Petrology of ferroan diogenites and genetic relationship with other diogenites and eucrites

A. YAMAGUCHI[1*], J.A. BARRAT[2], N. SHIRAI[3]

[1] National Institute of Polar Research, Tokyo 190-8518, Japan (*correspondence: yamaguch@nipr.ac.jp)

[2] UBO-IUEM, CNRS UMR 6538, Place Nicolas Copernic, 29280 Plouzané, France

[3] Department of Chemistry, Tokyo Metropolitan University, Hachioji, Tokyo 192-0397, Japan

HED meteorites are a group of differentiated achondrites likely originated from an asteroid, 4 Vesta. Eucrites are basalts or gabbros whereas diogenites are orthopyroxenites or harzburgites. The petrogenesis of eucrites and diogenites has been controversial. It has been suggested that diogenites and eucrites formed during solidification of a global magma ocean. Alternatively, diogenites were crystallized from magmas formed by secondary igneous processing. Ferroan diogenites have pryoxene with Mg' values (= molar Mg/(Mg+Fe) x100) slightly higher than cumulate eucrites. The study of these diogenites provides clues to understand the petrogenesis of eucrites and diogenites.

We examined ferroan diogenites, Y-75032 type (Y-75032, -791199, -791202, -791422, -791200, -791201, and -791439) (Mg' = 53-69), NWA 5613 (Mg' = 70-71), NWA 6928 (Mg' = 66-67), Dho 700 (Mg' = 69-70), and A-881839 (Mg' = 70-71). Y-75032 type diogenites are breccias which contain clasts of cumulate eucrites. On the pyroxene quadrilateral, these ferroan diogenites are plotted on a continuous "trend" [1] from normal diogenites to cumulate to basaltic eucrites, and partially overlapped with the range of cumulate eucrites. On Al_2O_3-TiO_2 diagram, pyroxenes in the ferroan diogenites except Dho 700 are plotted in the range of cumulate eucrites. Bulk compositions of A-881839 and NWA 5613 display REE patterns with large depletions of Eu with less pronounced light REE depletions ("NWA 5613 group") [2]. NWA 6928 displays a pronounced light REE depletion. In contrast, Y-75032 and -791199 (Y-75032 type) have higher REE abundances with slight Eu depletions.

Our results support the earlier conclusions that Y-75032 type diogenites could be related to cumulate eucrites (pigeonite cumulate eucrites). However, it seems likely that the other ferroan diogenites are petrologically more similar to normal diogenites.

[1] Takeda H. and Mori H. (1985) *PLPSC* **15,** *JGR* **90,** suppl. C636-C648. [2] Barrat J. A. *et al.* (2010) *GCA* **74,** 6218-6231.