STRUCTURE AND MORPHOLOGY OF THE ANCIENT CRATERED TERRAIN-SMOOTH PLAINS BOUNDARY ZONE IN THE EASTERN HEMISPHERE OF MARS. Ted A. Maxwell and Susan J. Barnett, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560

Geologic mapping and previous studies of the structural and geomorphic history of Mars have long indicated that a major problem in the evolution of the planet is the origin of the dichotomy between the highly cratered southern hemisphere and the northern smooth plains (1, 2, 3). In the eastern hemisphere of Mars, the boundary region (hereafter called "CTB" for cratered terrain boundary) is characterized by numerous terrain types, including the fretted channels of the Deuteronilus region, knobby terrain and scarps near Elysium, and fretted terrain of Ismenius Lacus. Previous attempts to explain the origin of the CTB have relied on large scale crustal properties and mechanisms, but have not been tested against presently observed structural patterns. Although it is likely that the initial zone of break-up between the two terrain types is completely obscured by later resurfacing, structural patterns may be related to large scale fractures or crustal discontinuities formed by the event. Consequently, the purposes of this study are to: 1) Compare the orientations of structural features north and south of the CTB, 2) Investigate the possibility of structural control of the scarp (where it exists as a scarp), 3) Determine the prior position of the boundary, and 4) Investigate the role that impact basins may have had on the present-day configuration of the boundary.

In order to develop a data base suited to these problems, we have digitized structural and physiographic features on either side of the CTB from +30° to -30° Latitude and 180° to 315° W Longitude. Using 1:2M Orthophotomaps, features digitized include the present location of the CTB (in many areas a subjective location), areas of distinct terrain types (lineated terrain), endpoints of individual plateaus north of the boundary, and endpoints of scarps, ridges and graben on both sides of the boundary. Rose diagrams were plotted for these structures based on their location relative to the CTB for comparision between features and to document possible relations between the orientations of elongate erosional remnants and features of more obvious tectonic origin.

Between Elysium Planitia and cratered terrain to the south, the CTB marks a change in orientation and style of both ridges and graben. From 180° to 270° W, ridges above the CTB have marked peaks at N, especially between Elysium Mons and the Tharsis plateau. From 225° to 270° W, additional orientations of NE occur (peaks at 10-15% of total length) due to ridges perpendicular to the CTB in the eastern part of the Amenthes quandrangle. In contrast, the same longitude range south of the CTB shows variations about primarily NW orientations, and strong NW trends continue to the west to the Isidis basin and within the Syrtis Major plateau. Ridge orientations between 270° and 315° are consistent with radar topography (4) and photogeologic interpretations (5) suggesting that the Syrtis Major volcanic shield was emplaced on ancient cratered terrain rather than being part of the resurfacing of the northern plains.

Comparision of scarp orientations also indicate variations on either side of the CTB, and they share some of the same major peaks as ridges. In particular, scarps southeast of the Isidis basin in the ancient cratered terrain display NW orientations similar to those of ridges; both are radial to

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the basin and parallel to the general trend of the CTB. Between 180° and 225°, however, a few NE trending scarps are present that are not matched by ridge trends. Differentiation of "true" scarps from ridges is difficult in Syrtis Major, where sun angle limitations of Viking images make it difficult to tell whether both sides of a linear scarp-or ridge-like feature are raised. In addition, several of these linear scarps may be the lateral margins of volcanic flows, and thus have no tectonic significance. The effect of the Isidis basin on structural patterns is significant north of Syrtis Major, where scarps are both radial and concentric to the basin.

Orientations of graben in the eastern equatorial region appear to be less influenced by their position relative to the CTB than ridges or scarps. Between 180° and 270°, graben orientations north and south of the CTB share similar NW to WNW orientations, although additional local trends are present. As is true for scarps, the Isidis basin exerts a strong control on graben in the Syrtis Major and Amenthes quadrangles, and structures there are concentric to the basin, but are restricted to the ancient cratered terrain and in many cases, embayed by smooth plains units. The trends of elongate, flat-topped erosional remnants matches those of graben more closely than other features, although some redundancy is present in the data since some of the erosional remnants are bounded by graben-like structures. Nonetheless, the distribution and density of the remnants suggests that retreat of the CTB was not uniform and the original boundary may have had a higher inclination to the present-day equator than is presently observed.

With the exception of the Isidis basin, no obvious basin related tectonic patterns are present in the eastern hemisphere boundary region, although the absence of ridge patterns within Isidis suggests that either the latest flooding obscured older features, or the elastic lithosphere was sufficiently thick to inhibit a tectonic response similar to that of lunar basins (6). When structures near the Isidis basin and Elysium are omitted from the data sets, the observations of differing orientations on either side of the CTB remain significant. If the orientations of ridges and scarps south of the boundary represent those of ancient fractures in the crust, then it is likely that the global-scale event that produced the highland/lowland dichotomy had a significant effect on structures presently observed in the ancient cratered terrain.

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