TISSINTITE FORMATION USING *IN-SITU* SYNCHROTRON-BASED MULTI-ANVIL TECHNIQUES AT BEAMLINE 6-BM-B OF APS AND ITS IMPLICATIONS FOR IMPACT EVENTS.

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The extreme pressures and temperatures induced during an impact event can result in the formation of mineral phases with unique properties and stability fields that can be used to infer upper and lower bounds to impact conditions. Therefore, the study of high-pressure, high-temperature (HP-HT) phases through static and shock experiments is vital to our interpretation of impacts from meteorites and terrestrial impactites. Here we report findings of our investigation of the newly discovered phase, tissintite. Tissintite is a clinopyroxene with a jadeite-type structure, a calcic-plagioclase compositon, and an estimated 25% structural vacancies at the M2 site ($(Ca,Na,\_)AlSi_2O_6$). This phase has been interpreted to form within a tight P-T-t-X "Goldilocks Zone", suggesting the phase's high potential to provide strict constraints on estimates of impact conditions.

We have performed HP-HT experiments coupled with in-situ energy dispersive X-ray diffraction measurements at the Argonne National Laboratory Advanced Photon Source using the large volume multi-anvil press with a D-DIA apparatus available on the 6-BM-B beamline. We used both a crystalline and amorphous plagioclase starting material of An60. The P-T range investigated here is 4.2 – 10 GPa and 1000 – 1350 °C. We used our novel spike heating method where the sample is raised to peak temperature in ~1s and quenched after 5 - 60 seconds. The spike heating protocol was designed to imitate heating and cooling times of large (~1mm) impact melts. The samples were recovered as hard pellets, cut, polished, and then imaged and analyzed using micro-Raman spectroscopic techniques.

Here we have defined the formation conditions of tissintite from an An 60 crystalline and glass precursor to be within ~4 – 9GPa and >1000 C. In previous experiments we observed in-situ formation of tissintite at pressures ranging from 6 – 8.5 GPa and at temperautres of 1000 – 1350 C. In this study, we observed tissintite formation accompanied by garnet and crystalline silica phases at pressures higher than 9.5 GPa. This is indicative of a upper bound for pressure, as the natural occurance of tissintite is found with no coexisting phases. Further, when extending to lower pressures, ~4 GPa, we found no change or tissintite formation within the crystalline starting material. In addition, we observed the crystallization of labradorite in 4 GPa experiments using the amorphous starting material, thus indicating a lower pressure bound for tissintite. These results can be used in meteorite studies to inform on the shock history of host samples.