Geochemical and Petrological Investigations of Lunar Feldspathic Crust by Lunar Sample Studies and Remote Sensing Data

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Feldspathic highland crust deriving from ferroan anorthosite (FAN) have been assumed to be formed by the lunar magma ocean (LMO) model, whose the early crust was accumulated by the crystallization and flotation of plagioclase (Warren, 1985). However, the studies of lunar meteorites which originated from the highlands not covered by the Apollo missions, found more magnesian anorthosites than FAN (e.g., Takeda et al., 2006). Furthermore, Kaguya observation revealed feldspathic crust with higher Mg# (= molar 100 ×Mg/(Mg + Fe)) than FAN (Ohtake et al., 2012).
Furthermore, purest anorthosite (PAN) (>98% plagioclase) lithology was found in central peak of several large craters by Kaguya observation. On the basis of Kaguya results, the massive PAN layer are assumed to be distributed under mafic-rich mixing layer in highlands (Ohtake et al., 2009; Yamamoto et al., 2012). Like this, lunar meteorite studies and global remote sensing data have provided new global information on geological features of lunar crust.

Feldspathic meteorites from lunar highlands are brecciated by impacts on the lunar surface. The 10-30% mafic minerals (pyroxene and olivine) are included in the meteorites. These feldspathic meteorites is similar with the surface composition of mafic-rich mixing layer of feldspathic crust in elemental composition (e.g., FeO, Th). On the other hand, several highly pure anorthosite (PAN) clasts were found among some of feldspathic lunar meteorites (Nagaoka et al., 2014). They are correspond with PAN lithology observed by Kaguya.

In this work, we have measured and summarized the elemental and mineral composition of feldspahtic lunar meteorites, by bulk chemical analyses, electron micro-probe analyses, and UV-VIS-NIR reflectance spectroscopy. In this presentation, we report and discuss geochemical and petrological features of lunar crust on the basis of recent geochemical and petrological studies combined the above lunar samples analyses data and the recent remote sensing data.

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