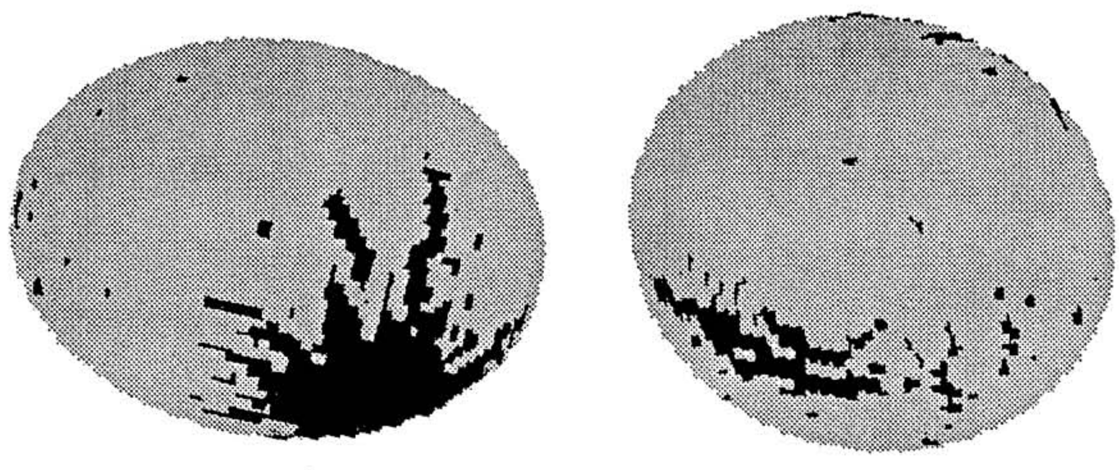
THE SURFACE AND INTERIOR OF PHOBOS: E. Asphaug, NASA Ames Research Center 245-3, Moffett Field CA 94035, and W. Benz, Steward Observatory, University of Arizona, Tucson AZ 85721

The impact crater Stickney dominates one hemisphere of the Martian moon Phobos; its diameter (11 km) is about half the size of the body (19 × 22 × 27 km). Besides demarking a threshold between cratering and catastrophic disruption, this impact reveals a great deal about the target's interior. Because Phobos has an unusually low density yet exhibits no direct evidence for volatiles such as water ice, it has been supposed that it sequesters volatiles in the deep interior, or that it is made of some exotic substance, or that it is a loosely-aggregated rubble-pile. The network of fracture grooves created by the Stickney impact constrain which, if any, of these models accord with observation.

We first model Phobos as a homogeneous elastic ellipsoid using the smooth particle hydrocode SPH3D with fracture (Benz and Asphaug, *Icarus*, in press), which is the first hydrocode capable of resolving the dynamical growth of explicit cracks. We use the fracture constants and equation of state for laboratory basalt, substituting a density of $1.95\,g/cm^3$. A 6 km/s impactor is introduced with the appropriate trajectory (normal incidence at the current center of Stickney) and a size determined by gravity crater scaling[1]. The outcome of this impact is shown in Figs. 1a and 1b, which are surface plots of the damaged ellipsoid 12 seconds after impact, viewed from two sides. Dark regions are fully-damaged computational cells (i.e., cracks) and lighter regions are intact rock. By this time fracture is complete, but the crater bowl has only just begun to develop, with flow velocities of a few m/s.



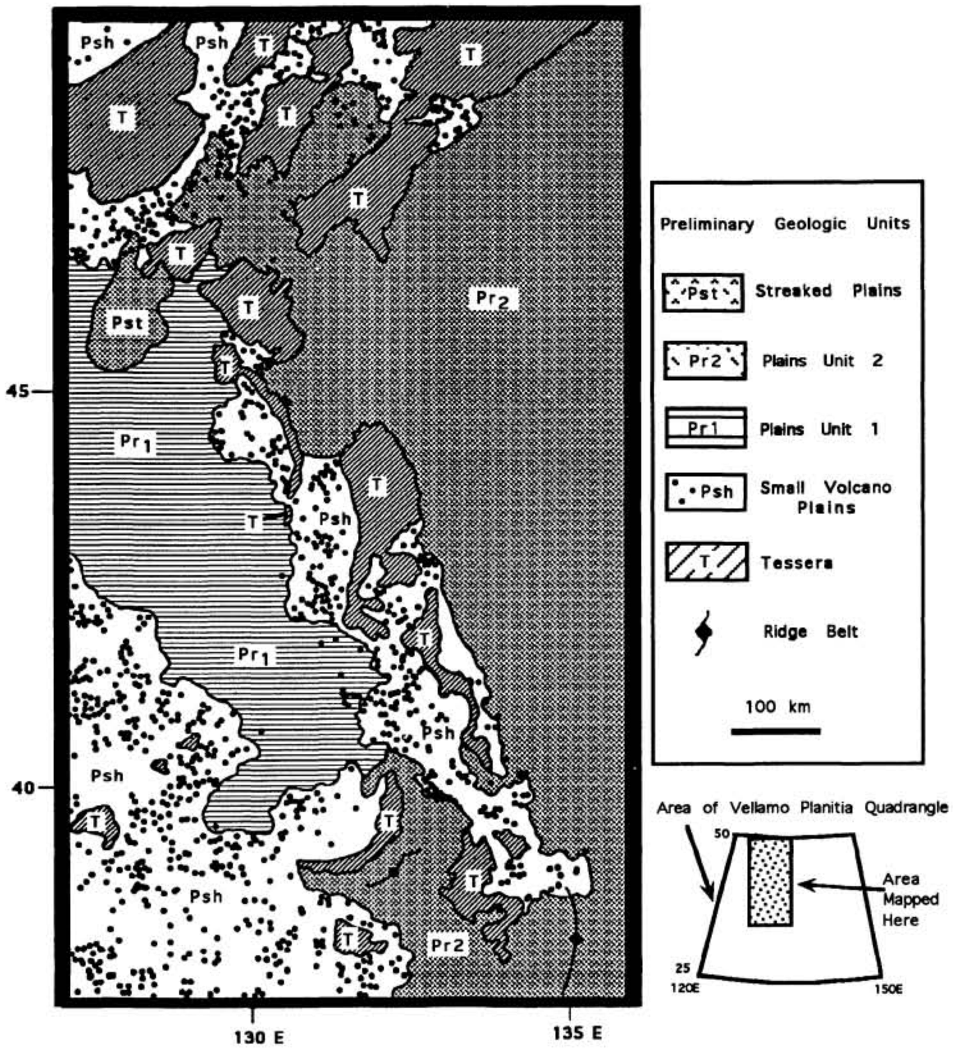
The fracture grooves antipodal to the crater (1b) do not appear until the final stages of the calculation, when reflected impact stresses come to focus. The fracture orientation is sensitive to the impact locus. Phobos shows a more complex fracture pattern than our simulation, with a general trend correlated with the axis of greatest tidal stress. Nonetheless we feel we have captured the major features of the event.

The damaged region is not quite as large as the predicted size of the final crater, suggesting that strength may indeed play some role in this impact. To test this hypothesis we tried a larger impactor (strength-scaled) to see what would happen. None of the body survived fragmentation, a large fraction escaped, and what remained was transformed into something quite different from the present Phobos. Hence, although the crater does not form purely in the gravity regime, gravity scaling is far closer to the truth than strength scaling. This study confirms the earlier work of Asphaug and Melosh[2] — who used a significantly different numerical method and fracture model, in axial symmetry — that the impact took place essentially in the gravity regime, with a correspondingly slow cratering flow and a retention of crater ejecta. It is worth noting that the crater flow fields predicted by both numerical models are in very good agreement with analytical crater scaling in the gravity regime[3].

AUBELE, J.C. STRATIGRAPHY OF SMALL VOLCANOES AND PLAINS, VENUS

a global period of small volcanic edifice building or a resurfacing event that occurred prior to the formation of the extensive ridged plains?

[1]Guest et al, JGR 97, 15949, 1992 ; [2]Schaber et al, JGR 97, 13257, 1992; [3]Phillips et al, JGR 97, 15923, 1992; [4]Squyres et al, JGR, 97, 13579, 1992; [5]McGill, LPI 789 (abst), 67, 1992; [6]Arvidson et al, JGR 97, 13303, 1992 [7]Greeley et al, JGR 97, 13319, 1992; [8]Campbell et al, JGR 97, 16249, 1992; [9]Head et al, JGR 97, 13153, 1992; [10]Crumpler et al, Sci 261, 591, 1993; [11]Baker et al, JGR 97, 13421, 1992; [12]Parker et al, LPSC XXIII (abst), 1035, 1992; [13]Campbell et al, Sci 246, 273, 1989; [14]Jurgens et al, GRL 15, 6, 577, 1988; [15]Slyuta et al, Aston. Vestnik 22(4), 287, 1988 (in Russ); [16]Aubele & Slyuta, EMP 50/51, 493, 1990; [17]Garvin & Williams, GRL 17, 9, 1381, 1990; [18]Aubele et al, LPSC XXIII (abst), 47, 1992; [19]Stofan et al, JGR 97, 13347, 1992



Preliminary Geologic Map of A Part of the Vellamo Planitia Quadrangle, Venus
Jayne C. Aubele

Part of the preliminary geologic map of the Vellamo quadrangle. Units shown in stratigraphic order. In this area the stratigraphic relationship between tessera, small volcano plains, and late ridged plains can be determined. The small volcano plains unit is recognized as widespread, both here and regionally on Venus. and predates the ridged plains.