Paper ID: 25059
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SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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COLLECTION OF ICY SAMPLES AT LUNAR NEAR POLAR CONDITIONS

Abstract

Previous Moon landing missions encompasses: APOLLO missions, LUNA missions, Surveyor missions, Chang'e 3 mission. Regolith collected and returned during APOLLO and LUNA missions is placed at latitudes ¡ 45 N/S and the collected regolith is primarily of 'mare type' with the exception of the APOLLO 15 and 16 regolith that somehow was at the boarder of 'highland type'. For the next missions at very high latitudes, it is expected the presence of 'important' fractions of volatile/ices among which water ice. The high latitudes regolith 'could resemble' (at least in a simplified scheme valid for drilling/sampling operations) an admixture of 'base regolith' (likely similar to the one of highland) and volatile/ices entrapped in different forms. For effective sampling and scientific operations at very high latitudes important issues need be taken into account, specifically related to sample(s) integrity, among which: reduction/control of physical contamination, reduction/control of thermal contamination and in general to limit as much as possible the loss of volatiles. These will apply to both in situ type missions and return type missions. Drill machinery, sampling tools and sampling strategy will therefore be key points in order to achieve such stringent requirements. In this respect important issues are related to: drilling methods to reach the required (and selectable) sampling depth avoiding excessive energy transfer to soil and excessive sampling time, down hole sampling to collect, hold and preserve the icy samples till its recovery to surface, (hermetic) containments of the collected samples (in case of earth return scenarios), possible need of sample dosing/aliquoting prior delivery to scientific instruments (in case of in situ-missions). Also in case of Mars missions at high latitudes the collection of subsurface samples containing ice/icy volatiles could present problematic similar to Moon scenario. The Mars milder temperature conditions help reducing the difficulty of collection operations; other situations, like the possible presence of solid ice (both water ice or carbon dioxide ice) with large dimensions may complicate the operations. The proposed paper will cover some of the above recalled important thematics associated to sampling in presence of ice or high contents of icy volatiles in the frame of planetary scenarios.