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

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Introduction: CR2 chondrites are some of the most primitive and pristine meteorites that contain abundant mm-sized silicate and "armoured" chondrules. Armored chondrules show rims of thin Fe-Ni metal on their surfaces or in their interiors, which are thought to be remnants of melting events in a dusty nebular environment [1]. X-ray computed tomography (CT) is an ideal technique to non-destructively map the compositions of such chondrules in 3D, due to variable attenuation of X-rays in different silicates and metal. Synchrotron radiation has been very successful in this respect (i.e. [2]-[4]). However the new generation of "medical" laboratory-based CT scanners also provide excellent spatial resolutions (<50 um), high sample throughput, and efficient image acquisition and reconstruction algorithms. Here we report the mineral compositions of chondrules separated from the CR2 chondrite NWA801 using a GE eXplore speCZT scanner.

Experimental: 523 individual mm-sized chondrules and chondrule fragments were extracted from 12 g of NWA801 (loaned by the Royal Ontario Museum) using automated freeze-thaw disaggregation [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, Si and Fe "standards" through 900 views at 16 ms exposure (110 kVp, 32 mA) at 50 um/voxel. CT grayscale numbers were converted to Houndsfield units (HU) and all final images were manipulated and examined by GE Microview and custom MatLab scripts.

Results: Histograms of HU-values versus number of voxels show one or more distinct peaks throughout the range of 2886 (Si) < HU < 25427 (Fe; saturated). These peaks correspond to the chemical compositions of the objects, which are approximately constrained by the standards. To quantify the compositions of the chondrules obtained by CT imaging, 14 fragments that span the range of HU values, together with the olivine, enstatite and augite "standards" were analyzed by an SX-50 electron microprobe (EMP) to obtain their mineral chemistries and structures. The fragments showed high forsteritic olivine with variable amounts of mesostasis containing low-Ca pyroxene, and Fe-oxide veins and nodules.

References: [1] Rubin A.E. 2010. *Geochimica et Cosmochimica Acta* 74:4807-4828, [2] Ebel D.S. and Rivers M. 2007. *Meteoritics & Planetary Science* 39:531-544, [3] Fredrich J.M., Wignarajah D.P., Chaudary, S., Rivers, M.L., Nehru, C.E., Ebel, D.S. 2008. *Earth & Planetary Science Letters* 275:132-180, [4] Uesugi, M., Uesugi, K., Oka, M., 2011, *Earth & Planetary Science Letters* 299:359-367, [5] Charles C.R.J. 2011. *Review of Scientific Instruments*, in-press.