USE OF MICRO-CT AND PRECISION CUTTING TO ASSESS METEORITE HETEROGENEITY: AN EXAMPLE USING BRACHINITE NWA 4872.

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Introduction: Cutting meteorites to produce polished sections is one of the first tasks in the classification and examination process. The choice of orientation of the cut is usually arbitrary. The danger of this is that either an unrepresentative sample may be produced or, conversely, interesting components may be missed. Micro-computed tomography (micro-CT) provides a view of a meteorite’s interior, highlighting density variations [e.g. 1, 2]. A targeted cut can then be made.

Methods: Micro-CT scans were run on a 23.6 g piece of brachinite Northwest Africa (NWA) 4872. A GE Locus Ultra was used with an X-ray peak voltage of 120 kVp, current of 20 mA and resulting isotropic voxel spacing of 154 \( \mu \)m. A Wells 6234 diamond-wire saw with a 0.5 mm wire was used to dry-cut the sample. Modal abundance determinations used backscatter electron (BSE) and Raman maps. BSE work used both a Hitachi SU6600 variable pressure, analytical field emission gun scanning electron microscope (SEM) and a FEI Quanta 200 environmental SEM. Raman mapping used a Horiba LabRAM Aramis micro-Raman spectrometer.

Results and Discussion: Micro-CT imaging revealed a heterogeneous distribution of high density materials. The largest high density region measured 2 mm across. Precision cutting exposed the edge of a high density phase and polishing revealed a large chromite grain. Many chromite grains are present in the sample, but are usually 100-300 \( \mu \)m.

This precise cut exposed an extreme example of heterogeneity in NWA 4872. The majority of the meteorite does not contain such large chromite grains. Modal determinations from an earlier arbitrary cut are likely more representative for the meteorite as a whole. The arbitrary cut showed that 9-10% of the section was made up of high density phases (sulfide, chromite, hematite, magnetite and goethite) with \( \sim 1% \) being chromite. The precise cut contains a single chromite grain that makes up \( \sim 1% \) of the section. This extreme example underlines the uncertainty in modal values from single sections and can help constrain uncertainty in modal abundance values for NWA 4872. Further work is required in order to state these values and uncertainties.

Targeted cutting of meteorites can reveal previously unexposed features and can help constrain uncertainty in modal abundance values. For rare and valuable samples, targeted cutting provides the maximum amount of information from a sample with the fewest number of cuts. With care and proper cleaning of the saw beforehand, powders from dry cuts can also be collected for future analyses.