MINERALOGICAL DIVERSITY OF THE VON KARMAN REGION AND THE VALIDITY OF MANTEL-DERIVED OLIVINE DETECTIONS BY CHANG’E-4/YUTU-2. D. P. Moriarty III1,2 and N. E. Petro1, 1NASA GSFC, 8800 Greenbelt Road, Greenbelt MD [Daniel.P.Moriarty@nasa.gov], 2USRA, 750 Columbia Gateway Drive, Columbia MD.

Introduction: As the Moon’s largest and oldest well-preserved impact structure, the South Pole–Aitken Basin (SPA) on southern farside is central to a number of unresolved science questions relevant to lunar and solar system evolution. The northwest quadrant of SPA hosts an especially rich diversity of rocks that, if sampled or analyzed in situ, could greatly advance numerous high-priority planetary science goals. These materials include SPA impact melt [1], mantle-derived SPA ejecta [2], farside crust, farside mare basalts, and unusual volcanic materials that may be related to the unique geophysical environment of SPA (specifically, Mafic Mound and the SPA Compositional Anomaly [3,1].

Although a sample return mission to the lunar farside has yet to be attempted, the Chang’E-4 mission has become the first landed mission to this unexplored region, specifically to Von Karman crater in NW SPA [4] (Fig. 1). The in situ observations conducted by Chang’E-4 and its Yutu-2 rover at the Statio Tianhe landing site offer the first detailed glimpse at the farside surface.

Chang’E-4 Mineralogical Context from M3: The Chang’E-4 landing site has been previously characterized through extensive geological analyses, which suggest that the landing site is effectively a cryptomare, with Von Karman’s mare fill masked by ejecta from later craters (specifically, Finsen, Von Karman L, Von Karman L’, and Antoniadi) [5]. Here, we seek to complement previous analyses with mineralogical analyses from Moon Mineralogy Mapper (M3) data.
Maps of band depth (sensitive to mafic mineral abundance) and band center (sensitive to pyroxene composition) for the Von Karman region are presented in Fig. 1. These maps are derived using the Parabolas and two-part Linear Continua (PLC) method developed and validated for use with M3 data [6].

The strongest absorption bands (indicating high mafic abundance) across the Von Karman region are observed in association with young craters and steep slopes, such as Finsen and Ba Jie / Zhinyu, a ~3.7 km diameter crater ~35 km west of Statio Tianhe. Relatively feldspathic materials with weak absorption bands are observed in crater structures primarily to the north and west of Von Karman. Statio Tianhe exhibits intermediate absorption band depths similar to mature mare soils throughout Leibnitz and Von Karman. The landing site exhibits long-wavelength absorption bands similar to those distributed throughout the Von Karman mare, indicating that the dominant mafic component at the site is mare in origin. Finsen’s rim also exhibits relatively long-wavelength absorption bands, but does not exhibit a continuous ejecta blanket extending to Statio Tianhe.

**Validity of Mantle-Derived Olivine Detections:**
Initial spectral observations from Chang’E-4/Yutu-2 revealed a broad 1 micron absorption feature, interpreted to be mantle-derived olivine delivered to Statio Tianhe in the form of ejecta from Finsen (>100 km to the NE) [7]. The likelihood of this claim can be evaluated using spectral parameter maps, such as the “olivine” parameter generated from Kaguya Multiband Imager data [8].

This parameter map is presented in Fig. 2. This parameter targets spectral band relationships resulting from the broad 1 um absorption feature observed in olivine. However, these spectral characteristics are not unique to olivine. For instance, lunar volcanic glasses are known to exhibit broad 1 um absorptions [9]. In fact, the strongest signals in the “olivine parameter” map of northern SPA are associated with pyroclastic glass deposits in Oppenheimer.

Nevertheless, this parameter map is an effective way to understand the spatial distribution (and therefore, the most likely origin) of the broad 1 um feature in Chang’E-4 spectra previously interpreted as mantle-derived olivine ejected by Finsen. Finsen is weak in this parameter, and is therefore an unlikely source of this spectral signature. However, this parameter is strongly associated with Ba Jie crater, and is continuously distributed from Ba Jie to the Statio Tianhe area. Therefore, the observed broad 1 um feature is most likely related to olivine- and/or glass-bearing mare materials excavated and delivered by Ba Jie.

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**References:**