

Interactive comment on “Authigenic formation of Ca-Mg carbonates in the shallow alkaline Lake Neusiedl, Austria” by Dario Fussmann et al.

Anonymous Referee #2

Received and published: 21 December 2019

This study reports the results of a comprehensive analysis of the chemistry, mineralogy and microbiology of lakewater and sediments in Neusiedlersee, a rather special lake regarding both its physical features (very shallow for its large surface area, no natural outlet, half of it covered by reed) and geochemistry (rather salty and alkaline, with extremely high Mg/Ca ratios). Since the formation of dolomite (or dolomite-like carbonates) have been reported long ago from the lake, the topic is important for getting a better grip on freshwater dolomite formation.

In addition, for the first time, the authors go beyond studying the minerals and chemistry, and provide a detailed characterization of the microbial communities both in water and sediments. To my knowledge, it is also a first that geochemical and mineralogical data are available at high spatial (depth) resolution from the sediment of this lake. In

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this sense, the study is also important for a general understanding of what is happening in the mud of shallow, alkaline lakes.

The study is very carefully designed and executed, and the results and their discussion are fully backed up by the data that are reported meticulously. Some of the results are quite surprising: no aragonite is detected even though it should form under these conditions and, contrary to previous and widely held views that dolomitization takes place in the sediment, the findings suggest that high-magnesian carbonates form in the water body. The results raise the possibility of partial dissolution in the sediment and reprecipitation in the water, when particles are stirred up by winds. The authors also point out the significance of fluctuations in pH and water chemistry as possible drivers of changes in the amount of Mg that can be incorporated into the precipitating carbonates.

In summary, this is an interesting and very carefully executed study that deserves to be published in *Bigeosciences*, after minor corrections.

I have no substantial concerns regarding the scientific content (with one exception: I agree with Anonymous Referee #1 comments about dolomite ordering reflections and the possible presence of dolomite - since this issue is put forward in detail by the Referee, I do not repeat it here). Some minor, editorial comments are below.

55: put comma after "(Zhang et al., 2013b)"

60: lower case after full stop

71: "interface characterized by varying..."

67-77: I think the statement about breaking Ostwald's step rule needs some explanation.

90: put comma after citation

92: "which addresses" is inconsistent with the subjective of the sentence

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118: “315 km²” (exponential missing)

121: “comparison”

132: “km²”

140: delete comma after “noteworthy”

143: “the thickness of soft sediment.”

305: “Notably, neither authigenic Ca-Mg carbonate phase shows any. . .”

308-313, Figure 2 caption, occurring 3 times: instead of “polarized light”, it should be “under crossed polars” or a similar phrase, since probably the left-hand images were also taken in polarized light (but without the analyzer).

378: I do not understand what “dolomite d” refers to.

443: “but the for..” is strange, please reword the sentence

453-466: This is an interesting discussion about dissolved silica. Is there a chance that clay minerals (such as smectite) can precipitate in situ?

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