

COMPARISON OF THE CRACKING AND FRACTURING SYSTEMS OF PHOBOS AND EUROPA. Sz. Bérczi¹, A. Horváth^{2,3}, E. Illés²;

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Abstract

The Voyager and Galileo images of Europa and the Viking Orbiter images of Phobos revealed the surface cracking and fracture systems of the satellites of Jupiter and Mars.

The complex system of lineaments and grooves cover the whole surface of these satellites.

Based on earlier studies we compared the main characteristics of these structures and propose a joint model of the layered structure (Phobos) and the tidal fractured structure (Europa). However, more details are needed about the relevance of these models.

Introduction

Viking Orbiters transferred good images of Phobos in 1976. The system of linear striations, lineaments (grooves) were found to cover the surface which were distinguished morphologically and were classified into three types according to their characteristics: a) morphology, b) geometrical distribution on the surface, and c) relation with orbital motion of Phobos.

According to the global character of the third system: that system was interpreted as expression of the probable inner layered structure of Phobos [1-6].



Fig. 1. The lineament system of Phobos on a Viking-image.

In studies of the Voyager and Galileo images the cracking system of Europa has been mapped [7] and on the basis of tidal stress field studies [8] the global pattern of the Europa cracking system was concluded

as expression of the stress field on the surface of Europa generated by the tidal forces of the near giant Jupiter.

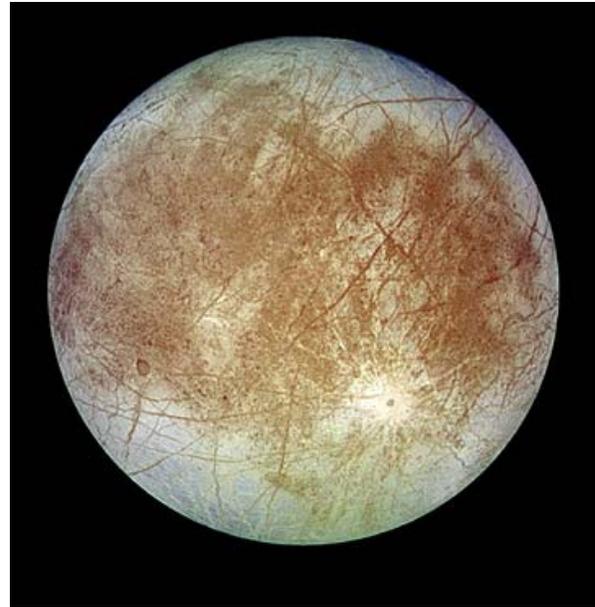


Fig. 2. The cracking system of Europa

Comparison of the two global patterns show strong similarities in the following characteristics. Both systems have a fractured "polar" region and a counterpart similarly fractured "antipolar" region. These fractured polar and antipolar regions are "connected" by various lineaments (Fig. 3., and Fig. 4.).

But the comparison showed differences between the two systems, too.

The third system of lineaments of Phobos [4] consists of lineaments forming arcs which are forming parallel planes which are perpendicular to the Phobos-Mars axis. Therefore the "polar" region of this system is 90 degrees rotated from the sub-planetary (sub-Martian) point (and its opposite point on the far side of Phobos) is in accord with this system (Fig. 3.).

On Europa the fractured "polar" region is in the vicinity of the sub-planetary (sub-Jovian) point and its counter-polar region at the anti-sub-planetary point.

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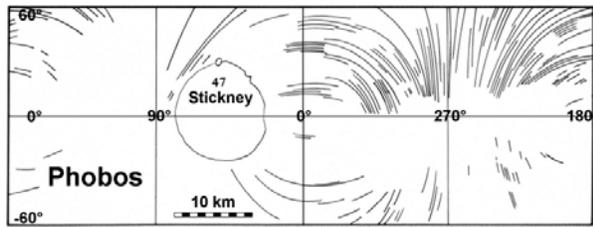


Fig. 3. The third lineament system of Phobos [4-6].

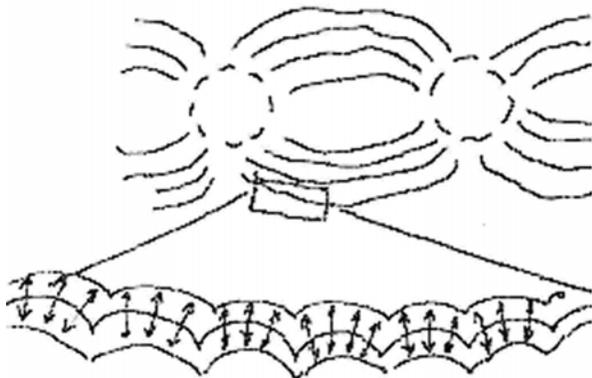


Fig. 4. Sketch of the lineament system of Europa [8].

Alternative model for the Phobos lineament system

The sub-Jovian focused global pattern cracking system of Europa has been interpreted by [8] as expression of the tidal stress field triggered by Jupiter.

If we use this model for Phobos, we can interpret the surface groove system in the following way. Supposed that Phobos were rotated 90 degrees in its equatorial plane, it could reach a position relative to Mars like as Europa has today relative to Jupiter. If this rotation occurred in the past then the third system of Phobos lineaments may represent an earlier tidal fracture system of Phobos. Then two possibilities of the origin of the Phobos lineament-system may remain open.

One possibility is that instead of the layered structure of Phobos the ancient fracture system is expressed by this third lineament system [10].

Second possibility: both the original theory of a layered structure of Phobos [4-6] and the tidal fracture model are valid, because the two systems might have been in interference and the layered structure was emphasized by the fracture system of the tidal stresses.

Layered or fractured Phobos?

In the light of the two described models about the origin of the lineament system of Phobos we suggest new observations of Phobos in order to decide between the old [4-6] and extended possibilities of the new tidal fractured [8] satellite model [9].

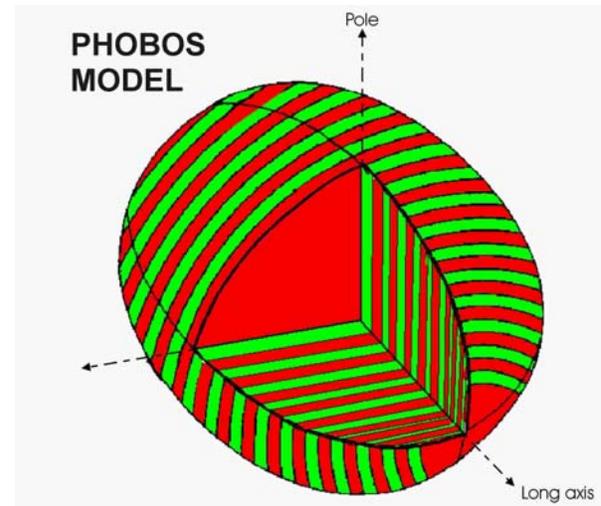


Fig. 5. The layered structure of Phobos [4-6].

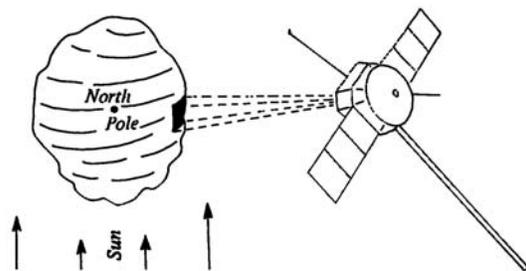


Fig. 5. The layered structure of Phobos [4-6].

References

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