

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

Dario Fussmann et al.

dario.fussmann@uni-goettingen.de

Received and published: 31 January 2020

Dear anonymous Referee #1,

we thank you for the clear and thorough review. The authors agree that the displayed XRD Spectra do not provide unequivocal evidence regarding a possible cation ordering of the VHMC phase. However, the supposed 01.5 dolomite ordering peak in figure 6 rather belongs to phyllosilicate phases like muscovite and illite. Furthermore, the 10.1 reflection belongs to Ca-Na feldspar phases. To support this statement, an excel file with XY-Processed XRD data and a figure with peaks of abundant mineral phases is added to the digital supplement folder. Nevertheless, as the sediment-powder spectra include a certain amount of noise, a “non-stoichiometric-dolomite” as defined by Sibley

Printer-friendly version

Discussion paper



et al. (1994) cannot be fully excluded in this study.

Page 9, lines 294-306: What was the criterion to determine that the precipitate was VHMC and not dolomite? Authors claim that due to the shift of 10.4 peak of ordered dolomite, lake sediments are VHMC. However, non-stoichiometric ordered dolomites also occur in nature, showing a shift of 10.4 for lower 2θ values (if Ca mole > 50%) or for higher 2θ values (if Ca mole < 50%).

Reply: The authors agree that the shift of the 10.4 peak alone is not evidence enough to prove the absence of dolomite. A new figure, added to the digital supplement folder, indicates all identified mineral peaks. In this figure, no superstructural ordering peak of dolomite is observed.

Page 13, figure 6: Looking at this figure, where authors marked the position of dolomite “ordering peaks”, one might think that samples have dolomite. As can be seen in both diffractograms, dolomite ordering peaks (i.e., 10.1 and 01.5) seem to be present, indicating that order dolomite can be found on the lake sediments. Could those peaks belong to other phases? A complete list of identified diffraction peaks could be provided in the supplementary material to demonstrate that such peaks do not belong to dolomite. In figure caption should be indicated that such list can be found in supplementary material.

Reply: An excel file with XY processed XRD data and a figure with peaks of abundant mineral phases has been added. It clearly shows that the peaks found at 22 and 35° 2θ belong to detrital phyllosilicates (muscovite, illite) and Ca-Na feldspar (anorthite), but do not represent the dolomite ordering peaks 10.1 and 01.5.

Page 13, caption figure 6: Please change “Positions of dolomite ordering peaks...” for “Position of ordered dolomite peaks...” or “Position of dolomite peaks...”. Ordering peaks are the superstructure peaks, i.e., those that are present in dolomite diffractograms but not in calcite diffractograms. Such peaks are reflections with $h0.l$ and $0k.l$, with odd-numbered l (Lippmann, 1973).

BGD

Interactive
comment

Printer-friendly version

Discussion paper



Reply: Caption is now changed to “Position of dolomite peaks. . .”

Page 25, lines 582-590: What are daily and/or seasonal pH variations of the lake? Deelman (1999) performed experiments with variations of pH from 6 (CO₂ bubbling) to 8 (degas) and during degasification process solutions were kept at 38°C. Changes on these conditions can result in longer times for dolomite precipitation. Interestingly, recent papers claim that dolomite formation could require several million years (Zohdier et al., 2014; Kell-Duivesteyn et al., 2019). In other words, dolomite could be found in deeper sediments of Lake Neusiedl. Did authors analyse deeper sediments? If not, I hope authors will continue to investigate this interesting lake in the future

Reply: The statement about fluctuating hydrochemical conditions is based upon observations by Wolfram and Herzig (2013), who processed monitoring data obtained by the “Biologische Station Neusiedler See”. These authors noticed temperature and pH changes during the winter months. They provide a mean value of 8.8 for the years 1998-2009 and mention fluctuations between annual pH values of 8.0-9.1. Unfortunately, Wolfram and Herzig did not publish the processed monitoring data set. Nevertheless, the attached table ("figure-2.pdf) provides examples of accessible pH data, which were taken in the open water of Lake Neusiedl. These data e. g. show a pH difference of 0.6 (8.5-9.1) within the year 1959.

On the one hand, the authors did not analyze deeper sediments of Lake Neusiedl, because the unconsolidated, lacustrine mud is placed directly upon coarse, semi-consolidated Pannonian strata (Loisl et al., 2018). The latter substrate was simply too hard to penetrate with the applied coring method. On the other hand, Lake Neusiedl is only of Holocene age and its sedimentary record thus comprises approximately 13000 years (Herzig and Dokulil, 2001). Based on this fact, deeper authigenic sediments and longer precipitation- or maturation times of Ca-Mg-carbonates to dolomite, as mentioned by Zohdi et al. (2014) can be excluded in this study.

BGD

Interactive
comment

Printer-friendly version

Discussion paper



References:

- Dinka, M., Über die regionalen wasserchemischen Verschiedenheiten des ungarischen Seeteil im Neusiedler See, BFB-Bericht, 79, 31-39, 1993
- Dinka, M., Ágoston-Szabó, E., Berczik, Á. and Kutrucz, G.: Influence of water level fluctuation on the spatial dynamic of the water chemistry at lake Ferto/Neusiedler See, *Limnologica*, 34, 1-2, [https://doi.org/10.1016/s0075-9511\(04\)80021-5](https://doi.org/10.1016/s0075-9511(04)80021-5), 2004
- Herzig, A., and Dokulil, M.: Neusiedler See - ein Steppensee in Europa., in: *Ökologie und Schutz von Seen.*, edited by: Dokulil, M., Hamm, A., and Kohl, J.-G., Facultas-Universitäts-Verlag, Wien, 401, 2001
- Loisl, J., Tari, G., Draganits, E., Zámolyi, A. and Gjerazi, I.: High-resolution seismic reflection data acquisition and interpretation, Lake Neusiedl, Austria, northwest Pannonian Basin, *Interpretation*, 6, 1, <https://doi.org/10.1190/int-2017-0086.1>, 2018
- Schroll, E. and Wieden, P.: Eine rezente Bildung von Dolomit im Schlamm des Neusiedler Sees, *Tschermaks mineralogische und petrographische Mitteilungen*, 7, 286, <https://doi.org/10.1007/bf01127917>, 1960
- Sibley, D.F., Nordeng, S.H. and Borkowski, M.L.: Dolomitization kinetics of hydrothermal bombs and natural settings. *Journal of Sedimentary Research*, 64, 3a, <https://doi.org/10.1306/d4267e29-2b26-11d7-8648000102c1865d>, 1994
- Stehlik, A., *Österr. Akad. Wiss. Math-Naturwiss. Kl. Sitzungsber., Abt I*, 180, 8-10, 1972
- Stehlik, A., *Biolog. Fosch. Stat. Neusiedersee*, BFB-Bericht, 13, 1976
- Wolfram, G. and Herzig, A.: Nährstoffbilanz Neusiedler See. *Wiener Mitteilungen*, 228, 317-338, 2013
- Zohdi, A., Moallemi, S. A., Moussavi-Harami, R., Mahboudi, A., Richter, D. K., Geske, A., Nickandish, A. A., Immenhauser, A.: Shallow burial dolomitization of

BGD

Interactive
comment

Printer-friendly version

Discussion paper



an Eocene carbonate platform, southeast Zagros Basin, Iran. *GeoArabia*, 19, 4, <https://doi.org/10.1007/s10347-014-0423-3>, 2014

Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2019-449/bg-2019-449-AC1-supplement.zip>

Interactive comment on *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2019-449>, 2019.

BGD

Interactive
comment

Printer-friendly version

Discussion paper



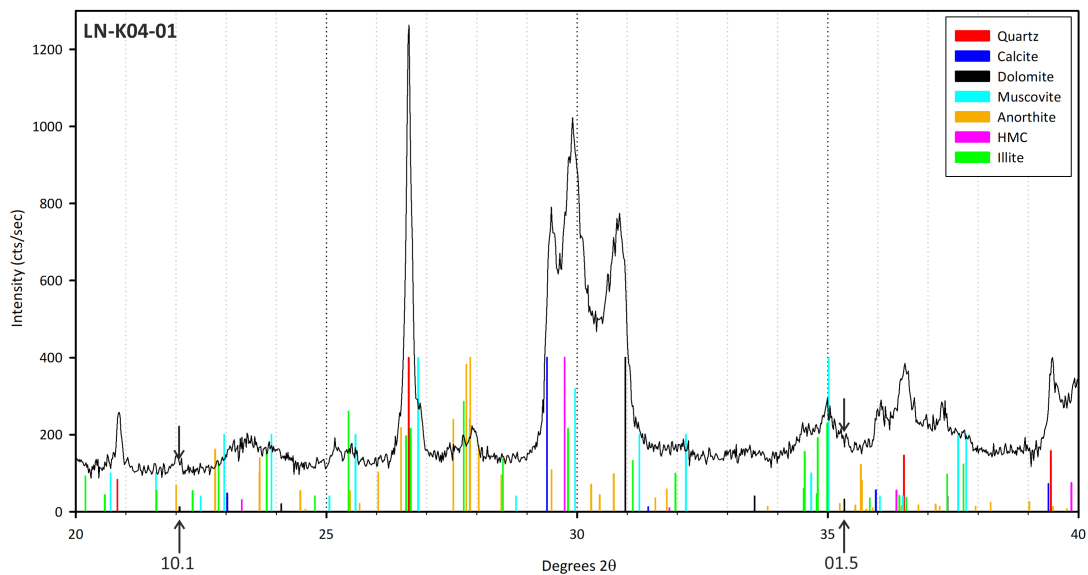


Fig. 1.

Printer-friendly version

Discussion paper



pH	Date [month/year]	Data type	Reference
8.8	1958	annual mean	Schroll and Wieden (1959)
8.8	09/1958	single value	Stehlik (1972)
8.75	12/1958	single value	Stehlik (1972)
8.5	02/1959	single value	Stehlik (1972)
8.97	07/1959	single value	Stehlik (1972)
9.0	09/1959	single value	Stehlik (1972)
8.9	10/1959	single value	Stehlik (1972)
9.1	11/1959	single value	Stehlik (1972)
8.7	06/1970	single value	Stehlik (1972)
8.63	12/1971	single value	Stehlik (1976)
8.44	12/1972	single value	Stehlik (1976)
8.62	02/1974	single value	Stehlik (1976)
8.7	11/1974	single value	Stehlik (1976)
9.0	07/1991	single value	Dinka (1993)
8.9	08/1991	single value	Dinka (1993)
8.5	07/1994	single value	Dinka et al., (2004)
8.1	07/1996	single value	Dinka et al., (2004)
9.5	07/2002	single value	Dinka et al., (2004)
8.7	1998-2009	mean value from 11 annual means	Wolfram and Herzig (2013)
9.02	08/2017	single value	this study

[Printer-friendly version](#)

[Discussion paper](#)

