REDISTRIBUTION OF CHONDRULES AND MATRIX GRAINS IN THE MOKOIA CHONDRITE PARENT BODY: A MODEL.

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Carbonaceous chondrites mainly consist of chondrules and inclusions embedded in a fine-grained matrix. This texture is widely believed to have retained its basic state when the components were accreted into their parent bodies, although it may have been modified to various extents by subsequent parent-body processes [e.g., 1].

Recently, we studied all chondrules and inclusions larger than 400 μm in diameter and their rims (referred to as chondrules/rims) in the Mokoia CV3 carbonaceous chondrite using a scanning electron microscope, and found that the chondrules/rims experienced various degrees of aqueous alteration and that some also exhibit evidence of thermal metamorphism [2, 3]. The mineralogical and petrographic characteristics of the chondrules/rims suggest that the alteration and metamorphism occurred within the meteorite parent body. In contrast, however, the surrounding matrix does not show evidence of such alteration and metamorphism. These findings indicate that the alteration and metamorphism of the chondrules/rims did not occur in situ. Based on these results, we proposed a model that the chondrules/rims are actually clasts transported from regions in the parent body different from the region where the host meteorite was finally lithified.

If it can be assumed that the chondrules and inclusions studied are representative of all chondrules and inclusions in Mokoia, the results and interpretation pose a fundamental problem regarding the formation of the whole Mokoia lithology; that is, it cannot be explained by either direct accretion of solar nebula materials or conventional brecciation on the surface of the meteorite parent body. We hypothesize that some hitherto unrecognized parent-body process, i.e., fluidization of chondrules/rims and matrix grains, played an important role in the formation of the meteorite lithology.

We propose a model for the formation of the Mokoia lithology through the following processes: (1) formation of chondrule/rim clasts and fine grains (which eventually form the meteorite matrix) due to fragmentation of lithologies with chondrite textures in multiple regions within the parent body, (2) transportation, (3) mixing, (4) accumulation in a fluidized state, and (5) lithification of those clasts and fine grains. In processes (2) and (3), chondrule/rim clasts were abraded and acquired the chondrule/rim configuration, and in processes (2)–(4), the chondrite texture was reconstructed. Processes (1)–(5) were possibly cyclic and were repeated multiple times.

References: [1] Wood J. A. 1963. *Icarus* 2: 152–180. [2] Tomeoka K. and Ohnishi I. 2010. *Geochimica et Cosmochimica Acta* 74:4438–4453. [3] Tomeoka K. and Ohnishi I. 2014. *Geochimica et Cosmochimica Acta* 137:18–34.