Is there a universal clumped isotope temperature calibration for all carbonate minerals?

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The carbonate clumped isotope thermometer, based on the measurement of the abundance of ^{18}O-^{16}O bonds in carbonates, is increasingly becoming a popular tool to determine the temperature of formation of various carbonate minerals. This is due to the fact that unlike other thermometers, such as oxygen isotopes or Mg/Ca ratios, it does not require the knowledge of the composition of the fluid from which the carbonate formed. In spite of the fact that a number of calibrations have been published, there is still no general consensus on the temperature dependence of this termometer [1] and on the question if different minerals require mineralogy-specific temperature equations.

In this contribution we present calibrations for calcite, dolomite and siderite produced in the same laboratory with the same analytical and standardisation procedures, and show that all minerals, in agreement with theory, have the same temperature dependence of their clumped isotope composition. However, we find a mineral-specific clumped isotope fractionation during conversion of the different minerals to CO_2 with phosphoric acid. Therefore, to calculate accurate temperatures of formation for calcite, dolomite and siderite from clumped isotopes, it is necessary to use mineral-specific fractionation equations.

[1] Fernandez *et al.* (2017) Geochem. Geophys. Geosys. 18 https://doi.org/10.1002/2017GC007106