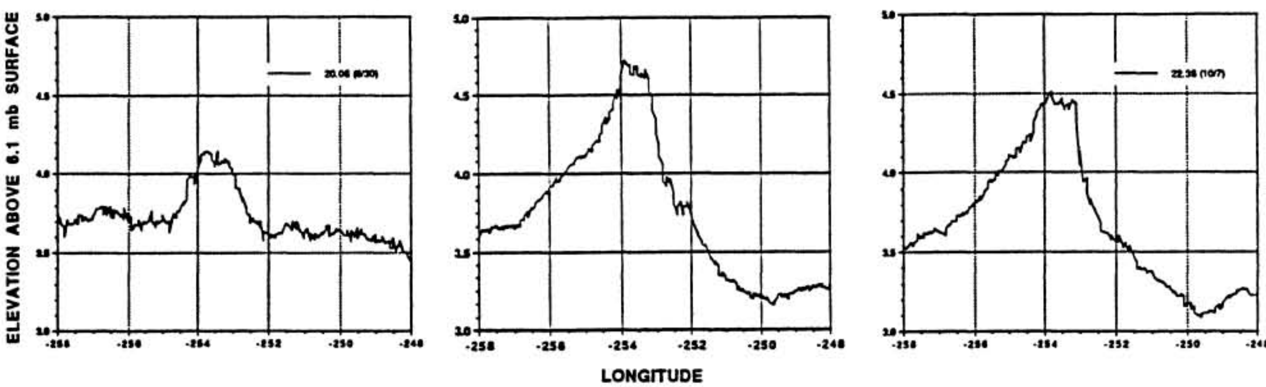

Fig. 1: Examples of the 1988 radar profiles across Tyrrhena Patera (248 - 258°W), obtained at latitudes 20.0°S (left), 21.9°S (center) and 22.3°S (right).

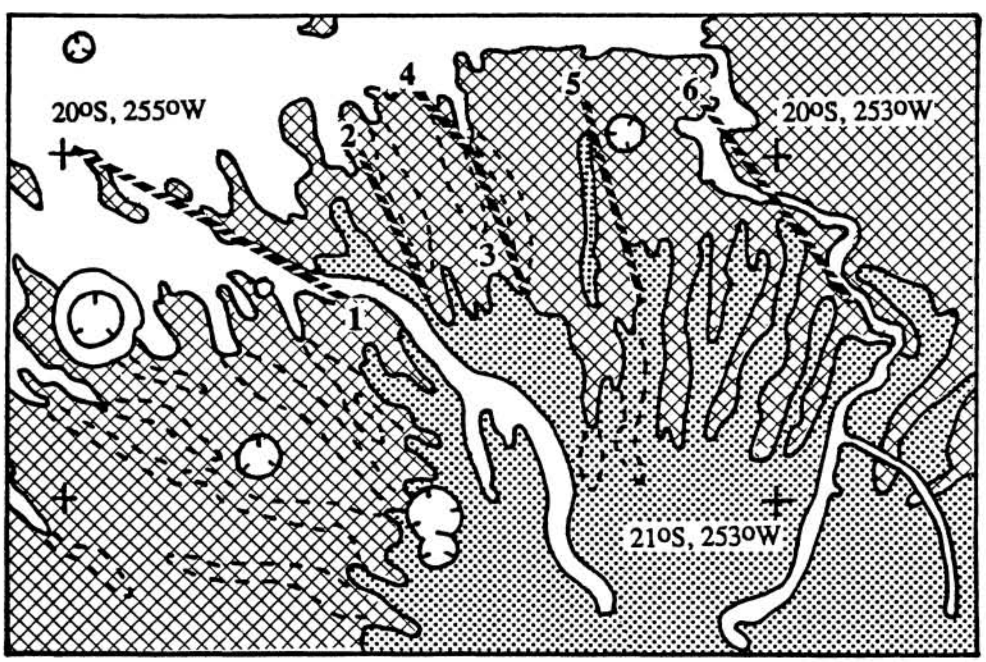

Fig.2: Northern flanks of Tyrrhena Patera, showing prominent valleys (solid outlines), shallow valleys (dotted), radar-derived slopes (dashed lines # 1 - 6) and craters (barbed circles). Two erosional surfaces (shadings) exist on the flanks of the volcano. Local slopes are as follows: 0.31° (#1), 0.23° (#2), 0.38° (#3), 3.03° (#4), 1.04° (#5) and 0.67° (#6).