
EAPS Planetary Lunch Colloquium Series (PICS)

Sean E. Wiggins

Graduate Student

Brown University

Tuesday, October 30th

12:30pm

54-517

Impact Fragmentation: the Evolution of the Lunar Crust

The upper portion of lunar crust has been thoroughly fragmented by impacts leading to the development of the lunar megaregolith. The impact events not only fragment the crust but create porosity as well. As GRAIL has revealed, this porosity extends down into the crust much deeper than originally predicted by impact models. To characterize the fragmentation of the lunar megaregolith and the deep lying porosity of the lunar crust, we have implemented both the tensile Grady-Kipp fragmentation model and a new tensile porosity routine into iSALE-2D. We find that fragment sizes are weakly dependent on impactor size and impact velocity. For impactors 1 km in diameter or smaller, a hemispherical zone centered on the point of impact contains meter scale fragments. For an impactor 1 km in diameter this zone extends to depths of 20 km. At larger impactor sizes, overburden pressure inhibits fragmentation and only a near surface zone is fragmented.

For a 10 km diameter impactor, this surface zone extends to a depth of 20 km and lateral distances 300 km from the point of impact. This suggests that impactors from 1-10 km in diameter can efficiently fragment the entire lunar crust to depths of 20 km. Additionally, the new porosity routine has revealed that a range of impactor sizes can generate porosity at significant depths, with large impactors (100 km in diameter) creating significant porosity at depth within a 1,000 km radius centered on the point of impact. This implies that basin forming impacts could be the most significant contributor to the porosity structure throughout the entirety of the Lunar crust. Additionally, we have found that while near-surface porosity and near-crater porosity will be crushed out by the shock wave, deep lying tensile porosity will instead act additively, implying that additional impacts will increase the porosity at depth.



For more information, contact Jason Soderblom (jms4@mit.edu)