Remote Sensing Based Evidence of Water Ice in the cold traps of Shackleton Crater at the Lunar South Pole

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Presence of water ice mixed with lunar regolith on the lunar surface has been a very fertile area of research. In this study we try to study the presence of water ice at optical depth. Chandrayaan-1's Moon Mineralogy Mapper M (3) instrument provides the highest resolution hyperspectral data available for the lunar surface. In this study we use M (3) data to generate relative smoothened spectra and then using the Spectral Angle Mapper and diagnostic absorption features of water ice at 1.3, 1.5 and 2.0 micrometers generate a mask for water pixels by taking reference spectra of pure ice frost at 77 K from the USGS spectral library. This generated mask is then overlaid on the temperature maps generated from data provided by Diviner Lunar Radiometer Experiment (DLRE) instrument onboard the Lunar Reconnaissance Orbiter (LRO). We find a high degree of correlation between the M (3) data and regions with temperatures less than 100 K over which ice is found to be stable over long periods. Thus we conclude that water ice may be present in extremely cold traps of the Shackleton Crater (89.9^0S, 0.0^0E) on the South Pole of the Moon which lies on the edge of the South Pole Aitkin Basin mountain range. These findings can be further reinforced by the Dual-frequency Synthetic Aperture Radar (SAR) operating in L- and S-band frequencies on board the Chandrayaan-2 mission.

References: [1] Direct evidence of surface exposed water ice in the lunar polar regions. Shuai Li, Shuai Li, Paul G. Luceya, Ralph E. Millikenb, Paul O. Haynec, Elizabeth Fisherb, Jean-Pierre Williamsd, Dana M. Hurleye,and Richard C. Elphicf. (2018) *PNAS.* *https://doi.org/10.1073/PNAS.1802345115*

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