THE ORIGIN OF THE PHLEGRA MONTES, MARS; J.M. Moore, Department of Geology, Arizona State University, Tempe, Arizona, 85287

The Phlegra Montes of Mars are a range of apparently block-faulted, knobby mountains which slope gently to the west and are bounded by escarpments on the east (1). Individual knobs frequently exhibit subdued topography and are surrounded by aprons of lobate debris.

The origin of the Phlegra Montes has been attributed to both basin impact and endogenic-tectonic processes (1,2). Previous searches have failed to reveal impact basins associated with the Phlegra Montes (3,4). The identification of block-faulted mountains on Mars formed by endogenic processes would be a new factor for models of martian tectonism. Because of the importance of such an identification, the origin of the Phlegra Montes is investigated in this study.

A search for impact basin-related landforms that could be associated with the Phlegra Montes was conducted. A map of Phlegra Montes lineaments was produced and used to test for geometric trends. The mountain range is slightly arcuate, concave to the west. Treating the range as an arc, measurements of cord lengths and inscribed radii segments were used to calculate a circle diameter. As the Phlegra Montes do not form an arc of constant radius and do not have a well-defined western boundary, the values for circle diameter range from ~2000 to ~3000 km. A search for isolated massifs or linear features west of the mountains that could be connected to form a circle in this diameter range failed to reveal any such landforms. Moreover, global topography and gravity maps do not indicate an impact basin associated with the Phlegra Montes (5,6). Therefore, the evidence for an impact-related origin of the mountains is very weak.

Evidence for relationships between the Phlegra Montes and clearly endogenic landforms were investigated. The mountain range forms a ridge that is radial to the broad, roughly circular topographic rise of Elysium (5) (Figure 1). This rise has widespread, though scattered, occurrences of knobby terrain and is bordered in places by circumferential lineaments. Several graben-like lineaments trending generally east-west in the Phlegra Montes are among the features that are circumferential around the basin. The center of the rise (28°N, 199°W) is near the southern end of the mountain range. The presence of large, volcanic features (the Elysium volcanoes) on the western side of the rise implies the rise has a thermal-tectonic origin, as is the case in African basin-and-swell topography and the Hawaiian swell (7). The presence of the Elysium volcanic complex on the western portion of the rise tends to mask the rise on topograhic and gravity maps. A positive gravity anomaly correlates reasonably well in size and shape with the swell's topography (6).

The radial orientation of the Phlegra Montes to the Elysium topographic swell implies a genetic relationship between the two features. This relationship is similar to the ridge associated with the Claritas Fossae, which is observed to be a long, radial feature extending off the Tharsis rise (8). The Claritas Fossae ridge is block-faulted as are the Phlegra Montes. Vertical block-faulting with major structure radially arrayed across thermal-tectonic domes is observed on Earth for such features as the Kenyan and Ethiopian swells (7,9). The Phlegra Montes may have originated as a rift,

formed during the inflation of the Elysium swell. The scarps of the rift might have deformed to more ridge-like, mountainous topography if the swell subsequently subsided following the termination of dynamic thermal support. The process that created the Phlegra Montes may be analogous to a model of the formation of ridges from graben scarps by creep deformation (10). These observations and inferences indicate a possible endogenic-tectonic origin for the Phlegra Montes. Therefore, these mountains and their associated swell may represent a class of martian tectonic structures not previously recognized.

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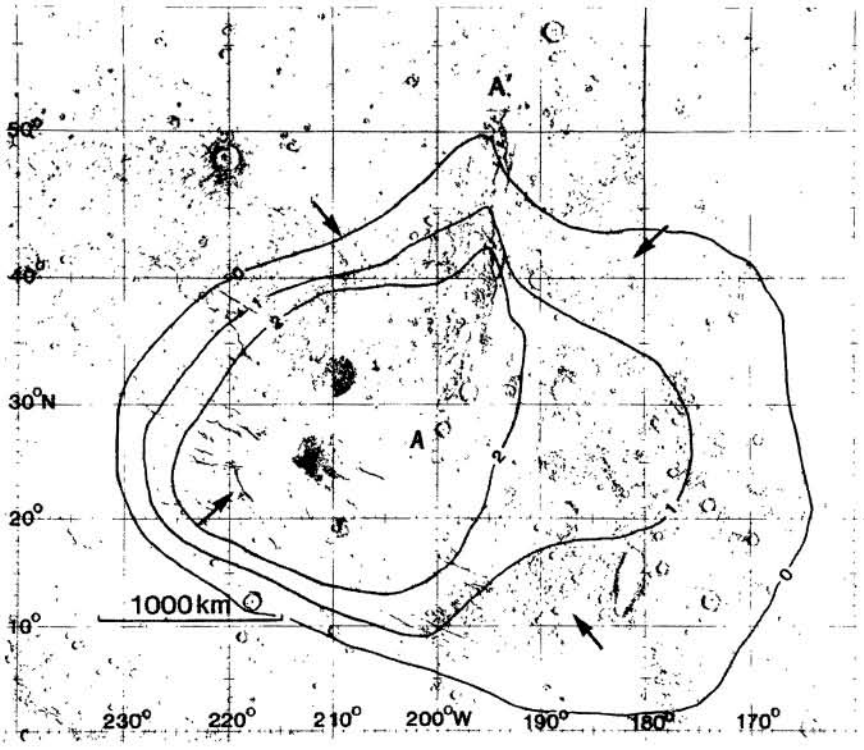

Figure 1. Regional view of Phlegra Montes (A-A') and the Elysium rise. Note the lineaments (arrows) which define and are radial to the Elysium rise (from the U.S.G.S. 1:15 M maps of Mars). The Phlegra Montes are radial to the Elysium swell as indicated by those contour lines (1 km intervals) that are unassociated with the volcanic constructs (5).