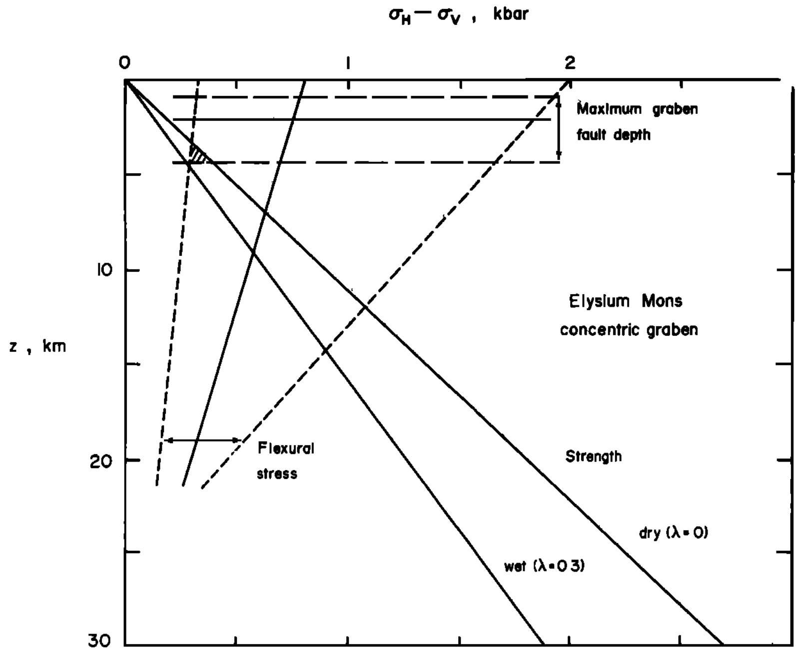

Fig. 7. Comparison of the maximum depth of faulting during the formation of one of the wider graben circumferential to Elysium Mons, inferred from the graben width by the method of *Golombek* [1979], with that predicted from the intersection of the predicted flexural stress distribution and the frictional strength envelope. The quantities σ_V and σ_H are the vertical principal stress and the most extensional horizontal principal stress, respectively; both are positive in extension. The extensional strength versus depth z is shown under both dry and wet ($\lambda = 0.3$) conditions, where λ is the ratio of fluid pressure to lithostatic stress [*Brace and Kohlstedt*, 1980]. The flexural stresses are from the Elysium Mons model of *Comer et al.* [1985] at the appropriate radial distance ($r = 220$ km); the range indicated by arrows includes the effects of uncertainties in Young's modulus for the elastic lithosphere and in the magnitude of the load. The uncertainties in the maximum depth of extensional faulting inferred from graben geometry are due principally to the uncertainty in fault dip. The shaded region indicates the overlap in the predicted maximum fault depths determined by the two methods.

where $\mathbf{r}$ and $\mathbf{r}'$ are position vectors on the planetary surface and dA' is a unit of surface area. As an approximation to (1), we replace $\boldsymbol{\sigma}_0$ with the stress distribution $\boldsymbol{\sigma}_d$ resulting from a finite disk load of unit magnitude [*Brotchie*, 1971; *Solomon and Head*, 1979], and we replace the integral in (1) with a sum over the number of disks:

$$\boldsymbol{\sigma}(\mathbf{r}) = \sum_{i=1}^{N} q_i \, \boldsymbol{\sigma}_d(\mathbf{r} - \mathbf{r}_i) \qquad (2)$$

where q_i and $\mathbf{r}_i$ are the load and the position of the center for the ith disk. Obviously, the stress tensors $\boldsymbol{\sigma}_d$ must be cast in terms of a global coordinate system before summation; standard spherical coordinates (r, θ, ϕ) with the polar axis at the geographic pole are used throughout. The principal horizontal stresses are found by means of standard relations.

A number of different combinations of loads for Elysium Planitia volcanic units and constructs were examined (Table 1). Each of these individual loads corresponds to a surface excess mass in the gravity models of *Janle and Ropers* [1983] for the Elysium region. The Elysium Mons and Hecates Tholus loads correspond to the disc loads TD5 and TD4 of

TABLE 1. Contributions to Elysium Regional Load Models

Load	Geometry	Radius, km	Latitude, °N	Longitude, °W	Excess Mass, 10^{21} g
Elysium Mons[a]	cone	100 (base)	25.2	213.5	0.54
Hecates Tholus[b]	truncated cone	30 (top), 92 (base)	32.0	209.6	0.22
Elysium Planitia[b]					
JR1	beveled disc	450 (top), 500 (base)	26.9	210.4	3.6
JR2	beveled disc	630 (top), 700 (base)	26.5	208.0	8.6
JR3	beveled disc	900 (top), 1000 (base)	25.5	204.8	8.8
JR6	beveled disc	510 (top), 570 (base)	16.5	176.5	1.4
JR7	beveled disc	430 (top), 480 (base)	33.8	176.5	1.0

[a]From *Comer et al.* [1985].
[b]From *Janle and Ropers* [1983].