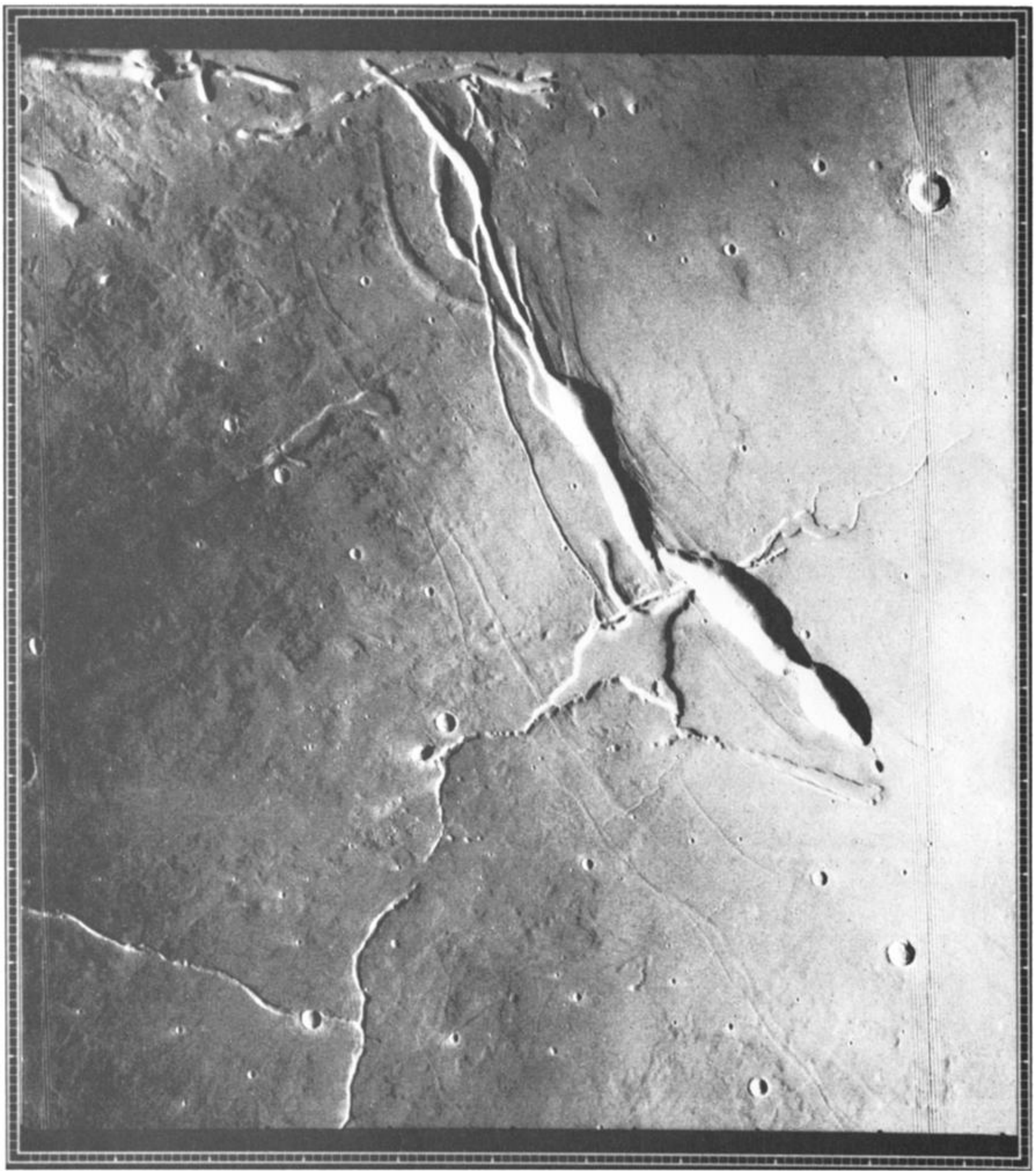

Fig. 4. Viking orbiter view of a wide depression west-southwest of Elysium Mons. Its association with the system of concentric fractures around the volcano suggests that it is at least partly tectonic in origin. Frame V0844A20; width of image is 260 km.

proach to determine the stress distribution predicted by regional loading models, including the models proposed by *Janle and Ropers* [1983] to fit line of sight gravity data. For the Tharsis load we use the spherical harmonic solutions of *Banerdt et al.* [1982] for displacement and stress in a thick elastic spherical shell given the topography and gravity.

The elastic theories used in these stress calculations are clearly idealizations of actual mechanical behavior, and it is important to recognize the limitations of these simplified descriptions of the stress field. The local and regional stress models are based on thin shell theory and are valid only for loads of horizontal dimension small compared with the planetary radius. For all models, perfect elasticity is assumed for the lithosphere. Further, for each type of model the lithosphere is taken to have a uniform thickness or flexural rigidity. Such time-dependent effects as viscoelasticity and load growth are ignored. Finally, loads estimated from present topography and gravity need not be correct representations of loads at the time of formation of ancient tectonic features.

The thin shell approximation is not a serious source of error for local loading problems [*Melosh*, 1978; *Pullan and Lambeck*, 1981; *Comer*, 1983], even for lithosphere several hundred kilometers in thickness such as that in the vicinity of Olympus Mons [*Thurber and Toksoz*, 1978; *Comer et al.*, 1985]. The approximation of horizontally limited loads in the Brotchie formulation of flexure presents no problem for individual volcanoes but may introduce a small error for loads on the scale of Elysium Planitia. The lithosphere, of course, is not perfectly