Geochronology Discuss.,
https://doi.org/10.5194/gchron-2020-19-AC2, 2020

Interactive comment on "Towards *in-situ* U–Pb dating of dolomites" *by* Bar Elisha et al.

Bar Elisha et al.

brelisha@gmail.com

Received and published: 1 September 2020

We thank the reviewer for his comments and suggestions for improving this manuscript. Please find our responses for each comment.

Comment: " I don't really understand the interest of REE, which don't bring much to the discussion. The spectra are identical to each other, and close to those expected for marine carbonates. I suggest to remove that part."

Response: Perhaps the only take-home message of the REE data is that despite the similarity in their patterns, the relatively high REE content of some of the samples is indicative for high common-Pb values and therefore lower chances for U-Pb analysis to be successful. REE analysis in carbonates can be easily done and can help to screen out samples with high common Pb. We will refine that point.

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Discussion paper

Comment: "Also, it would be nice to have higher magnifications for thin section photomicrographs (not “photomicrographic”) (Figure 1), as any detail can be hardly seen here."

Response: We will provide higher magnification of thin section photomicrographs and correct the text accordingly.

Comment: "...I am wondering why there are so much difference in the calcite/dolomite ratios calculated between XRD and EBSD?..."

Response: This is a very good question that we are not quite sure about the answer to. We speculate that the crystallographic parameters used in EBSD interpretation programs are different from those in XRD.

Comment: "Did you perform simple analyses such as optical cathodoluminescence (CL)? This can be useful to detect several cement generations or recrystallization events on a single carbonate sample, and can be done easily in all Earth science labs."

Response: We agree and will provide CL images of the samples in the revised version of our paper.

Comment: "...Have you tried to make spot analyses on polished slabs instead of thin sections?"

Response: We did not try spot analyses on polished slabs, only on 100 μm thick sections; we expect thick sections and polished slab to respond similarly to incoming laser radiation.

Comment: "...It can be expected to find ages younger than the stratigraphic age (as you also mention in the text). This does not mean that age is wrong, the question being to know which event is dated in a complex geological history..."

Response: Perhaps we did not clarify this properly in the text. For the non-stratigraphic

ages we argue that the date may truly represent the age of a geologic event, but it can also be a mixture of stratigraphic age and an unknown, much younger age related to a dolomitization event. In such a case, one would expect to observe several isochrons superimposed one another as we noted.

Comment: "I don't know if you have analyzed other dolomite samples than those presented here, but you only present results on micritic or sparitic dolomites which clearly have, according to your EBSD analyses, complex histories involving the presence of mixed calcite / dolomite mineralogy."

Response: Several of our samples (MU-1/2) were previously described in a Science paper as primary dolomite (or as syngenetic/penecontemporaneous, i.e. forming by diagenetic replacement of limestone immediately after the deposition of the stratum), and yet, some of the samples did not give stratigraphic age.

Comment: "TW plots: I read on the figures that you always have positive error correlations. I would expect to have also negative ones, notably in a TW diagram?"

Response: This is an interesting point; error correlations in LA data are difficult to assess because of the method by which uncertainties are propagated. Nevertheless, we calculate error correlations following Schimdtz and Schoene, 2007.

Other comments on the text will be addressed accordingly.

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