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Meteorites from Phobos and Deimos at Earth?

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Abstract

We examine the conditions under which material from the martian moons Phobos and Deimos could reach our planet in the form of meteorites. We find that the necessary ejection speeds from these moons (900 and 600 m/s for Phobos and Deimos respectively) are much smaller than from Mars' surface (5000 m/s). These speeds are below typical impact speeds for asteroids and comets (10-40 km/s) at Mars' orbit, and we conclude that delivery of meteorites from Phobos and Deimos to the Earth can occur.

Keywords: Mars, Phobos, Deimos, Earth, meteorite

1. Introduction

Meteorites are solid interplanetary material that survives its passage through the Earth's atmosphere and arrives at the ground. Most meteorites originate from minor bodies, but a few arrive from planetary bodies. The interchange of material between the Mars and Earth is now well-established, both from the point of view of the ejection of material from the martian surface (Head et al., 2002), as well as of the orbital dynamics of Mars-Earth transfer (Gladman et al., 1996). At this writing fifty meteorites from Mars are recognized among the world's meteorite collections (The Meteoritical Bulletin Database[1]). Here we examine one remaining open question in this field, and that is whether material might arrive at the Earth from the martian satellites.

This study is partly motivated by the claim that the Kaidun meteorite may have come from Phobos (Ivanov, 2004). This meteorite is largely made up of carbonaceous chondrite material, and spectral analysis suggests that the surface properties of Phobos and Deimos are bracketed by outer

[1] www.lpi.usra.edu/meteor/