DISCOVERY OF TWO ANTARCTIC EUCRITES WITH REFERENCE TO THE HED (HOWARDITE-EUCRITE-DIOGENITE) ASSOCIATION. Hiroshi Takeda and T. Tagai Mineralogical Inst., Faculty of Science, Univ. of Tokyo, Hongo, Tokyo 113, Japan.

Systematic pyroxene crystallization trend of the HED meteorites are generally regarded as rocks developed on the same parent body by fractional crystallization or partial melting (1, 2, 3, 4). However, the relation between diogenites and eucrites remains a subject of active debate focused on two major hypotheses. Phase equilibrium constraints on the HED association showed that simple fractional crystallization at 2 kbar can account for many of the mineralogical and chemical features of the diogenite-eucrite association, but its plausibility was strained by the absence of volcanic equivalents of the magmas that crystallized the diogenites (5). We reported that the Y75032-type achondrites found in the Yamato collection fill the gap between diogenites and the cumulate eucrites (6). Some members of the Y75032-type achondrites show a more polymict nature than others, but the lithic variations are more limited than normal howardites, in particular an Fe-rich ordinary eucrite has never been found. The facts suggested that it sampled two or three layers of the layered crust or pluton produced by the crystal fractionation (7).

We report the discovery of Fe-rich ordinary eucrite clasts in Y791439 among the Y75032-type achondrites. It contains more cumulate eucrite clasts rich in plagioclase. Another new nearly crystalline eucrite, Y791438, shows textures similar to ordinary eucrites such as Juvinas, but its mg number = MgX100/(Mg+Fe) is as Mg-rich as cumulate eucrites. We investigated their mineralogy to obtain some constraints on the HED association.

Y791439 was classified as one of the Y75032-type diogenites (8) and show all characteristics of a type of link materials between diogenites and cumulate eucrites. Shocked pyroxene fragments slightly more Fe-rich than normal diogenites are set in dark glassy matrix. The majority of the specimens of this group (e.g., Y75032, Y791000) are monomict breccias mainly of orthopyroxene and low-Ca inverted pigeonites, whose compositions fall in a limited range. Pyroxene compositions of Y791439 extend toward the cumulate eucrite side and their modal abundance of plagioclase (12 vol.%) exceeds the range of diogenites. Some cumulate eucrite clasts contain more plagioclase than pyroxenes. Inverted pigeonites show textures and chemistries similar to those of Binda, Serrà de Magé and Moore County.

Among small fragments of pyroxenes set in dark matrix glasses, more than ten fragments have chemical compositions almost identical to those of the Juvinas pigeonite (Fig. 1). A large clast is 0.55X0.20 mm in size. One clast contains plagioclase with An_{88}, which is more sodic than those of cumulate eucrites. They are heavily shocked and show fine-grained granoblastic textures, but still exsolution textures of ordinary eucrite can be recognized. The exsolution lamellae are as fine as those of Juvinas and are not resolvable by the microprobe analyses. These textures are distinct from those of cumulate eucrites.

Y791438 is a rare crystalline eucrite found in Antarctica, but its texture is slightly disturbed by shock events. The texture is intermediate between subophitic and equant, and lath shapes of plagioclase can be recognized. The modal abundance of plagioclase (20 vol.%) is smaller than that of pyroxene. Pigeonites show fine exsolution textures comparable to those of Juvinas and the augite lamellae are barely resolvable by the microprobe. A large grain of pigeonite consists of several small domains, in which the host pigeonite may be partly inverted in different orientations. The bulk chemical composition of pigeonite is $Ca_8Mg_{50}Fe_{42}$ (Fig. 1), which is more Mg-rich than those of Moore Co. and Y791195 and is comparable to those of Serrà de Magé and Nagaria (8). The An contents of plagioclase range from 90 to 95, which represent the original chemical zoning during rapid crystal growth.

Discovery of a magnesian eucrite with ordinary eucrite (non-cumulate) textures suggests the presence of a volcanic equivalent of the magmas that may have crystallized diogenites and support the plausibility of fractional crystallization. Further studies including trace element analyses and age determinations are required before we discuss the possibility of fractional crystallization. Discovery of Fe-rich ordinary eucrite clasts in the Y75032-type link material between diogenite and eucrite also suggests that diogenites, cumulate eucrites and volcanic eucrites are closely associated in their parent body. The presence of three types of lithologies in a rather monomict achondrite may rule out the possibility that diogenites and eucrites were derived from an unrelated pluton or crust. Presence of plagioclase-rich cumulate eucrites in this breccia does not lessen the appeal of the magma ocean scenario. The presence of large chromite crystals in diogenites-cumulate eucrites suggests that the magma was originally fairly Cr, Al-rich, and the position of olivine-pyroxene cotectic line may be changed by the Cr content.

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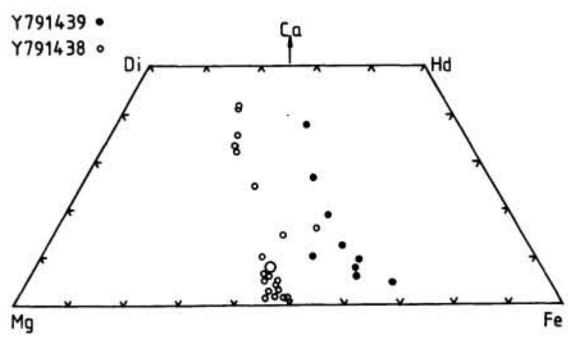

Fig. 1. Pyroxene quadrilateral showing chemical compositions of Y791438 and Y791439 eucrites. Large open circle: bulk pig. composition.