**Japan Geoscience Union Meeting 2011**
(May 22-27 2011 at Makuhari, Chiba, Japan)


PPS024-37 Room:103 Time:May 23 17:30-17:45

# Diversity of anorthositic highland crusts and exploration of the northern region of the Bailly basin

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Mineralogical studies of lunar meteorites of the Dhofar 489 group (e.g., Dhofar 489, 908, and 307) and Yamato (Y-) 86032, all possibly from the farside highlands, and reexamination of the Apollo anorthositic samples (FAN), revealed that mafic silicates show diversity of Mg numbers and large plagioclase crystals with minor mafic silicates are common [1,2]. Ohtake et al. [3] observed by the Kaguya multiband imager and spectral profiler, anorthosites composed of nearly pure anorthite (PAN) at numerous locations in the farside highlands. More olivine fragments are found in the matrices of the Dhofar 489 group (e.g., Dhofar 307, 309, 489, 908 etc.). Anorthositic clasts are major clasts in both groups, but more magnesian anorthosites are present in the Dhofar 489 group [2]. In conjunction with their low-Th concentrations, we proposed that the Dhofar 489 group may have been originated form some farside basins with the lowest Th concentration of the eariest crust of the Moon.

Based on the Th map made by the GRS group, Kobayashi et al. [4] showed the lowest Th zone surrounding SPA, including regions distributed north of the farside equator. This region of the lower-Th FHT, which extends from north of Dirichlet-Jackson (D-J) basin, to Hertzsprung and to the West of the Orientale basin, may represent the earliest and thickest anorthositic crust of the Moon. This lowest Th region extend to the nearside, north of the Bailly basin. We examined possible landing sites of the future lunar mission based on these maps. Bidirectional UV-visible-NIR diffuse reflectance spectra of NWA 482, Dho 307, Dho 911 and 60015 were obtained using a reflectance spectrometer at Brown Universikty.

Nyquist et al. [5] performed Sm-Nd and Ar-Ar studies of pristine ferroan anorthosites (FANs) of the returned Apollo samples and of Dhofar 908 and 489, and discussed implications for lunar crustal history. The pyroxene composition diagrams for 60025 in the new database show that the compositional range of 60025 pyroxenes is rather large for a pristine rock. In contrast, the 60015 FAN shows only a single tie line, but the sample does not show pristine crystalline textures. One simple explanation for the wide range of pyroxene compositions is a genomict breccia model, but in the LMO model it is not easy to postulate simple differentiation processes [1].

Haruyama et al. [6] made a large scale mosaic map of the region north of the Bailly basin similar to the D-J basin. Based on the Th map and this TC map, we propose that the highland plain between Pingre crater and Zuccherius crater is a good place to land to examine the region similar to the farside highland. In conjunction with such new observation, we also have to speculate a model in which the old lunar magma ocean (LMO) model could not explain the origin of the earliest crust. In order to explain diversity of the anorthositc rocks, we may have to invoke a model, in which trapped liquid grains with different Mg numbers are distributed along the grain boundaries of large plagioclase crystals. If we pick up an aggregate of only such large plagioclase crystals without mafic silicates at grain boundaries, it may represent a PAN common for both near and farside. Addition of a minor magnesian olivine may produce the magnesian anothosites observed in the Dho 489 group. In order to explain the formation of both FANs and the farside anorthosites, we may have to also invoke a convection model for the LMO [7].

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Keywords: Lunar farside, basin, lunar meteorites, Plagioclase, Anorthosite, Bailly Basin