

China chrysanthemum stone—retrograde coesite in calcite—evidence of an impact event?

Donald Kasper 6-22-2017

There is a description and picture of a chrysanthemum stone under the section on celestite/celestine on Mindat that reads as follows:

“2008, Michael, C. Roarke, Celestine, Yonghe sepiolite mine, Yinghe, Liuyang Co., Changsha Prefecture, Hunan Province China. 90 x 50 mm specimen of the Celestine variant “chrysanthemum stone”. White Celestine in polished dark metamorphic rock. RFC C1520.”

The Mindat page on chrysanthemum stone reads in part as follows:

“The composition of chrysanthemum stone is variable. Material from the "classic" occurrence at Yonghe in Liuyang County of Hunan Province consists of celestine, but specimens recovered from outcrops of the same strata at other places in the area are mostly mixtures of calcite, chalcedony and minor dolomite which replace earlier celestine (Yan et al., 2001).”

That paper title reads as follows:

“Length-Slow Chalcedony in Chrysanthemum Stone of Chihsia Formation, South China and Its Geological Implications. J Yan, Q Xia, EH Carlson - ACTA SEDIMENTOLOGICA SINICA, 2001 - SCIENCES PRESS”

Let us now stop using guessing based on a look, and use reflectance infrared spectroscopy to study this material. I received a specimen out of China today, buffed it to a good polish, and have scanned it in infrared. Its photo is attached.

The matrix is black. In infrared this is pure calcite. This is not a metamorphic rock. The calcite also has the sulfate mineral alunite. I only have one other specimen of alunite in my collection as this is very rare.

The white lozenge columnar blades have three minerals. There is quartz, muscovite mica, and the high pressure silica polymorph coesite. As coesite is exhumed, there are a number of retrograde reactions that occur. An Alps massif coesite sample I own has kaolinite clay, quartz, muscovite, garnet, and coesite. These are the only two coesite-bearing rocks I have.

Infrared conclusively shows that my specimen contains zero celestite/celestine.

One additional spectral band is unidentified presuming based on its spectral position, it was not atmospheric water noise.

The definition of a coesite is a silica mineral with a 700 cm⁻¹ region doublet. You can see that in the attached spectral graphs, which is diagnostic for coesite.

In reference to the Yan paper, length-slow refers to moganite, of which none was detected in my specimen. Retrograde metamorphism that formed length-slow chalcedony overgrowths on coesite are well documented.

There is also this reference to this material for moganite:

“Length-slow chalcedony in chrysanthemum stone of Chihsia Formation, South China and its geological implications. Y Jiaxin, EHC XiaQiongxia - Acta Sedimentologica Sinica, 2001”

Conclusion:

If confirmed by others, this is the first coesite in a carbonate. A brief check of the literature indicates coesite may come from impact events, and so if this is an impactite, would explain the planar columnar fan structures. These are not pincushion, 3-D crystal structures, they are largely flattened. They also have strange internal zig-zag structures. See, for example this discussion on silica in impactites:

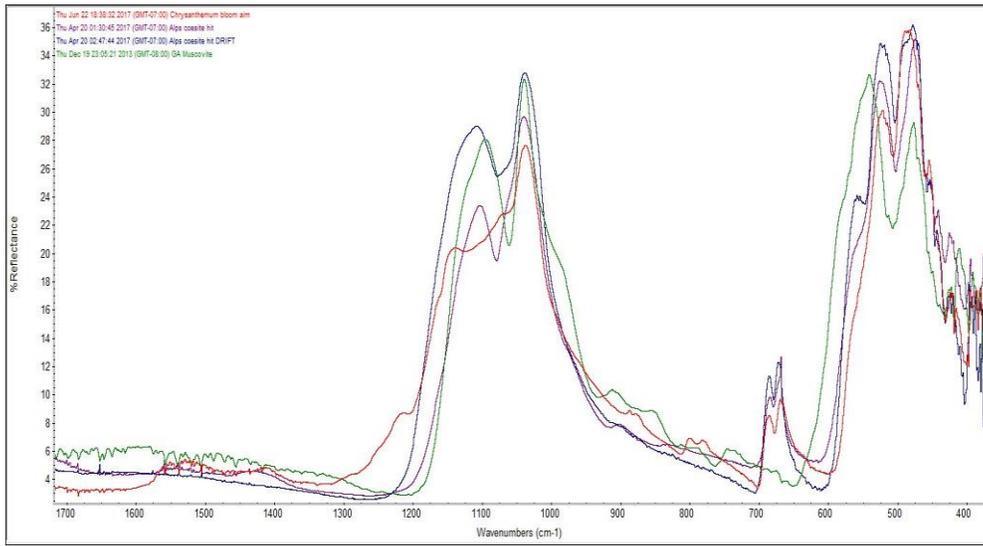
Shock-metamorphic microfeatures in chert from the Jebel Waqf as Suwwan impact structure, Jordan, Martin SCHMIEDER, Wolf Uwe REIMOLD, Elmar BUCHNER, Maria KHIRFAN, Elias SALAMEH, Hani KHOURY, Meteorites and Planetary Science, Volume 46, Issue 4, April 2011, Pages 574–586

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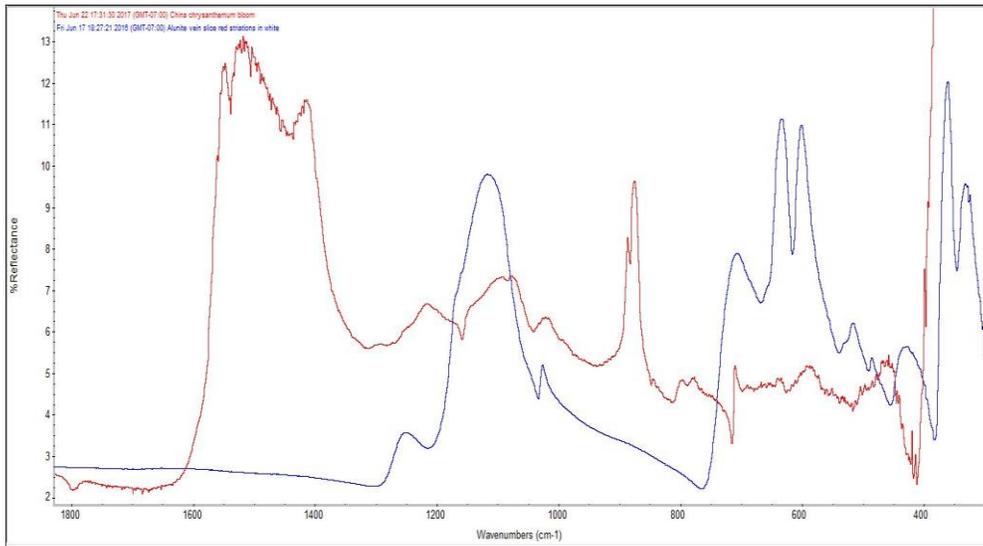


Chrysanthemum stone studied with reflectance infrared.

Graph of Chrysanthemum stone bloom, 2 Alps references, and a Muscovite.
Small and broad peak on the far left is calcite.



Graph of black matrix showing calcite and alunite. Not overlaid is presence of quartz.



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