COMPOSITIONAL AND MINERALOGICAL ANALYSIS OF MARE BASALTS IN NORTHERN OCEANUS PROCELLARUM: LANDING SITE OF THE CHANG'E-5 MISSION. H. J. Cao[1], X. B. Qi[1], J. Chen[1], X. H. Fu[1], L. Qiao[1], C. Q. Liu[1], X. J. Lu[1], Z. C. Ling[1*] [1] Shandong Key Laboratory of Optical Astronomy and Solar-Terrestrial Environment, School of Space Science and Physics, Institute of Space Sciences, Shandong University, Weihai, Shandong, 264209, China (zcling@sdu.edu.cn).

Introduction: Chang'e-5, China's first unmanned lunar sample return mission, have successfully landed and returned the new mare basalt samples (a total of 1731 g) from young mare unit (centered at 43.1°N, 51.8°W, ~1.21 Ga) in the northern Oceanus Procellarum [1, 2]. The difference of compositions, mineralogies, and chronologies between Chang'e-5 returned samples with Apollo and Luna collected lunar rocks and soils may reveal the distinct and complex magma extrusive and lava flooding history. These samples significantly add to our knowledge about compositional diversity and magma production within the lunar mantle [3, 4].

The northern Oceanus Procellarum located at Pocellarum-KREEP-Terrian (PKT) with elevated Th element, thin crust, and prolonged volcanism, reveals multiple-stage mare basalt filling events [5, 6, 7]. The collected samples would acquire the new information of heat source of partial melting, olivine-rich mineral assemblages, and geochemistry characteristics, profoundly improving our understandings of late lunar thermal evolution and constrain lunar impact history.

Methods and Data: We employ the multiple lunar remote sensing data to analyze the spectra, mineralogy, and composition of candidate Chang'e-5 landing area, including Kaguya TC & MI, LROC WAC & NAC, Chandrayaan-1 M^3, and LRO LOLA. We focus on fresh, small craters less than 1 km in diameter, possibly suggesting the mineral abundance derived from hyperspectral data with very sharp absorption bands for lunar olivine and pyroxene. The Modified Gaussian Model (MGM) deconvolution method is used to estimate the mineral mode of Chang'e-5 landing site.

Chemical compositional properties of mare basalts: Kaguya MI-derived elemental maps show the landing area including kipukas, Sinuous rilles, some craters is fairy heterogeneous in surface iron (FeO: 15.0-18.7 wt.%) and titanium (TiO_2: 2.1-8.4 wt.%) contents, indicating that landing area mare deposits are dominated by Mid- to High-Ti mare basalt unit (Figure 1a and 1b). Compared to the various mare basalt types of Apollo and Luna sample (Figure 1c and 1d), Chang'e-5 mare basalt (FeO: 17.2 wt.%; TiO_2: 5.9 wt.%; Mg#: 47.6) represents a special type of basalt different from known returned mare basalts. The high FeO and TiO_2 contents demonstrate the characteristic of lunar late-stage volcanism.

Spectral and mineral characteristics of different units: The results of spectral survey of 2379 small craters suggest that eastern *Emt* unit has more high-Ca pyroxene (HCP) relative to low-Ca pyroxene (LCP) than the western mare units (Figure 2). As given by 3D scatter plot of the result of the spectral survey (Figure 3c and 3d), the *Emt* unit has the longest 1 and 2 µm absorption features, while the western mare units exhibit intermediate compositional and spectral properties. Statistically, the *Emt* unit has a mean HCP/LCP value of 1.54, much more than those of other units (Figure 3a and 3b). Spectrally, the *Emt* unit is richer in iron and calcium than western mare units.

Conclusion: The distinct spectral and compositional characteristics of candidate landing area for Chang'e-5 mission demonstrate that returned young samples from the *Emt* unit (Figure 1) will provide significantly new insights into later melting mechanism of lunar mantle.

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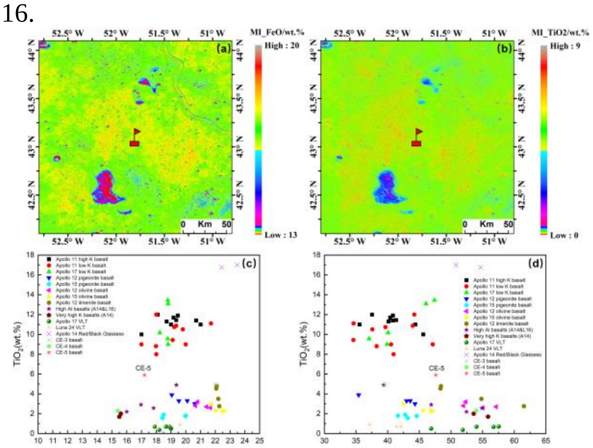

Figure 1. (a) FeO map and (b) TiO_2 map using Kaguya Multiband Imager (MI) data; (c) and (d) Comparison of

chemical variations (FeO, TiO_2, and Mg#) between Chang'E-5 mare basalt and other mare basalts of Apollo and Luna samples as well as Chang'e-4 and Chang'e-3 mare basalt. The basemap in (a) and (b) is TC DTM shaded relief image.

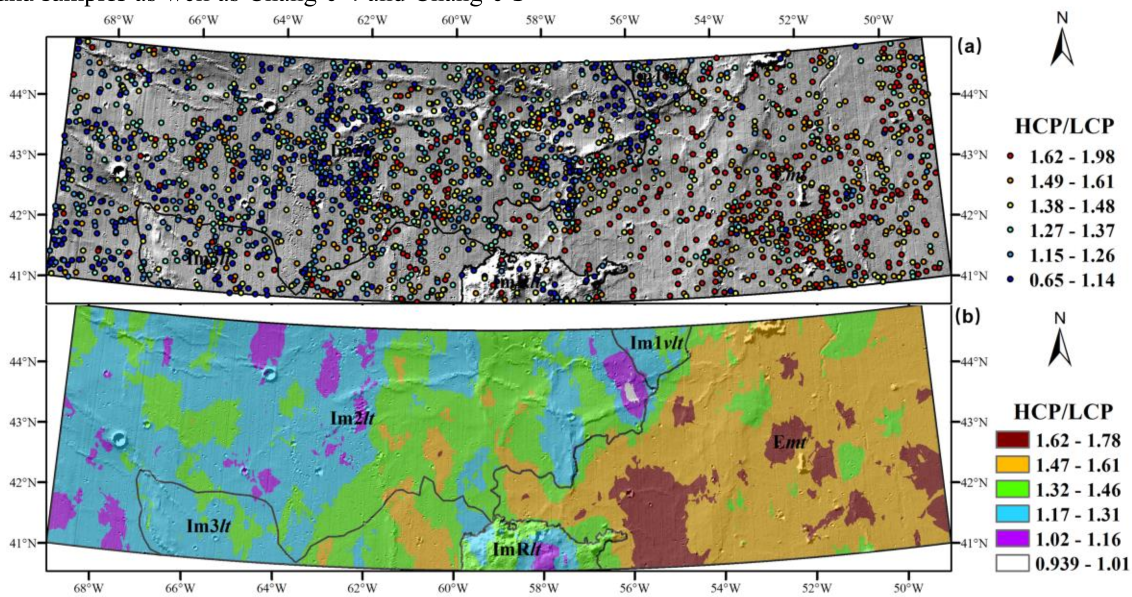

Figure 2. (a) Spectral survey of fresh, small craters of candidate landing area for Chang'e-5 mission. (a) Mineral ratios of High-Ca pyroxene (HCP) and Low-Ca pyroxene (LCP) derived from MGM method; (b) Mineral map based on the interpolation of (a) using Kriging interpolation technique. The basemap in (a) and (b) is LOLA shaded relief image.

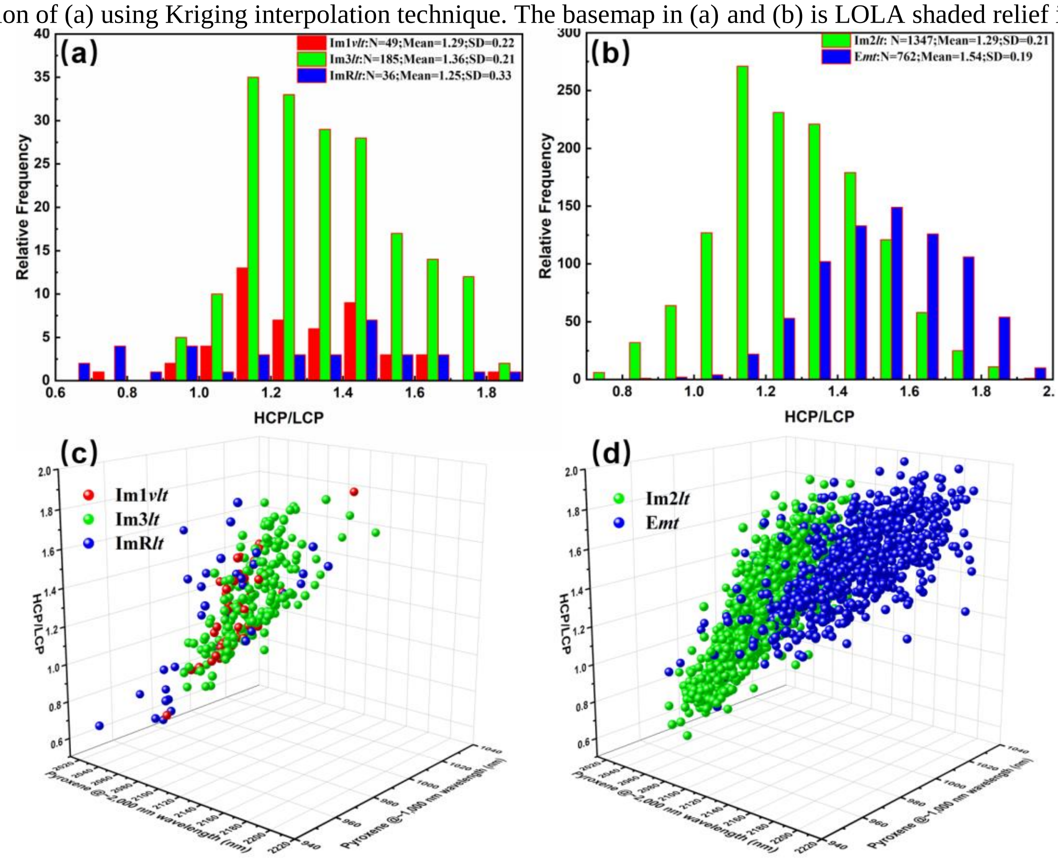

Figure 3. (a) and (b) Histogram of HCP/LCP ratios derived from the spectral survey of fresh, small craters; (c) and (d) Pyroxene VNIS peak positions and HCP/LCP ratios of candidate landing site for Chang'e-5 mission.