INVESTIGATION OF TISSINTITE FORMATION USING *IN-SITU* SYNCHROTRON-BASED MULTI-ANVIL TECHNIQUES AT BEAMLINE 6-BM-B OF APS.

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Pressures and temperatures induced during an impact event can give rise to the formation of mineral phases with unique properties. If the stability fields of these phases are determined, the presence of these minerals 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 initial investigation of the newly discovered phase, tissintite, which is a clinopyroxene, Ca-analogue of jadeite, with a calcic-plagioclase composition and ~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 6 – 8 GPa and 1200 – 1350 °C. Two different heating protocols were used: stepped heating by increasing the temperature by 200 °C every 60 seconds, and spike heating to the peak temperature in ~1s and quenched after 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 scanning electron microscopy (SEM) and micro-Raman spectroscopic techniques.

We observed through in-situ X-ray diffraction a jadeite-like structure form during heating in experiments using both crystalline and amorphous material around 1000℃. The Raman spectra collected for our samples are nearly identical to published data for natural tissintite. Based on a comparison of Raman and X-ray diffraction data for known tissintite and our synthetic samples, we have produced a material that matches tissintite.