

## PROPOSALS FOR MARS EXPRESS AND NOZOMI MISSIONS HOW TO DETERMINE THE LAYERED STRUCTURE OF PHOBOS. *A. Horváth*<sup>1,2</sup>, *Sz. Bérczi*<sup>3</sup>, <sup>1</sup>Konkoly Observatory, H-1525 Budapest Pf. 67, Hungary, <sup>2</sup>Budapest Planetarium of Society for Dissemination of Scientific Knowledge, H-1476 Budapest Pf. 47, ([planet@mail.datanet.hu](mailto:planet@mail.datanet.hu)), <sup>3</sup>Eötvös University, Dept. G. Physics, Cosmic Mat. Sp. Res. Gr. H-1117 Budapest, Pázmány 1/a.

**Abstract:** On the Viking Orbiter images of Phobos it has been discovered that a complex system of lineaments and grooves cover the whole surface of this Martian satellite. Based on earlier studies we suggest some measurements to be taken by Nozomi and Mars Express spacecrafts in order to observe the suggested layered structure in more details and to decide the relevance of this model.

**Introduction:** In 1976 the Viking Orbiters took excellent images of Phobos. On these images it was found that a complex system of linear striations, lineaments or grooves cover the surface. This observation triggered several interpretations of the origin of these lineament systems. Many of these interpretations emphasized that the complex system of grooves embrace the whole satellite [1-3] (Fig. 1). These linear features were distinguished morphologically and were classified into three types according to their characteristics: a) appearance and morphology, b) their geometrical distribution on the surface, and c) relation with orbital motion of Phobos [4-13].

**The three grooves systems on Phobos**

### *A) Grooves radially spreading from Stickney*

This system consists of deep and wide grooves, lengths are max. 20 km. The radially spreading groove system is perpendicular to the Stickney ridge system, and probably

was formed at the same event when a large impact excavated the Stickney crater.

### *B) Grooves parallel with Phobos' orbital plane*

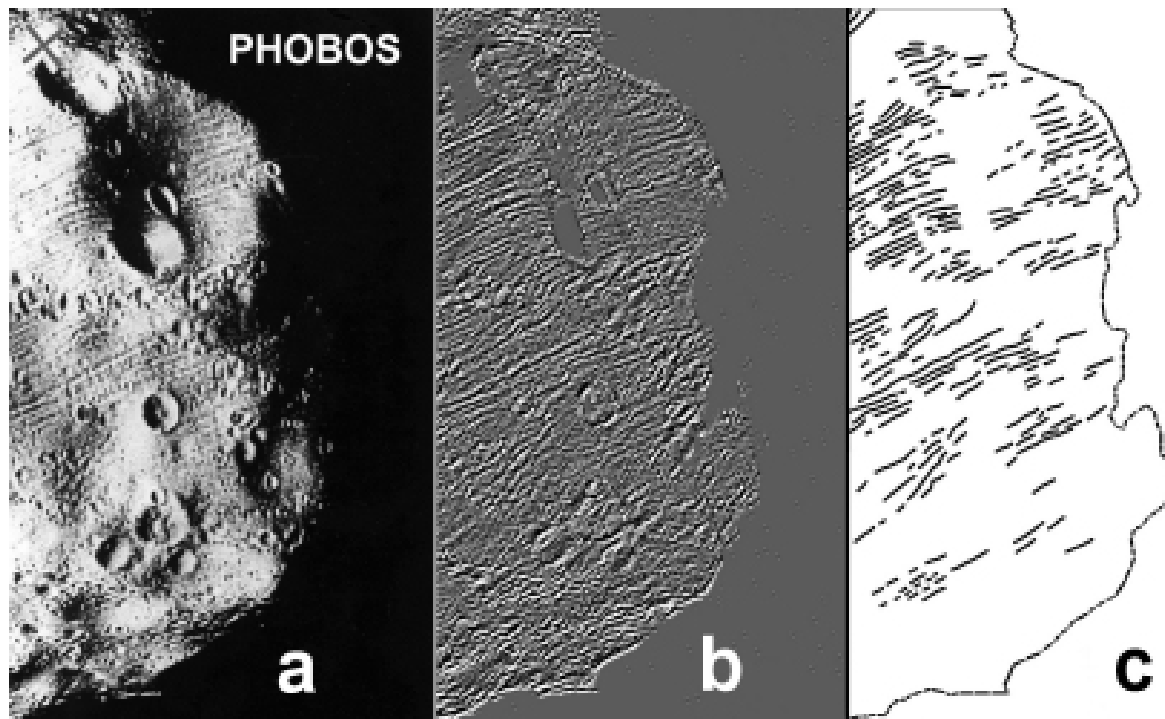
In interpretation of the second system both their distribution on the surface and the Phobos' orbital relationships were used. Materials excavated by the Stickney event could have been ejected into a complex orbit in the Phobos-Mars system. However most of this material remained in the vicinity of the satellite and finally could reimpact also to the surface. The boulders orbiting Phobos with slow velocity could form the large irregular craters and chains of such craters in the orbital plane of Phobos.

### *C) Grooves forming arcs concentric to the Phobos-Mars axis (layer-grooves)*

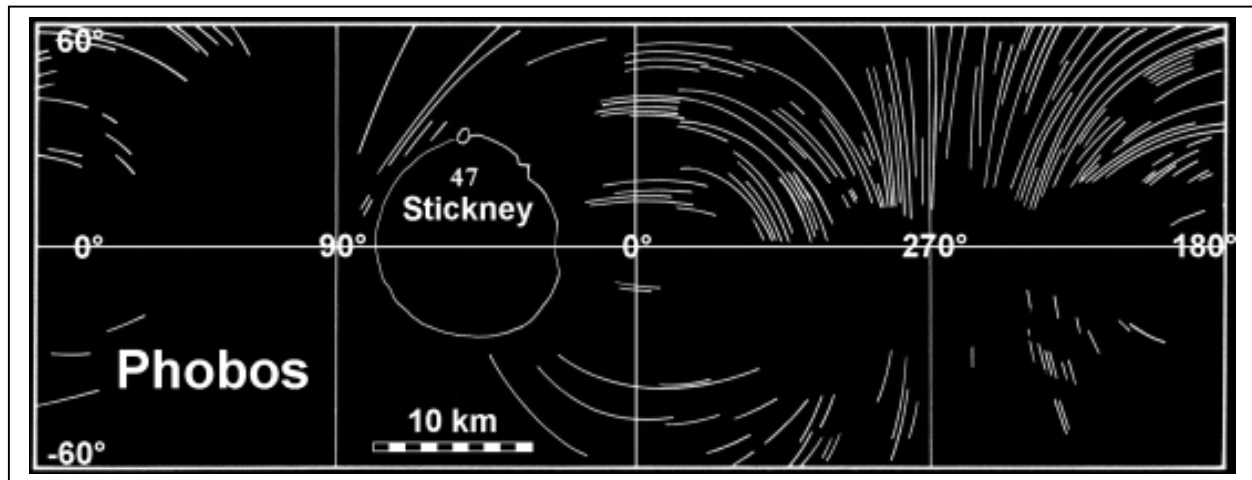
In interpretation of the third system the Phobos' orbital relationships were also used. The third system of the grooves appears to form arcs of small circles which fit to parallel planes [6, 7]. These planes are oriented so that they are normal to the Phobos-Mars direction (Fig. 2).

Illés and Horváth (1980) proposed [6, 7 and 8] that this third system of grooves can be interpreted as the surface manifestations of an inner layered structure of Phobos (Fig. 3). This system could have been formed when Phobos was part of a much larger and therefore geologically active parent asteroidal body [6-9, 11-13].

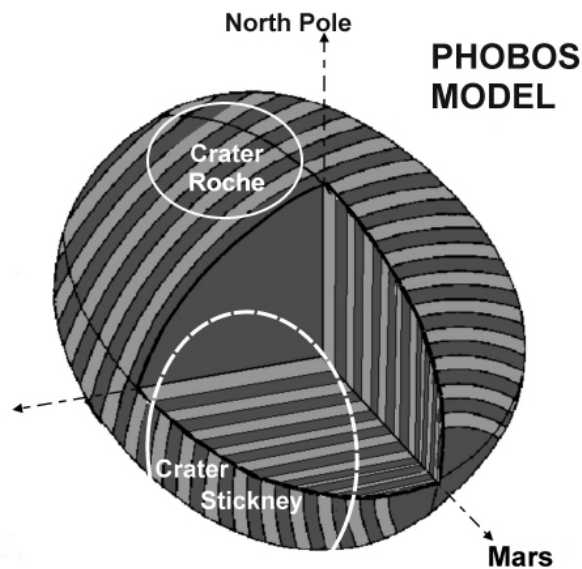
**Fig. 1** Lineaments on Phobos and their enhancement [13] on image taken by Viking Orbiter in 1976.



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**Fig. 2** Layer-grooves of the black Phobos [8]



**Fig. 3** The proposed inner layered structure of Phobos [8]

#### Proposals for Mars Express and Nozomi Missions

We suggest some measurements to be carried out by Mars Express and Nozomi spacecrafts in order to observe whether Phobos has a layered structure or not.

Our proposal contains mainly remote *sensing measurements*, particularly imaging at grazing illumination. Especially images between 0-180° longitude and any latitude would be interesting, as the Viking Orbiters did not send photos of high enough resolution from these sites.

Observations of the *remanent magnetic field* would be useful as well, to analyse how do the anomalies correlate with surface morphological features.

opportunity to observe also Phobos. Our proposal of the Phobos observations can decide if the theory of the layered structure of Phobos is valid or not. If yes, we have an asteroidal sized body in the near vicinity of Mars, where further studies can be organized, together with Martian programs. By these serendipitous measurements of Phobos it becomes possible to investigate such asteroidal type body like Gaspra, Ida [13] and Eros as well. The expected data can point to the time and events when larger bodies in the Solar System were already differentiated.

**Acknowledgements:** The authors acknowledge the Phobos-images of Viking spacecraft which were sent by G. Neukum and also thank for the discussions with I. Almár, E. Illés-Almár, and J. W. Head.

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