TEXTURES OF SINGLE CHONDRULES IN CR2 CHONDRITE NWA801 BY MEDICAL X-RAY MICRO-COMPUTED TOMOGRAPHY.

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Introduction: "Armoured" chondrules contain one or more concentric rings of Fe-Ni metal on their exterior surfaces or throughout their interiors. These chondrules are found in the CR2-class of carbonaceous chondrites, and the 3D distributions of metal and silicates inside these chondrules are important to constrain the nebular environment where they formed. Petrography suggests that many CR2 chondrules are remnants of precursor chondrules that were incorporated into dustballs, which were re-melted in one or more episodes in a dusty nebular setting [1]. X-ray computed tomography (CT) is an ideal way to test this idea, since 3D renderings of chondrule textures can be obtained non-destructively. Synchrotron radiation has been very successful for imaging chondrule textures due to its very high spatial resolutions (ca. 1 um; i.e. [2]-[4]). However new laboratory-based medical CT scanners have received less attention, although these instruments offer high resolutions, rapid data acquisition and processing times, the ability to image large numbers of samples, and are more widely available than synchrotron facilities. Here we investigate the use of two General Electric CT scanners, the Locus and eXplore speCZT, for mapping the 3D textures of single chondrules removed from the CR2 chondrite NWA801.

Experimental: Automated freeze thaw disaggregation was used to extract 523 individual mm-sized chondrules and chondrule fragments from 12 g of NWA801 [5]. All objects were sieved and grouped by size onto glass mounts with up to 12 objects/mount. 3D renderings were obtained for all objects along with enstatite, olivine, augite and Fe "standards" on the eXplore speCZT through 900 views at 16 ms exposure (110 kVp, 32 mA) at 50 um/voxel. One mount containing several large chondrules was imaged on the Locus through 900 views at a 4500 ms exposure (80 kVp, 0.45 mA) at 20 um/voxel. CT grayscale numbers from both scanners were converted to Houndsfield units (HU) and all final images were manipulated and examined by GE Microview and custom MatLab scripts.

Results: 12% of chondrules contain distinct multiple Fe-Ni rims and 75% showed only a single Fe-Ni rim usually on the exterior surface of the chondrule. A total of 13% of the objects were either "metallic" chondrules or large Fe-Ni blebs of ca. 1 mm or less in diameter. This suggests that enveloping compound chondrules [1] in NWA801 formed at about the same frequently as the large Fe-Ni blebs, but that both these objects formed less frequently as non-compound chondrules. Thus the majority of NWA801 chondrules are not products of compound mergers.

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