# A NEW LOOK AT AUBRITES: INVESTIGATING 3D MODAL MINERALOGY WITH X-RAY COMPUTED TOMOGRAPHY

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The aubrites (~30 known meteorites) are a unique group of differentiated meteorites that formed on asteroids with oxygen fugacities ($fO_2$) ~2 to ~6 log units below the iron-wüstite buffer. At these highly reduced conditions, elements deviate from the geochemical behavior exhibited at terrestrial $fO_2$, forming FeO-poor silicates and exotic sulfides. While previous studies have described the petrology and 2D modal abundances of aubrites, this work investigates the 3D modal mineralogies of silicate, metal, and sulfide phases in aubrite samples, which are then compared to the available 2D data. In addition to 3D modal mineralogies, we have examined the geochemistry of fourteen aubrites, including mineral major-element compositions, bulk-rock compositions, and oxygen isotopic compositions to understand their formation and evolution at extreme $fO_2$ conditions. We utilize X-ray computed tomography (XCT) to non-destructively analyze the distribution and abundances of mineral phases in aubrites and locate composite clasts of sulfide grains for future analytical study. In order to better constrain elemental behavior under reduced conditions, we specifically target minerals phases that comprise moderately volatile elements (i.e. oldhamite [CaS], caswellsilverite [$NaCrS_2$] and djerfisherite [$K_6Na(Fe,Cu,Ni)_{25}S_{26}Cl$]) as it has been shown that their geochemical behavior changes as a function of $fO_2$.

Currently, we have produced 3D scans of the Norton County aubrite. The results of the XCT data have allowed for the determination of the abundances of silicate groundmass (i.e., enstatite, forsterite, albite, and diopside), light (based on electron density) sulfides (i.e. alabandite [MnS] and daubréelite [$FeCr_2S_4$]), heavy (based on electron density) sulfides (i.e., troilite [FeS]), and Fe,Ni metal by segmenting a density histogram in *Volume Graphics Studio* software. XCT scans of additional aubrites are underway. By combining the 3D representation of the exotic phases found in aubrites with existing 2D characterizations, we are able to better determine modal abundances. By integrating 3D and 2D modal abundances and geochemistry, we can ultimately better constrain aubrite petrogenesis and elemental partitioning under reduced conditions. Furthermore, application of this new 3D approach offers the opportunity to identify and select clasts for future study prior to cutting the sample, which will minimize sample loss of this precious material.