From Mars or the Moon via impact to Earth

Fritz, Jörg[1]
[1]Museum für Naturkunde, Berlin

The numbers of martian (44) and lunar (56) meteorites are rapidly increasing, because of governmental expeditions in Antarctica, and private collectors in the hot desserts. These meteorites recovered on Earth not only provided unique samples, but also lead the planetary community to recognize the amount of solid material exchanged between planetary bodies in the Solar System. The basic concepts of this process will be described by reviewing on geochemical and petrological data, and numerical models on impact ejection and orbital evolution of rocks and dust in space. The geoscientific relevance of the interplanetary transfer of rocks and dust in the Earth-Moon system via impact will be discussed.

Petrology and ejection ages (4π cosmic ray exposure age plus terrestrial residence time) of the recovered lunar and martian meteorites document several different impact events during the last 10 and 20 Ma, respectively. The minimum size of these documented impact events can be estimated by the lunar crater production rates and the temporal frequency of the documented ejection events. It follows that small projectiles of ˜50 m Ø, and ˜150 m Ø impacting on the Moon or Mars respectively, can eject abundant rock fragments into space.

An efficient transfer of ^{3}He-rich lunar material to Earth via impact is documented for the late Eocene asteroid shower to the Earth-Moon system. This theory is based on abundant and independent geochemical data relater to the late Eocene event and broadly accepted standard models on impact ejection and celestial mechanics. A minimum size for a lunar impact to be recorded by a ^{3}He-spike in Earth's sediments is not defined by now. However, the formation of the ˜100 km Ø sized Tycho crater on the Moon (suggested age ˜100 Ma) should be recorded in Earth's sediments. The Tycho ejecta blanket on the Moon is a key point for the calibration of the crater production rates for the Moon and, implicitly, for the dating of planetary surfaces, e.g. Mars. Additionally, the Tycho ejecta layer on Earth likely presents a source for fossil lunar meteorites deriving from a well constrained locality on the Moon.

Moreover, an efficient exchange of rocks and dust in the Earth-Moon system should be considered also for the heavy bombardment before 3.8 Ga ago. Can lunar fragments ejected by the giant Imbrium impact be identified in the oldest sediments available on Earth? Could impact ejecta from early Earth still be preserved in the lunar regolith? How much material was added to the Earth-Moon system after its formation and 3.8 Ga ago by impacts, and what are the implications for the evolution of the Earth-Moon system?

In the last decade the large number of lunar and martian meteorites recovered on Earth revolutionized our understanding of how easy it is to deliver rocks and dust between planets via impact. The implications of this process are now to be explored.

References: see references in Fritz et al. 2005 MAPS; Fritz et al. 2007 Icarus

→

Abs. No. **441**
Meeting: **DMG 2008**
submitted by: **fritz, joerg**
email: **joerg.fritz.1@rz.hu-berlin.de**
date: **0000-00-00**
Req. presentation: **Vortrag**
Req. session: **S03**