Compositional Estimation of the lunar olivine exposures

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Recent remote-sensing data obtained by the SELENE (Kaguya) Spectral Profiler (SP) found exposures with olivine-rich spectral features, globally distributed on the lunar surface [1]. And it is suggest that these olivine-rich exposures possibly originated from the mantle that is excavated from depth by basin-forming impacts. Previous lunar sample analyses indicate that olivine-rich rocks on the Moon have three major origins: 1) mantle material, 2) olivine-rich volcanic material, and 3) olivine-bearing crustal intrusion (troctorite) [2], but our recent work [3] revealed that roughly 60% of the olivine-rich sites are mantle origin, 5% are volcanic, 30% are crustal, and 5% are of unclear origin based on their iron content, geologic setting, and distribution.

In this study, we tried to estimate Mg# (Mg/(Mg+Fe) in mole per cent) for these olivine-rich spectra to further asses their origin and to discuss Mg# of the lunar material.

About 150 SP reflectance spectra were dentified as having unambiguous olivine-rich absorption features. In this study, we assumed pure olivine composition for all of the identified spectra. We tried to adapt spectral fitting with correlational constraints developed by [4] (for example, the center wavelengths of three olivine absorptions are coupled as observed in the previous laboratory measurement [5]). In this new approach, modal abundance of olivine, pyroxene, and plagioclase were estimated with Mg# of olivine and pyroxene. When we compared the results having smaller errors, Mg# of the volcanic origin is much lower than that of the mantle origin. The estimated Mg# range of the volcanic origin is consistent with the sample analyses of the returned lunar basalt samples [6]. Spectra of the possible crustal intrusion origin tend to have greater fitting errors and need more detailed analyses. Therefore, comparing Mg# between the crustal and mantle origin is currently difficult, though crustal origin spectra with lower fitting errors appear to be lower than that of the possible mantel origin.

References: [1] Yamamoto et al. (2010), *Nature GeoSci.* 3, 533-536. [2] Shearer et al. (2015), *Meteorit. Planet. Sci.*, 50, 1449-1467. [3] Ohtake et al. (2017), *48th LPSC, abstract* #1651. [4] Nimura et al. (2006), *37th LPSC, Abstract* #1600. [5] Sunshine and Pieters (1998), *J. Geophys. Res.*, 103, 13675-13688. [6] Kato et al. *49th LPSC abstract*.

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