MARTIAN FRETTED TERRAIN. Dean B. Eppler and Michael C. Malin, Geology Department, Arizona State University, Tempe, AZ 85281.

Martian fretted terrain was first described by Sharp (1) as "smooth, flat, lowland areas separated from a cratered upland by abrupt escarpments of complex planimetric configuration." This description, combined with estimates of age (2,3) and some speculations on material properties and process vigor (3), represented the state of studies that could be addressed using Mariner 9 photography.

With the receipt of Viking Orbiter images of considerably higher resolution and quality, studies of fretted terrain have resumed. Initial discussions have principally addressed features of hillslope degradation and downslope mass transport, first as evidence of frost creep and/or gelifluction (4), and later as evidence of debris movement in rock glaciers (5,6). The test between the two alternative mechanisms proposed may come from observations of age relationships: the rock glacier model of Squyres is presumably operating today, the frost creep/gelifluction model of Carr and Schaber most likely is not.

These studies have emphasized environmental factors influencing the evolution of slopes and lowland surfaces after a depression is formed; they touch only briefly on other implications and controlling factors. In addition, they explicitly discuss only the processes of slope modification and not the origin of the original depressions. Following a rather traditional, terrestrially oriented approach, we first address those factors that control landform development: a landform reflects the properties of its materials, the various processes operating on it, the timescales over which these processes and material properties may vary, and the accumulated time of modification. In a Davisian context, features of low, subtle relief suggesting intense degradation would be deemed old. In our mind, these features are simply degraded, as process intensity might have been great, or the material properties might have favored rapid deterioration. Separating the influences of each factor requires examination of not only similarities between features, but differences as well.

Fretted terrain, best seen along the margin between heavily cratered uplands and lightly cratered lowlands between 285° and 350°W, shows a continuum of landform types from relatively steep-sided ridges or uplands separated by narrow valleys (on the east in Nilosyrtis Mensae = NM) to widely spaced or isolated flat topped mesas with steep slopes above smooth, flat plains (on the west in Deuteronilus Mensae = DM). Between the two ends, for example, in Protonilus Mensae (PM), landforms show traces of both types: the uplands are somewhat narrower than those in NM, and the valleys are somewhat wider (though not as wide as the lowland plains of DM).

Upland surfaces vary from "hummocky," irregularly undulating textured surfaces displaying several topographic levels and rounded slope brink profiles (NM) to smoother, relatively flat, sharp bordered mesa surfaces with crisp, steep, precipitous slope brinks (DM). Lowland surfaces in NM often display numerous lineations arranged longitudinally down valleys; DM lowlands are more rugged except near mesas where surfaces are smoothed or subdued in texture.

Ridges and valleys in NM and ridge-like mesas, facets of pyramids, and lineations associated with mesas in DM are oriented along trends similar to ridges, linear crater wall segments, and other features found in nearby heavily cratered uplands. From this we infer structural control of both the initial process of fretting (that which produces depressions) and secondary processes of modification.

Closed linear basins and fractured, undulating surfaces formed by collapse suggest subsidence played a role in fretting. Scarp brink morphology, the scale of 'plates' within collapsed areas and the scale of "communication" of collapse features further suggests removal of support from beneath a competent cap rock (3).

Two types of depositional models were proposed by Squyres and Carr and Schaber for formation of aprons around mesas in DM and PM and lineated floors in NM. We have examined these and several additional models, as well as two erosional models in which aprons are inferred to be in-place bedrock material. Most models can be excluded with currently available data, but several remain viable.

We conclude that material properties and structural relationships are more important than environmental factors in producing fretted terrain. We also feel material properties may also play more of a role in slope-related movements than do environmental factors.

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