RIDGES AND SCARPS IN THE EQUATORIAL BELT OF MARS

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Abstract. The morphology and distribution of ridges and scarps on Mars in the ±30° latitude belt were investigated. Two distinct types of ridges were recognized. The first is long and linear, resembling mare ridges on the Moon; it occurs mostly in plains areas. The other is composed of short, anastomosing segments and occurs mostly in ancient cratered terrain and intervening plateaus. Where ridges are eroded, landscape configurations suggest that they are located along regional structures. The age of ridges is uncertain, but some are as young as the latest documented volcanic activity on Mars. The origins of ridges are probably diverse—they may result from wrinkling due to compression or from buckling due to settling over subsurface structures. The similar morphologic expressions of ridge types of various origins may be related to a similar deformation mechanism caused by two main factors: (1) most ridges are developed in thick layers of competent material and (2) ridges formed under stresses near a free surface.

1. Introduction

Ridges and scarps on Mars that resemble mare ridges on the Moon were observed in Mariner pictures (Lucchitta, 1978) but it was not until the advent of Viking images that their abundance and similarity to mare ridges on the Moon was recognized. In order to explore this similarity and learn more about their origin, we studied the morphology of ridges and scarps on Mars and mapped their distribution. Specifically, we investigated ridges on the 1:5 million quadrangles MC-8 to MC-23, composing the equatorial region between latitudes 30°N and 30°S, and mapped all ridges and scarps that could be identified on Viking orthophotomosaic quadrangles at scales of 1:1250 000 and 1:2 000 000. The ridges were digitized for statistical purposes and trend analyses; the results of this separate study will be reported elsewhere. The investigation discussed here deals mainly with the morphologic aspect of ridges and scarps on Mars and its implication.

2. Ridge Types

The ridges on Mars are of distinct morphologic types. Locally, however, transitional types occur, and types may grade into each other regionally, suggesting that all ridges have some common element in their origin. Most conspicuous are long, linear ridges nearly identical to lunar mare ridges, and short anastomosing ridges that are unlike most ridges on the Moon.

The long, linear ridges that resemble lunar mare ridges (Figures 1a and b) may locally be en echelon or offset. Like their lunar counterparts, they are composed of broad arches with superposed irregular, crenulated, narrow wrinkles that may be located near either side of the arch or on the adjacent flat ground. This type is most common on relatively...
Fig. 1a. Lunar mare ridge northwest of the Aristarchus Plateau. Ridge is composed of broad arches (A) that may be truncated by scarps (B). Ridge has superposed irregular crenulated wrinkles (C) that may have developed near either side of the arch and that locally extend onto adjacent flat surfaces (D). Apollo panoramic camera photograph AS-15-0361; north toward top.

Fig. 1b. Martian ridge south of Kasei Vallis. Like its lunar counterpart, ridge is composed of arch (A) with scarps (B), and superposed wrinkles (C) that may extend onto adjacent flat ground (D). Viking Orbiter image 664A16.