

Comments on Koltai et al (cp-2017-100) by Ian Fairchild

Overview

This paper brings a little-studied type of speleothem site to the attention of the readership. Other such sites may have been overlooked up to now, but offer some interesting possibilities for palaeoclimate work particularly in areas where carbonate rocks are lacking. The likelihood of obtaining good-quality dates owing to the high U content of groundwater is a particularly attractive feature.

The authors have worked on an interesting site where speleothem deposits occur in non-carbonate fractured bedrocks, building on some previous publications at this site. The strengths of the current paper are 1) the large number of good U-Th dates demonstrating periods of overlapping growth, 2) the discussion of the relationship between mineralogy and isotope geochemistry and lack of relationship of mineralogy to growth period and 3) documentation of the extent to which the combined dataset reproduces known isotopic shifts in the Alpine region. As a result, the authors provide a balanced, cautiously optimistic view of the potential of such non-carbonate bedrock sites for future palaeoclimate work. The work is very well-presented for the most part, although a few suggestions for minor change are made below.

Relationship with water chemistry

Spötl et al. (2002) presented some water analyses from the study area. The water are said to be highly mineralised. Can more discussion be drawn from those data about the likely conditions of growth of the fracture-fills, e.g. Ionic strength, Mg/Ca, oxidation state, supersaturation etc?

Macroscopic nature of the precipitates

I think it would be helpful for readers looking for analogous occurrences elsewhere to provide a figure with macroscopic images of the vein-lining deposits and to describe and comment on features at this spatial scale.

Secondary calcite

P4, lines 9-10 and Figure 2. I could not see why this calcite couldn't be primary from the information provided. If it has straight extinction rather than undulose extinction that might be a criterion (as would a low Mg content).

Stable isotope compositions

1. P6, lines 13-14. Carbonate isotopes are primarily interpreted as a proxy for isotopic composition of atmospheric precipitation, but temperature changes in the 13-10 ka intervals surely may have been sufficient to have influenced the composition of calcite too?
2. The relationship between carbon and oxygen isotopes in some samples is for a strong covariation, but the slope is not mentioned in the text. Carbon isotopes change much more than oxygen. Needs a bit more discussion, including ideas of Hansen et al (GCA, 2017) of which Spötl is a co-author. Could there be some equilibration effects here?
3. The discussion properly considers potential differences amongst the conditions in which aragonite and calcite form.
 - a) However, the two phases are not distinguished in the crossplots of Figure 3 and I think it would be helpful to do this.

- b) I also think that the data for the other samples should also be cross-plotted to illustrate more clearly the variation in the extent of covariation.
- c) LAS34 is shown in Fig. 3, but ages are not plotted in a figure – the reason for this is apparently not referred to in the text.

Suggested minor corrections

P1, Line 23. The words: “by yielding high-resolution, multi-proxy data” are redundant. By no means all of the iconic records are multiproxy or high-resolution.

P2, line 20 “E-W” is conventional, not “W-E”

P2, line 24 To avoid repetition of the word *valley* in “the deglaciation of the valley”, how about “local deglaciation”.

P2, line 29. Reference to “highly mineralised”. More details would be useful.

P3, line 27. “chemical” rather than “chemistry”

P4, line 5” detritus-rich” not “detrital-rich”

P4, line 6 “however” requires a semi-colon before it and does not need the comma afterwards. Alternatively substitute “but”.

P4, line 7. “thick” not “wide”. [the habit of some authors of referring to the “width” of layers comes from the dendroclimatological literature, but the geometry of tree rings is different]

P4, lines 29-30. “enriched” and “depleted” Higher and lower delta values are meant. [see Sharp (2007)!]

P4, lines 33-34. The actual slope of the regression lines is not mentioned. Carbon isotopes changes much more than oxygen.

P6, line 8 “springs”

Figure 1. Neither this figure nor the text mention the altitude of the site or specify its precise location.

Figure 2. This figure (part c) does not make it clear why the secondary calcite cannot be primary since simultaneous growth of aragonite and calcite is also shown elsewhere.

Figure 4, caption. Superscript needed: ²³⁰Th

Figure 5 has references to colour, but these need to be made more explicit for the colour-blind. Add a background shade for the aragonitic sample, as in Figures 4 and 6.

Figure 6 reference to colour in the caption should be supplemented by writing the name of the sample next to the plots on the figure itself.

Supplementary information

Supplementary table 1. Excessive significant figures for ²³⁸U and ²³⁰Th/²³²Th ratios?

It would be useful to present the STALAGE age models graphically in the supplementary information

