MT. KOCHER, FAR SIDE, MOON: A LANDING SITE WITH ACCESS TO BOTH H2O-RICH PSRs AND THE INNER SOUTH POLE AITKEN BASIN, AND A CANDIDATE SITE FOR ARTEMIS BASE CAMP.

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Introduction: Mt. Kocher near the lunar South Pole on the lunar far side is exceptional in allowing access to both PSRs and the inner annulus of the South Pole Aitken Basin while offering extended solar illumination and direct to Earth (DTE) visibility. Mt. Kocher is a positive relief feature on the lunar far side located 50 km south of Ashbrook Crater and 50 km southeast of Kocher Crater [1]. Few studies address Mt. Kocher as a potential target for scientific exploration [1]. In our survey of candidate sites for NASA's Artemis Base Camp (ABC) near the lunar south pole, we identified Mt. Kocher as one of the optimal candidates. Due to its high elevation, it offers several areas of substantial solar illumination (>65% of the time) and of unusually high direct to Earth visibility (>50% of the time), in spite of being located on the lunar far side [2]. Among these areas, one site, MK1, meets our other criteria for a good candidate ABC site: it offers i) a flat area at least 1 km^2 for habitats, ii) another flat area of at least 0.25 km^2 located 2 to 3 km away, and separated from the habitat area by a topographic obstacle of at least 100 m in height, for rocket landings and launches, iii) trafficable terrain with slopes <10° between the two ABC areas, and iv) trafficable terrain with slopes <20° to access sites of scientific interest. MK1 is unique among our ABC candidate sites in that it offers (within 10 km) combined access to two top priority lunar science targets: (1) an H_2O-rich Permanently Shadowed Region (PSR) [3] and (2) the Mg-rich pyroxene-bearing inner annulus of the South Pole-Aitken (SPA) Basin [4].

Science Objectives: We propose a CLPS-delivered rover mission to MK1, landing at the MK1 landing/launch pad area, and conducting a 10+ km traverse with the following science objectives:

O1: Characterize H_2O and other volatiles in, around, and well outside of the PSR;

O2: Characterize the geologic diversity, mineralogy and geochemistry of SPA materials;

O3: Assess the suitability of the MK1 site and surrounding areas for the ABC and for science opportunities for human exploration.

These objectives are directly responsive to the priorities of the NRC Decadal Survey, the Lunar Exploration Roadmap, and the NASA Artemis Plan.

O1 may be best addressed by rover-borne neutron and near-IR spectrometry, and by visible imaging with active lighting, O2 by near-IR and thermal IR spectrometry, and O3 by high-resolution (human foveal or better) visible imaging.

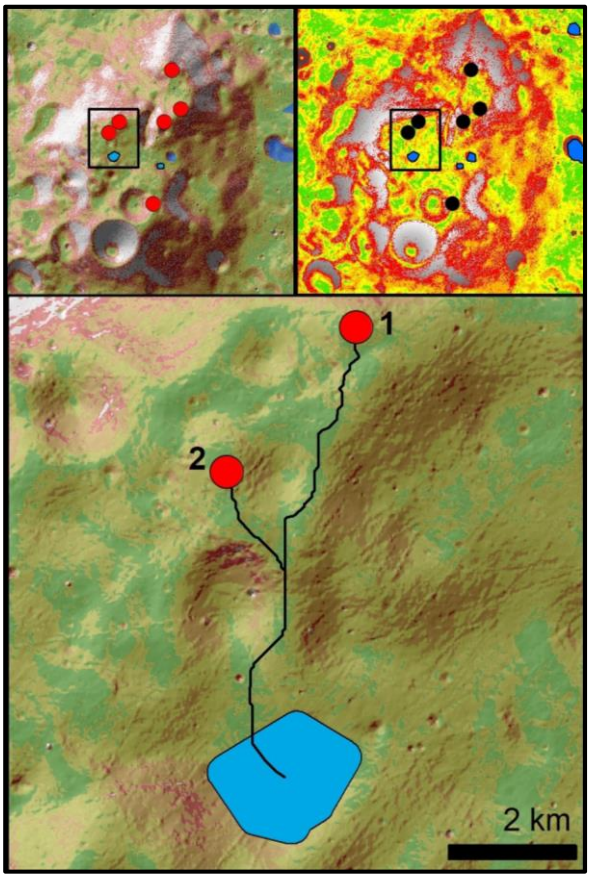

Figure 1. Top Left: Mt. Kocher with its six high solar illumination and DTE visibility areas (red dots) and local H_2O-rich PSRs (blue). **Top Right:** Mt. Kocher slope map: Green (<5°), Yellow (5-10°), Orange (10-15°), Red (15-20°). **Bottom:** Boxed area indicated at Top left. MK1 is located at dot marked "1". Dot "2" is an alternate nearby high illumination and DTE visibility site. Path is ArcGIS least-cost path. Roving distances: MK1 to PSR (center): 8.1 km; Site "2" to PSR is 5.7 km.

A rover capable of traversing 10+ kilometers within 2 weeks would be sufficient. Surviving the lunar night is not critically required, except for a few hours at a time to explore the PSR and traverse other shadowed regions.

Conclusion: A CLPS-delivered rover mission to Mt. Kosher will advance lunar science ***and*** ABC planning.

References: [1] Kaschubek D. et al. (2021) *Acta Astro., 186*, 33-49. [2] Mazarico E. et al. (2011) *Icarus*, *211*, 1066-1081. [3] Lemelin M. et al. (2021) *Planet Sci. J.*, *2*, 103. [4] Moriarty D. P., III and Pieters C. M. (2018) *JGR Planets.*, *123*, 729-747.