MERCURY RADAR ALTIMETRY: NEW RESULTS; J. K. Harmon[1], D. B. Campbell[1], D. L. Bindschadler[2], J. W. Head[2], and I. I. Shapiro[3]. (1) Nat'l Astronomy and Ionosphere Center, Arecibo, PR 00613; (2) Dept. of Geological Sciences, Brown Univ., Providence, RI 02912; (3) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138.

Radar altimetry measurements of Mercury have been made at Arecibo Observatory during 1978-84. The measurement techniques and preliminary results were reported by Harmon et al. (1984). Since then, additional data reduction and geological analyses have been completed, some results of which are reported here.

A major step has been the reduction of all data through 1982 to absolute altitudes (Fig. 1). The altitudes show a total variation of 6 km, although long-wavelength topography has an amplitude of about 3.5 km. The topography is dominated by two large bulges centered roughly at 10°W and 190°W longitude, with a third, smaller highlands region appearing in the unimaged hemisphere at 305°W (Figs. 1, 4). Fig. 1 indicates that Mercury's equatorial topographic figure is roughly aligned with its dynamical figure as inferred from the 3:2 spin-orbit resonance. The western edge of one of the large bulges is very sharp, dropping by 3 km at 37°W, near crater Handel (Fig. 2). This drop coincides with an extensive N-S-trending fault system seen in images. Another dramatic drop has been seen across crater Zeami which may be a signature of the fault system seen NE of Tolstoj basin.

Two smooth, bowl-shaped depressions centered on Tir Planitia (Fig. 3) and at 210°W in the unimaged hemisphere (Fig. 1) provide support for the existence of an annulus of circum-Caloris smooth plains. The observed downwarping is suggestive of subsidence under volcanic load, while adjacent topographic highs may be an uplift response to this subsidence. The Arecibo data indicate that the circum-Caloris region possesses the largest expanse of smooth plains in the equatorial zone of Mercury, although less extensive "smooth" regions can be seen in profiles from both the imaged and unimaged (Fig. 4) hemispheres.

Three features identified as scarps from images (Santa Maria Rupes, a second scarp just east of Santa Maria, and a third scarp east of crater Asvaghosa) were found to exhibit radar altimetric signatures (Fig. 2). Each is approximately 70 km across and 750 m high. In at least one case (the feature east of Asvaghosa) the radar profile is sufficiently symmetrical to establish it as being closer to a ridge than a scarp in appearance.

Large Mercury craters (diameter $\geq$ 40 km) average 2.3 km in depth as estimated from radar profiles. Some large and/or fresh craters yield radar depths of 3 km or more. These depths are consistent with shadow-derived values from Mariner 10 imagery. The one very large basin observed with the radar (centered at 130°W, 2°N) is shallower than some smaller basins and craters, consistent with degradation or isostatic relaxation, but does exhibit some distinctive topographic features.

The unmapped hemisphere (Fig. 4) shows a number of large craters as well as topographically smooth areas indicative of smooth or intercrater plains. No marked topographic differences are found between this and the imaged hemisphere nor is there evidence for another feature on the scale of Caloris.

Reference: J. K. Harmon, D. B. Campbell, J. W. Head, D. L. Bindschadler, and I. I. Shapiro (1984). Lunar Planet. Sci. XV, 343.

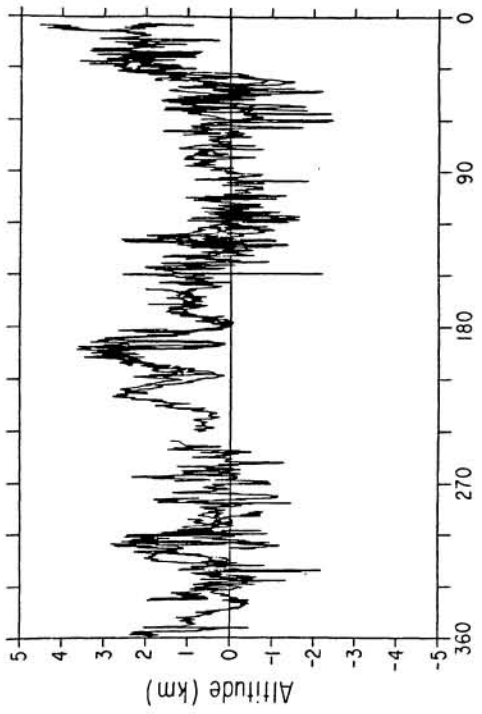

Fig. 1. Mercury altitude profiles from 1978-82 on absolute altitude scale. The zero-altitude datum corresponds to a 2439.0-km-radius reference sphere.

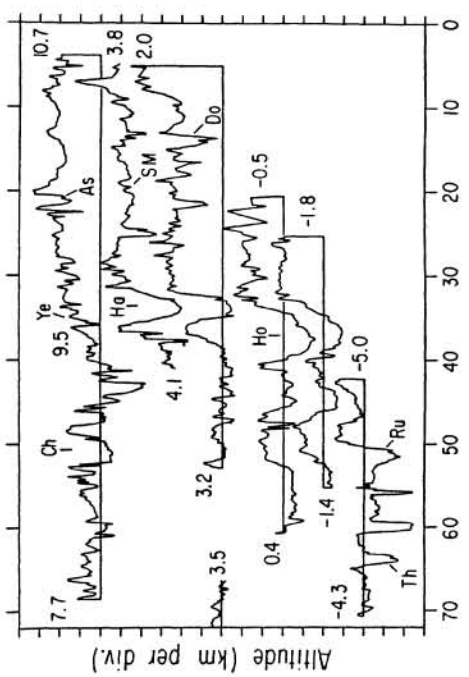

Fig. 2. Altitude profiles for the H-6 quadrangle. Numbers denote latitude. Horizontal lines give datum level. As=Asvaghosa, Ye=Yeats, Ha=Handel, Ho=Homer, SM=Santa Maria scarp.

Fig. 3. Altitude profiles in the vicinity of the circum-Caloris smooth plains (Tir Planitia) and crater Mozart. Numbers are latitudes. Dotted lines separate major geologic units. The line T-T shows the Mariner 10 terminator.

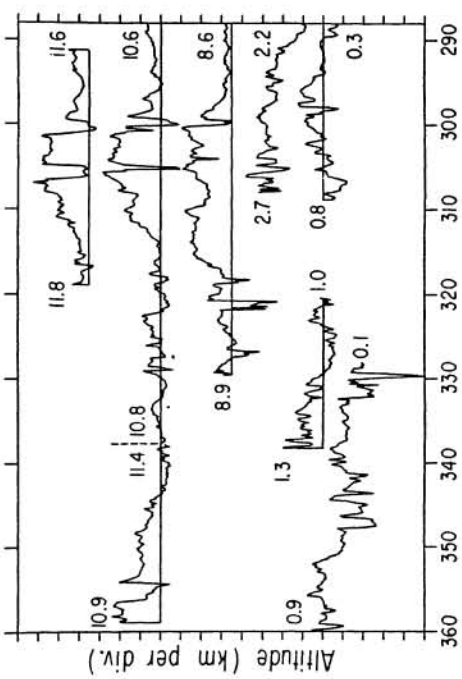

Fig. 4. Altitude profiles for the H-10 quadrangle. Numbers give latitude. Horizontal lines give datum level. This quadrangle was not imaged by Mariner 10.