HEAVILY-METAMORPHOSED CHONDRITIC CLASTS IN THE CV3 CARBONACEOUS CHONDRITES MOKOIA AND YAMATO 86009

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Based on the mineralogy, petrography, bulk chemical and O-isotope compositions, CV chondrites are subdivided into the oxidized Allende-like, oxidized Bali-like, and reduced subgroups, which have experienced different styles and degrees of secondary alteration and thermal metamorphism and may represent different lithologies of a single CV asteroidal body [1]. Neither the size nor the thermal history of the CV asteroid are well-known. Based on the paleomagnetic record of the Allende meteorite, it is inferred that the CV parent asteroid experienced partial differentiation [2]. This hypothesis, however, is inconsistent with the lack igneous or heavily-metamorphosed fragments in CV meteorite breccias. In addition, the metamorphic classification of CVs using Raman spectroscopy [3] suggests that Allende (petrologic type >3.6) is the most heavily metamorphosed CV chondrite. Here we describe the mineralogy and petrography of heavily-metamorphosed chondritic clasts in Mokoia and Y-86009, which may represent fragments of the interior portion of CV asteroid. The preliminary characterization of the clasts have been reported in [4–7].

Most clasts have coarse-grained granular textures with triple junctions, indicative of sintering and prolonged high-temperature (>1000°C) annealing inside planetesimals [e.g., 8]. The clasts consist of ferroan olivine ($Fa_{33–39}$), ferroan Al-diopside ($Fs_{7–13}Wo_{44–53}$), anorthitic plagioclase ($An_{37–84}Ab_{63–17}$), Cr-spinel (Cr/(Cr+Al) = 0.21–0.45, Fe/(Fe+Mg) = 0.69–0.74), nepheline, pyrrhotite, pentlandite, and rare grains of Ni-rich taenite. Olivine, pyroxene and plagioclase are the major minerals. Although olivine and pyroxene show compositional variations between the clasts, they have almost uniform composition within an individual clast. Based on the olivine-spinel [6] and two-pyroxene [7] thermometer, the estimated equilibrated temperatures of the clasts are ~700–900°C. Several clasts appear to be less metamorphosed. They have non-granular textures (plagioclase and/or pyroxene fill interstitial regions between olivine crystals) and show minor variations in chemical compositions of pyroxene (e.g., $Fs_{10–11}Wo_{49–52}$).

The mineralogy, bulk chemical compositions, and O-isotope compositions of the clasts ($\Delta^{17}O$ ~ –5‰; so far measured only in Y-86009 [6]) are inconsistent with those of known thermally metamorphosed chondrites (e.g., H, L, LL, R, CO, CK) and primitive achondrites, but close to those of CV chondrites. To understand a genetic relationship between the clasts and the host CV chondrites, we will measure O- and Mg-isotope compositions of the Mokoia clasts using the UH Cameca ims-1280.

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