

LETTER

Making tissintite: Mimicking meteorites in the multi-anvil

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ABSTRACT

Tissintite is a shock-induced, Ca-rich mineral, isostructural to jadeite, observed in several meteorite samples such as the martian shergottite Tissint. It may form within a “Goldilocks Zone,” indicating a potential to provide strict constraints on peak pressure and temperature conditions experienced during impact. Here we present the first laboratory synthesis of tissintite, which was synthesized using a large volume multi-anvil apparatus at conditions ranging from 6–8.5 GPa and 1000–1350 °C. For these experiments, we utilized a novel heating protocol in which we reached impact-relevant temperatures within 1 s and in doing so approximated the temperature-time conditions in a post-shock melt. We have established that heating for impact-relevant timescales is not sufficient to completely transform crystalline labradorite to tissintite at these pressures. Our findings suggest that tissintite forms from amorphous plagioclase during decompression.

Keywords: Tissintite, high-pressure, high-temperature, shock, multi-anvil