

The Geology of Moretus Crater on the Moon using Chandrayaan-1 and Lunar Reconnaissance Orbiter Data

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The South Polar Aitken (SPA) basin of the Moon is the oldest and possibly the largest impact basin in our Solar System. The impact which happened prior to ~4.1 Ga creating this giant basin was powerful enough to cover the entire southern hemisphere of the lunar surface by its kilometers thick ejecta. Moretus is an Eratosthenian crater in the south polar region of the Moon. The crater is approximately 114 km in diameter and has a well-developed central peak having an altitude of ~2.5 km above the crater floor. In this study, we report the results of a compositional analysis of the central peak, the crater walls and the floor of the Moretus crater using the Moon Mineralogy Mapper (M³) data onboard ISRO's Chandrayaan-1. High-resolution data from the Narrow-Angle Camera (NAC) and mosaic of the Wide Angle Camera (WAC) onboard the Lunar Reconnaissance Orbiter were used for morphological analysis of the crater. Spectral characteristics of individual units were generated from small fresh craters and freshly exposed surfaces in order to minimize the effects of space weathering. The study reveals homogeneity in the mineralogical composition throughout the crater. The crater floor and the walls show a dominance of Low Calcium Pyroxenes (LCP). The central peak is mostly composed of units bearing the same LCPs. Patches of the central peak show spectra which is quite similar to the spectra of pure anorthosite. The spectra also closely resemble laboratory-generated spectra of volcanic orange glass from the Apollo sample return missions. A closer view using high-resolution NAC images reveals that these patches co-relate with in-situ boulders on the central peak which have probably been exhumed from the deepest levels during the crater formation. Considering excavation depth to the crater diameter ratio as 0.1, the probable excavation depth of Moretus crater could be 11.4 km. The excavation depth suggests that the materials belong to the crustal level which is considerably deeper than the SPA ejecta in this region and might constitute the remnants of the primordial crust that had barely solidified.

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