LITHOLOGY OF LUNAR FARSIDE CRUST.

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Introduction: Dhofar 489 and 14 paired meteorites are originated from the lunar farside crust [1, 2]. They are crystalline matrix anorthositic breccias, consisting of clasts of magnesian anorthosite (MAN), a spinel troctolite (ST), impact-melt and granulitic clasts. Preliminary study of Dhofar 309 showed that a wide range of variations in texture, mineral composition, and modal abundance relative to those in Dhofar 489 [3]. In this study, we present further result of mineralogical and petrologic studies of Dhofar 489 et al. (Dhofar 307, 309, 908), to understand the compositional / textural diversity of the impact-melt suite and to discuss the lithologies of the farside crust.

Diversity of the impact-melt suite: While Dhofar 489 includes the clasts of probably pristine MAN and ST, others dominantly consist of angular clasts of crystalline impact melt (IM). Some of the IM clasts include angular plagioclase up to 1 mm across. While fine-grained (10-50 μm across) olivines in the IM clasts are sub-rounded, plagioclases are lath-shaped. A few MAN clasts are present in Dhofar 309. The modal abundance of the IM clasts in Dhofar 309 is roughly similar to that of the ST clast in Dhofar 489 (Plagioclase ~70%, olivine ~25%), suggesting the precursor of the IM have a similar composition to the ST. Yet, the pyroxene abundance in the IM clast (10.7%) is greater than that of ST clast (2.7 %). The pyroxene of > 10 vol% in the IM clast should be originated from neither the MAN nor ST, but from some other rock type bearing pyroxene, although clasts of norite have not been found. Olivine compositions in Dhofar 309 show bimodal distribution for the MAN and IM, as well as the MAN and ST in Dhofar 489. The olivine composition of the MAN in Dhofar 309 (Fo_{77-79} at peak composition) is slightly more Mg-rich than those of Dhofar 489 (Fo_{75-77}). The difference in Fo value may reflect distinct crystallization timing from the trapped liquid among the plagioclase cumulates.

Lithology of the farside crust: The highly anorthositic compositions, relatively coarse grain sizes and extremely low abundances in incompatible trace elements of the MAN and ST [1] imply that they formed as cumulates from a common differentiation magma body. If the ST is a primary product of the magma ocean, it was generated at the depth of a few tens of km [1]. The bimodal mg# distribution of MAN and ST/IM and higher modal pyroxene in the IM indicate that at least three distinct rock types (MAN, ST, norite) exist in the farside crust. However, the pyroxene may not be a dominant phase in the farside highland as suggested by the global mineral maps [4]. Norites distributed in and around the South Pole-Aitken basin of the farside [4] might be associated with the missing norite in the impact-melt suite sampled by Dhofar 489 et al..

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