TOPOGRAPHIC MODELS FOR DISCOVERY RUPES, MERCURY USING DIGITAL STEREOPHOTOGRAMMETRY AND PHOTOCLINOMETRY. **T. R. Watters**, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560, **M. S. Robinson**, U. S. Geological Survey, 2255 North Gemini Drive, Flagstaff, Arizona 86001, **A.C. Cook**, DLR, Institute of Planetary Exploration, Rudower Chausee 5, D-12489 Berlin, Germany

Discovery Rupes is the largest of a class of tectonic features on Mercury referred to as lobate scarps. These landforms reflect crustal shortening and are thought to have formed by thrust faulting. Discovery Rupes is over 500 km long and has been estimated to be as high as 3 km [1]. Using Mariner 10 stereo pairs, a digital elevation model has been generated by digital stereophotogrametry utilizing improved pointing geometry data and a new control net. These preliminary data indicate that the maximum relief of Discovery is only ~1.5 km and that much of the scarp is at or below 1.3 km. Preliminary estimates of the maximum elevation from profiles across Discovery derived by photoclinometry using recalibrated Mariner 10 images are within 10% of the relief indicated in the DEM.

Landforms described as lobate scarps were first discovered on Mercury in images returned by Mariner 10 [1]. Characterized as features unique in the solar system [2], they are in fact similar in morphology to those found in the highlands of Mars [3,4]. Lobate scarps are generally one-sided, often lobate and occur in linear or arcuate segments. They are thought to have formed by thrust faults, based on their morphology and because some clearly deform crater floors [1,3,5,6]. Lobate scarps occur at two scales, moderate- and large-scale. Moderate-scale scarps typically have lengths ranging from 20 to 150 km [1,5,7]. The best known and largest lobate scarp on Mercury is Discovery Rupes (note that only ~45% of the surface of Mercury has been imaged to date). Discovery is over 500 km long and its maximum relief has been estimated to be as little as 1 km and as high as 3 km [1,6,7].

One source of topographic data for Mercury has been derived from Mariner 10 images using photoclinometry [1,8,9,10]. The cameras flown on Mariner 10 were slow-scan vidicons [11], similar to that flown on the Viking Orbiters that mapped Mars. Previous efforts to derive topography from Mariner 10 images using photoclinometry relied on image calibrations and spacecraft pointing data derived early in the mission [1,8,9,10]. Recent efforts to rederive and improve the radiometric calibration and the accuracy of the pointing geometry data of Mariner 10 images have been completed [12,13,14]. Using these data, a new control net for Mercury has been generated [15].

Using the improved pointing geometry and control net, a digital elevation model covering much Discovery Rupes has been generated using digital stereophotogrametry on Mariner 10 stereo pairs (frames 27399 and 166613; 27398 and 166625) [16]. The preliminary DEM has a grid spacing of 500 m/pixel and a relative vertical uncertainty of <500 m. Profiles across high relief areas of Discovery indicate that the structure has a maximum relief of ~1.5 km (Figure 1). The average relief of the scarp over the areas traversed by the profiles shown in Figure 1 is 1.3 km (n=3). The relief of the southern segments of the scarp is generally < 1 km. The maximum slope of the scarp face is estimated to be up to ~27°. With these data, improved estimates of horizontal shortening and comparisons with terrestrial thrust faults are possible [17].

Photoclinometric profiles were generated across Discovery Rupes in an effort to provide an independent check of the DEM. Using recalibrated Mariner 10 images and employing the Lommel-Seeliger/Lambert photometric function, photoclinometric profiles across Discovery Rupes were successfully generated. The horizontal DN, the brightness value of a horizontal surface, was estimated by determining the average of a 9x9 array of pixels. A preliminary comparison of photoclinometric profiles across Discovery and coterminous profiles extracted from the DEM reveals that the difference in maximum relief is less than 10%.

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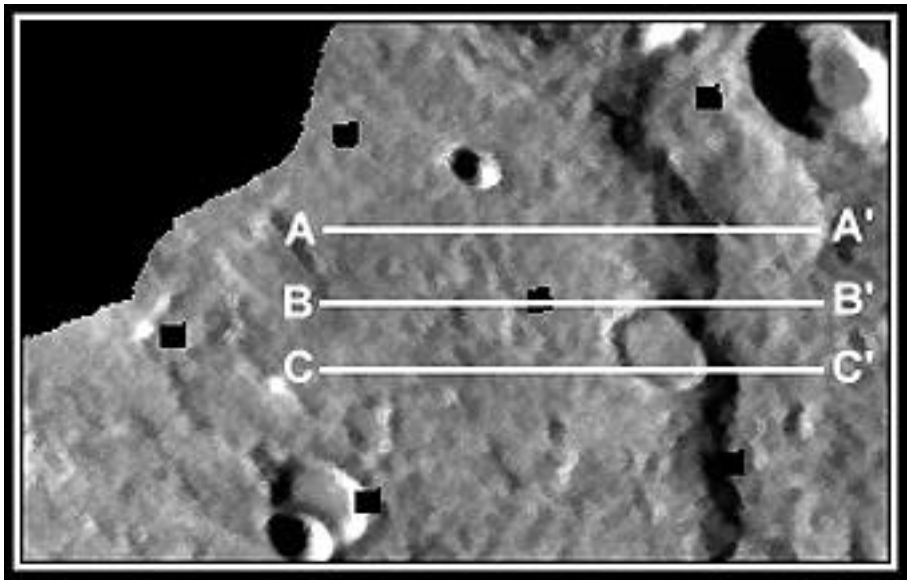

Figure 1A. Mariner 10 image of part of Discovery Rupes (FDS 27399). Lines indicate the locations of profiles shown in 1B.

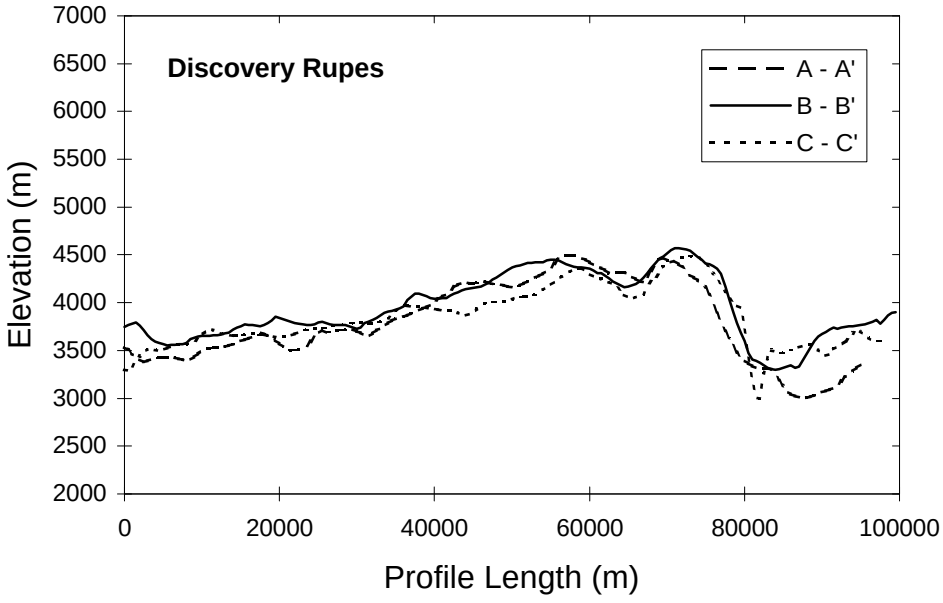

Figure 1B. Elevation profiles across Discovery Rupes extracted from the DEM. Profile locations are shown in 1A. Elevations are relative not absolute and the vertical exaggeration is ~12:1.