Western Science

Ph.D. Geology Public Lecture

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Comparative Analysis of Ejecta Emplacement on the Moon and Mercury

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Via ZOOM

Abstract

Impact cratering is the most ubiquitous geological processes in our Solar System. One of the important aspects of this process is ejecta emplacement. The main theme of this thesis revolves around ejecta emplacement on airless bodies like the Moon and Mercury, using multiwavelength remote sensing techniques. On the Moon, we focus on the unique radar-dark halo craters (RDHCs), which are surrounded by ring-shaped structures that appear "dark" in P-band (70-cm) radar images. We analyze the physical properties and emplacement mechanism of theses radar-dark haloes (RDHs) using radar, thermal infrared, and microwave datasets. Utilizing multiple wavelengths allows for an improved understanding of scatter distribution around the RDHCs at varying depths in the lunar surface/subsurface. Furthermore, we investigate the influence of these RDHs on the local regolith formation and evolution by assessing the regolith thickness around these craters. The emplacement of RDHs disturbs the typical breakdown of rocks via impact gardening, which fundamentally affects the evolution of the local regolith. This finding warrants a careful re-examination of our understanding of regolith formation on the Moon. On Mercury, we investigate a different type of ejecta deposits exterior impact melts. We analyze the dominant factor(s) governing melt emplacement on Mercury, and compare it to those on the Moon and Venus. Mercury's surface gravity lies between those of the Moon and Venus; however, its impact velocities, our results show that the main factor controlling melt distribution around Mercurian craters is the same as seen on the Moon. The local topographic variations on the Moon and Mercury cause melt to flow in the direction of the lowest crater rim elevation during the modification stage of the cratering process. Overall, our work provides more insight into the origin of the RDHs and their impact on the evolution of the lunar surface. Additionally, we present better constraints on how exterior impact melt is deposited on terrestrial planets. These studies collectively contribute to a more comprehensive understanding of ejecta emplacement on the Moon and Mercury.

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