THERMAL EFFECTS ASSOCIATED WITH THE FORMATION OF CUMULATE EUCRITES, INCLUDING YAMATO 980318. P. C. Buchanan[1] and T. Tomiyama[2], [1]Antarcitc Meteorite Research Center, National Institute of Polar Research, 1-9-10 Kaga, Itabashi-ku, Tokyo 173-8515 JAPAN (e-mail: buchanan@nipr.ac.jp), [2]Dept. of Polar Science, School of Mathematics and Physics, Graduate Univ. for Advanced Studies, JAPAN.

Introduction: Cumulate eucrites include a broad compositional spectrum of igneous rocks, ranging from magnesian feldspar cumulates (e.g., Serra de Magé with a bulk Mg# of 58.4, [1]) to ferroan heteradcumulates that are composed of plagioclase enclosed in poikilitic Fe-rich augite with Mg# of 20.7 [2]. These medium- to coarse-grained eucrites display variable degrees of enrichment of pyroxene or plagioclase. Compositional and mineralogical variations among these igneous rocks suggest fractional crystallization with associated cumulus processes in magma chamber(s) intruded into the crust of the HED parent body (4 Vesta).

Data: Yamato (Y)980318 was recovered by the Japanese Antarctic Research Expedition in 1998. The medium-grained meteorite (166.81 g) has a weathering classification of B/C [3] and is composed of blocky white feldspars and anhedral brown pyroxenes with rare grains of chromite, ilmenite, and a silica mineral. Mild to moderate shock caused undulating extinction and mosaic texture of feldspars. Pyroxenes have relatively sharp extinction, but rare faults offset exsolution lamellae.

Feldspar has a range of composition, $Ab_{6.5-12.8}An_{93.1-86.8}$, and is slightly reverse zoned. Similar reverse zoning of feldspar was described in the cumulate eucrites Medanitos and Moama [e.g., 4]. Pyroxene host commonly is $Wo_{2.0}En_{50.9}$; inverted pigeonite of composition $Wo_{1.8}En_{51.6}$ occurs in the centers of some grains. Exsolution lamellae include a thick set (up to 30 µm wide) with composition $Wo_{45.0}En_{36.7}$. A thinner set (up to 5 µm wide) has a composition of $Wo_{44.7}En_{37.2}$. Finer sets, some of them blebby, also occur. These pyroxene compositions and exsolution textures are similar to those described in the cumulate eucrite Moore County [5].

Modal analysis of a thin section and of areas of the surface that are not covered by fusion crust (total >7 cm^2) suggest 34-38 % feldspar. The meteorite has a bulk Mg# of 53.6, which is similar to that of Moore County (Mg# 52.1) [1]. Hence, composition, mineralogy, and exsolution textures suggest that Y980318 crystallized and cooled in the same or a similar environment as Moore County.

Discussion: Mineral chemistry and exsolution textures suggest that each cumulate eucrite experienced a different rate of subsolidus cooling, probably at depths ranging from 3 to 8 km [6]. Hence, a reasonable model for formation of these igneous rocks is in a series of magma chambers intruded into a basaltic crust formed by serial magmatism [see also 7, 8]. Metamorphism of the crustal material surrounding these magma chambers was not solely the result of the geothermal gradient of 4 Vesta, but was complicated by contact metamorphism. Hence, limited volumes of non-cumulate eucrites that were originally extruded onto the surface of 4 Vesta might have subsequently been metamorphosed at relatively shallow levels.

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