Investigation of Tissintite Formation and Its Implications for Impact Studies.

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Impact-induced shock pressures and temperatures often result in the formation of mineral phases, with unique properties, observed in meteorite samples. If the stability fields of these phases are known, the presence or absence of these phases can be used to infer upper and lower boundaries to the impact conditions experienced by meteorite samples. The study of high pressure phases observed in meteorites and terrestrial impactites through static and shock experiments are therefore vital to our understanding and interpretation of these samples. Here we present results of our investigation into the formation of the newly discovered phase, tissintite. Tissintite is a clinopyroxene with a calcic-plagioclase composition, (Ca,Na,_)$AlSi_2O_6$, and has been suggested to contain ~25% structural vacancies at the M2 site. According to Ma, et al., 2015, tissintite likely formed within a "Goldilocks Zone", where the P-T-t-X was just right for its formation. Thus, this phase has a high potential to supply strict boundaries to impact conditions if observed within meteorite and terrestrial impact samples. Previous to this study, synthetic tissintite **had** never before been reported.

We performed high-pressure and high temperature experiments coupled with *in-situ* energy dispersive X-ray diffraction measurements at the Advanced Photon Source at Argonne National Laboratory (APS @ ANL) using the large volume multi-anvil press with a D-DIA apparatus installed at beamline 6-BM-B. We used both crystalline and amorphous plagioclase starting material of ~ An60 composition. We have defined the the pressure and temperature range for tissintite formation of An 60 composition to be 4.2 - 8.5 GPa and >1000 C. Samples were recovered as dense pellets and investigated using scanning electron microscopy (SEM) and micro-Raman spectroscopy available at Stony Brook University. Our results suggest tissintite may not be an appropriate indicator for peak pressures, but will aid in our interpretation of the impact timeline (Rucks et al., 2018 *in review*).

References:

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