Spectral charactaristics of possible antipodal ejecta deposits of Tycho crater

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Recently, melt deposits have been identified at the antipode of crater Tycho on the lunar farside. Because of absence of a potential source crater nearby this region, these deposits are formed by concentration of ballistic ejecta from Tycho crater at its antipode. Coincidence of model ages by crater counting of these deposits and impact melt deposits on Tycho ejecta also supports this interpretation.
We examine multi spectral data of the Tycho antipode region to describe spectral characteristics and regional extent of these possible antipodal deposits of Tycho crater. Global spectral cube data of Spectral Profiler (SP-Cube) is used in this study. SP-Cube provides lunar spectral reflectance and band depth from 510 nm to 1600 nm covering the whole surface of the Moon with 0.5 x 0.5 deg. mesh. Independent Component Analysis (ICA) is applied to SP-Cube to identify spectral characteristics of the target materials. ICA can extract significant spectral components from original spectral cube data as independent components.
Pseudo color composite of the ICA component can visualize a distinct structure at the Tycho antipode. A white circular spot with a ~150 km of diameter is located on 167.25E and 43.25N and a dark red-pink tail extending over 1000 km to the west. Shorter light pink streaks are also found. The location and size of the white spot exactly correspond to a rocky region found in Diviner rock abundance map. The associating tail and streak structures have not been reported in previous works. The Tycho antipode structure has spectral characteristics of 1) low albedo, 2) bluish spectral slope in a VIS range, and 3) weak or no 1-um absorption feature.
As possible ejecta from Tycho, the antipode deposits have unique spectral characteristics. Morphological observations suggest that they are rich in impact melt, but a dark ring material around Tycho, in which many melt pond deposits exist, has redder spectral slope. Difference of reflectance spectra may originate from variation of source materials or cooling history of impact melt. Impact melt on the dark ring near the crater rim is ejected with slower velocity, while that reaching to the antipode has a higher ejection velocity. Considering excavation process of crater cavity, slow ejecta should originates from a deeper region of impact point, while fast ejecta does from shallower region. Mixing with local materials on the farside is potentially affected chemical composition of the antipode deposits.

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