Sequencing Lunar Basins

S. C. WERNER[1], M.-H. ZHU[2], T. ROLF[1], K. WÜNNEMANN[3]

[1]Centre for Earth Evolution and Dynamics, University of Oslo, Norway (stephanie.werner@geo.uio.no)
2Space Science Institute, Macau University of Science and Technology, Taipa, Macau
3Museum für Naturkunde, Leibniz Institute for Evolu-tion and Biodiversity Science, Berlin, Germany

All cratering chronology and Solar System evolution models rely on the lunar surface record to be calibrated in rates and time. For decades this calibration has been debated. The formation sequence and cratering chronology of lunar basins is also essential for understanding the age of the lunar surface and the Moon's early interior and surface evolution.

We introduce new basin - projectile size scaling relationships derived from numerical modelling. Thus, we have a reliable tool set 1) to evaluate the sequence of basin forming events in time, 2) to determine the thermal anomaly introduced, 3) to assess possible ejecta deposition sequences across the Moon, and 4) to estimate the mass delivered to the Moon.

We explore how large basin-forming impacts affected the internal evolution of the Moon, which is inevitably linked to the surface, e.g. via volcanism and heat loss. Recently proposed global lunar evolution models can explain various observations on the present-day Moon, but they do not, or only partly, consider the thermal input of large basin-forming impacts. Therefore, in this study we couple the thermochemical evolution of the Moon with its early bombardment.

The new scaling relations also permit for comparison of the crater record with candidate projectile populations, such as the main belt asteroids. We observe a disparity using these size distributions and scaling relationships, both can be described by smooth functions, while the observed basin and crater record appears to show an discontinuity at about 200 km crater diameter in the size-frequency distributions. Hence, for reliable mass estimates, we will elaborate on and refine the determination of the final impact structure diameter at the transition between basin-scale and complex craters.

We will describe the sequence of basins and their formation age in the light sample and meteorite ages, crater size-frequency measurements, and give an estimate on the material delivered to the Moon after surface solidification. We will discuss whether it is in agreement with currently favored Solar System evolution models.