SURFICIAL AND STRUCTURAL ANALYSIS OF LARGE PATTERNED FRACTURES IN SOUTHERN ACIDALIA PLANITIA, MARS; Murray C. Borrello, Dept. of Geol./Geog., Univ. of Massachusetts, Amherst, MA 01003

Extraordinary patterned fractures similar to giant mud cracks occur in Elysium, Utopia and Acidalia Planitiae areas of Mars. Theories as to their origin range from permafrost patterning to tectonic fracturing (reviewed by Pechmann, 1980). Recent studies indicate the patterned fractures may be a surface reflection of rough, buried terrane in which fracturing occurs as a result of differential compaction (McGill, 1986).

The patterned terrane in the southern portion of the Acidalia region (MC4-SC, MC4-SE) is being studied to determine its age relative to other terranes and events, and to constrain models for the origin of the fractures. This abstract deals primarily with geometry of the fractures and the relative age of the material containing the patterned fractures.

Two types of fracture patterns occur in the Acidalia region: straight-sided and circular. Straight-sided fracture patterns are well exposed near 12°W, 41°N. These features are roughly polygonal, from 11 to 32 Km in diameter, with individual fractures graben-like in appearance. Curved-sided and circular fracture patterns occur near 17°W, 45°N and appear more subdued due to a thin cover of younger material.

A surficial geologic map in the MC4-SE subquadrangle shows modified southern highlands in the south and smooth plains material with and without fractures in the north. The fractures making up the patterned terrane appear to be among the oldest features in the Acidalia plains region. An age sequence has been constructed based on cross-cutting relationships and superposition:

Youngest: Volcanism; cinder cones and other volcanic landforms
Formation of smooth, younger plains material
Formation of hummocky plains terrane
<u>Deposition and fracturing of northern plains material</u>
Modification of southern highland terrane
Oldest: Deposition of southern highland terrane

Six geomorphic and structural domains exist in the MC4-SE subquadrangle. Of these, only two include patterned terrane and, therefore, are of greatest interest to this study. The first domain is characterized by subdued circular fractures covered by a thin veneer of younger material. The second domain is characterized by well-exposed, straight-sided, roughly polygonal fractures.

Both domains contain features interpreted as volcanic landforms, including flat-topped hills, domes, flows and cinder cones (Allen, 1979; Greeley and Spudis, 1981; Scott, 1982; Frey and Jarosewich, 1982). These volcanic features appear to be superposed on the fractures and in some cases lie undisturbed across fracture traces. Also common in both domains are possible erosional remnants such as knobs, mesas and hills not associated with volcanism.

Structural analyses have been conducted using fracture trace orientations as a function of frequency and length but no dominant trends occur on a regional scale. Also, the distribution of triple junctions and T-intersections was analyzed for structural alignmnets using a modified Fry method,

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which demonstrated a random distribution of points. At the limits of the Fry method, the absence of preferred orientation and the random distribution of points indicate no significant horizontal stress differences and no subsurface control affected the development of these fractures. The patterned fractures, therefore, can be classified as random "T" intersections in which no dominant orientation occurs in initial or subsequent fractures (Lachenbruch, 1962).

This study shows that, at the limits of resolution of the techniques used, fractures in the southern Acidalia plains area appear to be among the oldest features in that area. They also appear to have been unaffected in their development by any regional stresses or subsurface controls.

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