SURFACE AND NEAR SURFACE DYNAMICS ON PHOBOS: POSSIBLE GROOVES FORMATION BY IMPACT EJECTA. M. Hamelin, Laboratoire Atmosphère, Milieux, Observations spatiales (LATMOS), 4 av. de Neptune, 94107, Saint Maur, France, michel.hamelin@latmos.ipsl.fr

Introduction: Phobos is orbiting around Mars close to the Roche limit. Therefore the surface material is loosely bounded and easily ejected by impactors. Whereas dynamics in the close vicinity of Phobos has been studied for both geophysical and navigation reasons, the dynamics on the surface itself has not been studied to the same extent.

Among many hypotheses about the formation of grooves on the surface of Phobos, it has been suggested that they could have been plowed by impact ejecta, but this was questioned using the arguments that no block was observed at the end of the grooves and that the grooves do not run down slope[1]. Then the study of surface and near surface dynamics on Phobos can clarify the soundness of these controversial arguments.

I compute the trajectory of a gliding test mass for any initial position and velocity. Depending on these initial conditions a gliding mass stay gliding or can take off after some distance. Generally the trajectories are not 'down hill' as the motion is strongly dependent on the velocity. Then the two above controversial arguments fail. I discuss the consequences for material transport on or close to the surface, with in particular the possibility that some of the Phobos groves could have been dug out by gliding or rolling blocks.

Pseudo-gravity map: The gravitational field used here is the ellipsoidal model of Davis [2] that describes as well the past and future Phobos as it gets closer to Mars. Phobos is represented by a homogeneous ellipsoid locked on a circular orbit around Mars. Gravity features on the surface including tidal effects are shown in Fig. 1.

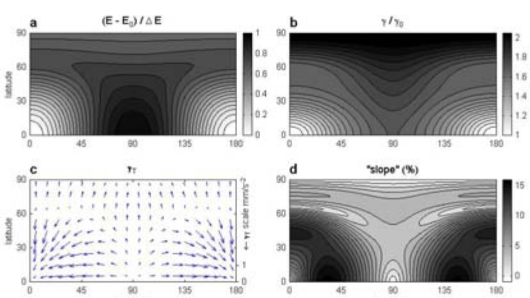

Figure 1.

a) Normalized pseudo-potential energy (scaled between highest and lowest values). **b)** Normalized gravity.

c) Tangent component of the gravity (arrows, scale in mm/s2). **d)** slope amplitude (in %). Note the 'crest' feature at ~65° latitude on the prime meridian.

Trajectories starting from leading/trailing apex: An example of trajectories starting from the highest apex is shown in Fig. 2.

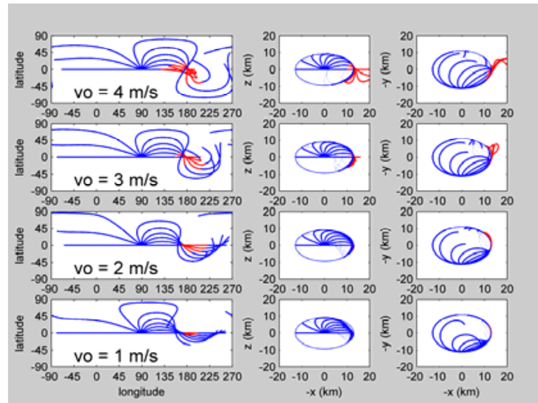

Figure 2. Trajectories of a test mass launched tangentially from the trailing apex (highest potential as for the leading one). Coordinates: +x = to Mars; +y = trailing direction. Starting velocities are 1,2,3 and 4 m/s; launch azimuths are multiples of 22.5°. The red part of the curves corresponds to a flying part of the trajectory.

Discussion. Comparison with grooves patterns: the trajectories of Fig.2 show some similarities with the grooves patterns of Fig. 3:

- Same East-West asymmetry with long traces westward of Stickney and dense traces eastward.
- Area without groves eastward of Stickney that could be due to flight of the blocks.

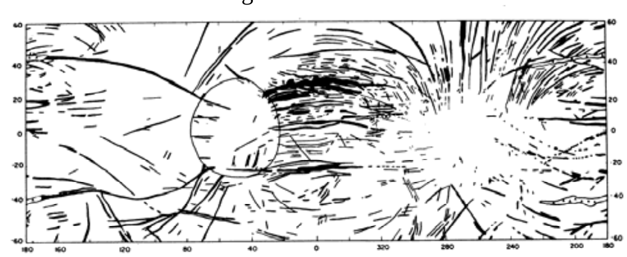

Figure 3. Grooves patterns, from Thomas [3]

Generally the motion discards from down slope depending strongly on the velocity (Coriolis effect).

However, Stickney is not exactly at the trailing apex and the impact could have occurred when Phobos was at a larger distance from Mars. More examples will be shown and discussed.

References: [1] Thomas, P.C. (1997) *Icarus 131*, 78-106. [2]Davis, D.R. et al. (1981) *Icarus 47*, 220-233; [3] Thomas, P. et al. (1979) *J. Geophys. Res. 84*, 8457-8477.