

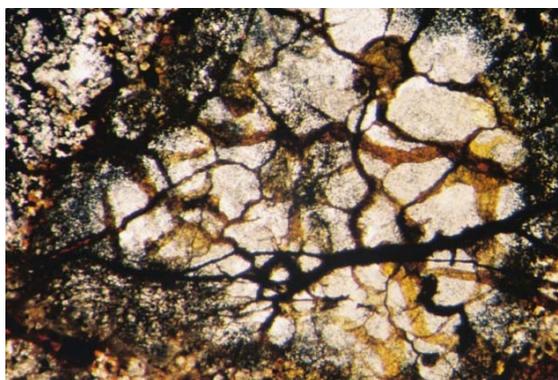
BALLEN SILICA INDICATIVE OF HIGH SHOCK PRESSURES IN THE ANOMALOUS, METAL-RICH LARNED AUBRITE FROM CENTRAL KANSAS, USA.

A. J. Irving¹, T. E. Bunch², S. M. Kuehner¹ and D. Stimpson.
¹Dept. of Earth & Space Sciences, Univ. of Washington Seattle, WA 98195, USA, irving@ess.washington.edu; ²Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011, USA.

Introduction: A large (28.1 kilogram) anomalous aubrite mass (the third largest known aubrite after Norton County and Peña Blanca Spring) was found in the 1970s in central Kansas, and recently made available for detailed study. The relatively high metal content of this specimen (leading to an initial suspicion that it might be a mesosiderite) probably helped preserve it within an Fe-rich, shaley rind composed mostly of greenalite.

Petrography: The specimen is a polymict breccia composed mostly of large metal-poor clasts, but with locally abundant metal in the matrix. The major phase is essentially pure enstatite ($\text{Fs}_{0.1-0.2}\text{Wo}_{0.4-1.1}$, in grains up to 1.2 cm, many exhibiting abundant fractures, mosaicism and PDFs), with accessory diopside ($\text{Fs}_{0.2}\text{Wo}_{0.47}$), schreibersite, sodic plagioclase glass ($\sim\text{Ab}_{79}\text{Or}_{21}$), silica polymorph, Cr-bearing troilite, daubreelite, alabandite, Si-bearing kamacite (Si 1.35-2.2 wt.%, Ni 5.9-6.6 wt.%) and rare taenite (Si 1.1 wt.%, Ni 12.6 wt.%). One 1.4×1.0 mm clast is a websterite composed of 52 vol.% enstatite, 40 vol.% diopside and 8 vol.% schreibersite and sulfides (including an iron sulfide phase compositionally similar to greigite). Secondary (terrestrial) veinlets crosscut the specimen, and are composed of a hydrous iron silicate compositionally similar to greenalite.

Shock Effects: Grains of a silica polymorph exhibiting *ballen structure* occur as inclusions in enstatite and are locally abundant in the matrix. This distinctive textural variety of silica has been described at several impact crater sites [1], and is indicative of shock pressures of 30-55 GPa. Other evidence of high shock pressures include PDFs in pyroxene and the presence of non-stoichiometric feldspathic glass.



Ballen silica in Larned matrix (width of field = 5 mm)

Discussion: In some respects Larned is different from other aubrites [e.g., 2], especially in its unusually high content of metal (possibly of exotic impactor origin), its more abundant silica, and the unusually high degree of shock it has experienced.

References: [1] Ferrière L. et al. 2009. *Eur. J. Mineral.* **21**, 203-217; Okumura T. et al. 2008. *GSA Abstr. Prog.* **40**, 379. [2] Keil K. 2010. *Chemie Erde*, doi: 10.1016/j.chemer.2010.02.002.