CRITICAL FIELD GEOLOGICAL OBSERVATIONAL AND SAMPLING OBJECTIVES FOR ARTEMIS NEAR-SOUTH POLE EXPLORATION. H. H. Schmitt[1], [1]University of Wisconsin-Madison, P. O. Box 90730, Albuquerque NM 878199.

Introduction: Continued synthesis of observations and sample analyses, resulting from Apollo missions to the Moon, have identified a significant number of specific objectives for future sampling at a potential near-South Pole Artemis landing site. Of particular importance are samples that expand our knowledge of the Moon outside the partially explored, near-side, upper few hundred kilomiters of the lunar globe. That sector would be dominated by the effects of a possible Procellarum basin-forming event [1], accented by re-working by many other near-side impacts, and the existence and influence of the Procellarum KREEP Terrain. Near-South Pole exploration by Artemis not only expands field geological coverage of the lunar near-side but would examine materials dominated by ejecta from the South-Pole Aitken basin [2]. South-Pole Aitken ejecta either covers or mutes the effect of any potential Procellarum-related ejecta.

In addition, a near-South Pole location provides the opportunity to compare the abundance and characteristics of lunar resources there with those identified at locations nearer the lunar equator [3]. Not only are there potential resources associated with permanent shadow, but there are theoretical analyses and observational data that strongly suggest that ancient pyroclastic and solar wind volatiles in the regolith are generally concentrated at high latitudes [4].

Recent synthesis of the Apollo 17 deep drill core [5] indicates that varying degrees of regolith maturation relate directly to the history of the energy of solar wind. The geometry of a near-South Pole-Aitken location relative to that of the solar wind may give additional insights into the evolution of the Sun.

Mg-Suite and FAN Samples: Borg's [6] continued refinement of the isotopic ages for Mg-suite and FAN samples, as well as ages for the sources of mare basalt magmas, indicate a coincidence of formation at 4.35 Ga [6]. Additional, more globally distributed samples of these materials will be critical in explaining whether 4.35 Ga is the age of a Moon-forming giant impact [7] or that of a Procellarum-induced isotopic homogenization of the Moon's upper mantle.

Deep Drill Cores: Schmitt's synthesis of data on maturity idexes and nitrogen isotopic ratios for ejecta units in the Apollo 17 deep drill core (70001/9) [5] indicate that $\delta^{15}N‰$ increases with increased maturity. This correlation permits calculation of the $\delta^{15}N‰$ for the solar wind at times when the earliest ejecta units were deposited. For most of the core's depositional history the solar wind's $\delta^{15}N‰$ was -105 ± 5 and its average energy level was constant. At about 0.5 ± 0.2 Ga, however, it appears that the energy level increased by a factor of ~1.7, if that solar $\delta^{15}N‰$ remained constant. Testing these conclusions with a deep drill core sample at a near-South Pole location would be invaluable in continuing the deciphering of the lunar regolith's record of solar history.

Regolith Resources: Not only do water ice and other solid forms of normally volatile compounds and elements exist in permanently shadowed locations near the South and North Poles of the Moon [4], but cold trapping of volatiles at high latitudes may enhance their concentrations in regolith. Sampling and/or three-dimensional analysis of regolith near the South Pole will contribute to future trade studies on the economics of high latitude resource production versus that in equatorial locations.

Unknown-Unknowns: Exploration of previously unexplored regions of the Moon has and will invariably produce surprises. This is the nature of science.

Crew Selection and Training: The full realization of the potential of future lunar landings depends on the presence of at least one experienced field geologist on the landing crew as well as, at a minimum, an Apollo 13-17 style terrestrial training program [8] that provides both realistic training on the use of sampling and documentation equipment and exposure to new geological challenges.

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