

Interactive comment on “Biogeochemical processes controlling density stratification in an iron-meromictic lake” by E. Nixdorf and B. Boehrer

Anonymous Referee #2

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General comments

The paper is about an interesting novel approach to evaluate density gradients in iron-meromictic lakes by the relatively simple method of using data of electrical conductivity. The authors combine findings from a long-term lake monitoring with results from a mesocosm lab experiment that aimed at imitating the chemical processes that occur in the chemocline of the lake. Emphasis of the study is on the chemical processes related to iron, the formation of iron hydroxides, their precipitation and re-dissolution as reflected by the electrical conductivity.

Despite the fact that the geochemical processes occurring in iron-meromictic lakes are already well known and extensively discussed by the authors, the paper is a valuable

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contribution to new methodological pathways in limnological research on meromictic lakes and the understanding of iron-related processes occurring in different layers and especially within the chemocline. Herewith, it addresses relevant scientific questions within the scope of HESS and presents a novel concept that enables substantial conclusions. However, some revisions are necessary to improve the overall quality and to specify findings.

Specific comments

The title of the paper seems to reflect the content not adequately. The research did not focus on the understanding of the (already known) biogeochemical processes but on the effects of these processes on electrical conductivity as an expression of water density in the different layers of meromictic lakes. The prominent part of the title should address this aspect. The same discrepancy is also felt when comparing the abstract with the main paper.

The introduction is not well structured. The contents of the first paragraph is repeated in the following paragraphs. It can be deleted without loss of information. The second paragraph starts to describe the formation of meromictic lakes followed by a paragraph referred to the distribution of meromictic lakes and returning to the background of their formation in the fourth and fifth paragraph.

Chapter 2 should be arranged in another way. Whereas subchapters 1 and 2 can form the description of the study site, subchapter 2.3 should become part of the following methodology chapter (chapter 3). Table 1 does not provide significant information. It may be not necessary. Some of the information can be added to the text. It does not become clear if the authors considered different species of iron.

In the result chapter (chapter 4), some data could be presented more precisely. Especially figure 4 seems to need a revision. The figure would be more clearly with a real time scale on the x-axis. The breaks in the measurements should become visible. Furthermore, it would be useful to compare the rates of the decrease in conductivity

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in certain periods of the experiment to evaluate if the formation of iron precipitates is a steady process or if different steps occur.

In the last paragraph of chapter 4.1 the authors describe “elevated values of electrical conductivity . . . towards the end of the experiment near the bottom” by referring to figure 5. This does not become visible from the figure that shows a permanent slight decrease in the whole lower water layer during the experiment.

It would be interesting to test if the assumptions drawn from the experiment results and lake measurements could be confirmed by geochemical modelling. This would also allow a more reliable assumption for the interpretation of the carbon data (chapter 4.2).

The conclusions expressed in the first paragraph of chapter 4.3 have to be proved by statistical analyses.

The chapter entitled “Conclusions” more resembles a “Summary” than what can be expected from conclusions. It should be renamed or be revised.

Technical corrections

The authors should call their research lake always “Waldsee” as in the abstract and not “Lake Waldsee” (due to doubling of the term “lake”).

Does the lake originate from surface (abstract) or underground mining (chapter 2.1)?

Figure 2 is far too small. It is not possible to read the different legends.

Figure 4: 06/25 measurement has to be placed as third bar instead of sixths.

Figure 5: Same depth scale from bottom to surface should be used as in figure 4.

Figure 6: enlarge for better readability.

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