CUMULATE EUCRITES: MINERALOGICAL EVIDENCE FOR IMPACT EVENTS DURING SLOW COOLING. A. Yamaguchi[1] and H. Takeda[2], [1]National Institute of Polar Research, Tokyo 173-8515, Japan. [2]Research Institute, Chiba Institute of Technology, Chiba 275-0016, Japan.

Eucrites record the oldest planetary differentiation in the solar system, and probably form most of the outer crust of the asteroid 4Vesta. Cumulate eucrites formed deep in the crust, and cooled very slowly. Previous workers mainly studied on pyroxene mineralogy to estimate the thermal history of cumulate eucrites [e.g., 1,2]. In this study, we focused on the texture, and occurrence and chemistry of minor minerals in unbrecciated cumulate eucrites, Y-791195, Moore County, Serra de Magé, and Moama.

Most grains of pyroxene and plagioclase in these cumulate eucrites have sharp optical extinction, indicating that these eucrites did not experienced a significant shock metamorphism after post-crystallization slow cooling. Thus, these cumulate eucrites probably escaped the latest impact bombardment.

Textures of Moama, Moore County, and Serra de Magé are undisturbed, displaying a coarse-grained texture [1]. In contrast, Y-791195 has a granular texture [2]. In this meteorite, we found recrystallized portions composed of finer-grained minerals (20-100 μm) in a coarser-grained (~0.5 mm) granular portion. This indicates that Y-791195 was brecciated and recrsytallized by subsequent slow cooling.

We found irregular chains of fine (<30 μm) chromite grains in pyroxene in Serra de Magé, Moore County, and Y-791195. Most of the chromites in Moore County and Y-791195 are enriched in TiO_2 (6.1-18.3 and 7.3-15.9 wt%, respectively), similar to those found in basaltic eucrites [3]. Because the orientation of some chromite chains are not related to any crystallographic orientation of the host mineral, these chromites may have formed along healed fractures after mild brecciation [4]. In Moore County, some Ti-rich chromites are closely associated with ilmenite and minor Fe-metal and troilite. This assemblage could have been formed by decomposition of Cr-ulvöspinel by changes of T-f(O_2) [3]. In Moama and Moore County, there are fine grains (<2-3 μm) of troilite and/or minor Fe-metal that penetrate grains of silicate and oxides. Some troilite and Fe metal are in contact with tiny grains of silica minerals, indicating the reduction of silicate by S. The fine inclusions of troilite in tridymite and plagioclase could have been formed by shock injection because these minerals do not contain a significant amount of FeO. Troilite grains are surrounded by host silicate minerals, suggesting the fractures were closed by subsequent annealing.

The presence of these annealed shock textures indicates that some cumulate eucrites may have experienced impact events during slow cooling after initial crystallization. These observations are consistent with incomplete inversion textures of pigeonites in Y-791195 and Moore County [1,2], and with incomplete augite exsolution in orthopyroxene of Serra de Magé. The post-crystallization thermal history of cumulate eucrites is similar to that of equilibrated basaltic eucrites [5]. These facts suggest that the eucritic crust experienced multiple impact events shortly after or during volcanism.

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