Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS003-13 Room: 201A Time: May 24 11:45-11:57

Mineralogical comparisons of the Dhofar 489 and Y86032 group lunar meteorites with reference to farside basins.

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Two lunar meterorite groups of the farside origin have been reported. Although low Th and FeO concentrations are common features, types of mineral fragments and clasts are different. Pyroxene fragments similar to those of so-called Mg-suite rocks are dominant in the matrices of the Y-86032 group, but 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 dominant in the Dhofar 489 group.
Dhofar 307 PTS contains magnesian granulitic (GR) clast similar to the spinel troctolite (ST) clast in Dhofar 489 in mineral chemistry. Rapid growth features of the Dhofar 309 clasts (IM) indicate formation in an impact melt pool. The range of the modal abundances of the minerals and their compositons of three clasts (ST, IM, GR) obtained from the mineral distribution maps are practically the same and suggest that they were produced by impact events at the floor of a basin of the farside. The Th map made by the GRS group [1] showed the lowest Th zone surrounding SPA, including regions distributed north of the farside equator [2,3]. This region of the FHT with the lowest Th may represent the earliest anorthositic crust of the Moon, from where the Dhofar 48 9 lunar meteorites might have been derived. Among large basins within the region of the lowest Th concentrations of the farside, we found that the Derichlet-Jackson basin is one of the candidates for the ejection site, with abundant craters on the floor. Korolev and Mendeleev have flat floor.
Y-86032 [Yamaguchi A., Personal Com.]is composed of several types of feldspathic clasts, granulitic breccias, and minor basaltic clasts set in a clastic matrix. An An97 anorthosite that has An contents similar to those of nearside FANs. Mg number (= molar Mg/(Mg+Fe)x100) values vary significantly from ca.45 to ca.80 covering the ranges of both nearside FANs and the Mg number gap between FANs and the Mg-suite. A light-gray feldspathic (LG) breccia mainly consists of fragments of anorthosites (An93 anorthosite) more sodic than nearside FANs. LG also contains an augite-plagioclase clast. Basaltic clasts in the dark-gray matrix are present in Y-8603 2, but are not found in the Dhofar 489 group. The crystallization of these basaltic clasts predate the lithification age of the clastic matrix at ca.3.8 Ga [4]. The low K contents of plagioclase in both the anorthositic and basaltic clasts and generally low incompatible element abundances in all the lithologies in Y-86032 indicate that KREEP was not involved during the formation of the precursor lithologies. All these facts support the idea that Y-86032 was derived from a region far distant from the PKT. The presence of such basaltic class and pyroxene fragments similar to Mg-suite rocks without KREEP elements, and more FAN-like anorthosites suggest that Y-86032 may have been derived from a region closer to the near side.
Nyquist et al. [4] showed that An An97 anorthositic clast has distinct Sm-Nd isotopic systematics, and suggests either that An97 anorthosites come from isotopically diverse sources, or that the Sm-Nd isotopic systematics of this clast were reset ca.4.3 Gyr ago. The Ar-Ar age of Dhofar 489 is 4. 23 Gyr, which is similar to the above clasts of Y-86032. Clasts with ancient (ca. 4.4 Gyr) age were found in Y-86032. These lines of evidence suggest that these ages may represent time of basin

formation of the farside.
The mineralogical and geochemical difference have been attributed to the locations of the ejected sites; Y-86032 gruop sites are much closer to the farside, because of their higher Th and FAN components. Dhofar 489 may have been originated from some farside basins with the lowest Th concentration of the eariest crust of the Moon, and some craters on the floor.
References (See Japanese abstract).

Keywords: Lunar farside, basin, lunar meteorites, Yamato 86032, Dhofar 489 group, mineralogy