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Biogeosciences Discussions

Interactive comment on "Influence of bioturbation on the biogeochemistry of the sediment in the littoral zone of an acidic mine pit lake" *by* S. Lagauzère et al.

Anonymous Referee #1

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Comments on the manuscript: Influence of bioturbation on the biogeochemistry of the sediment in the littoral zone of an acidic mine pit lake by Sandra Lagauzère et al.

General comments The authors investigate the influence of acid-resistant chironomid larvae on the biogeochemistry of littoral sediments in acidic mine pit lakes. They use a short-term laboratory experiment to measure larvae-induced changes in oxygen dynamics and iron cycling in sediment microcosms. Major findings include that the chironomids stimulate oxygen consumption and mineralisation of organic matter in the sediment. The larvae's effects on iron cycling are complex and include changes in oxidation and reduction rates of iron, abundance of iron-oxidising bacteria, and rates

of mineral formation. However, the net outcome of these effects is that the exchange of iron between sediment and water is not affected by chironomid larvae. The authors conclude that chironomid larvae will not affect the acidity status of the lake through altered iron cycling. The subject of the manuscript is timely, interesting, and suitable for Biogeosciences. To my knowledge, the bioturbation effects of Chironomus crassimanus have not been investigated before; and bioturbation studies in acidic aquatic environments are extremely rare. The methods used are appropriate (but see specific comments below), the manuscript is generally well written and the findings are discussed in the right (literature) context. Presentation of data is fine (but see technical comments below). What else can I say? Years ago I tried to study the bioturbation effects by C. crassimanus - and failed. Now these authors were a lot more successful: Congratulations!

Specific comments P7369 L10ff.: Here and elsewhere: I think you have to make perfectly clear to the reader that part of your data set deals with solute distribution within the sediment, while another part deals with total solute fluxes between sediment and water. Your microsensor profiles, for instance, only represent oxygen distribution across the sediment-water interface and within the sediment. Nevertheless, the larvae may not only affect DOU (diffusive oxygen uptake) that you calculated from the concentration profiles, but also TOU (total oxygen uptake) that includes the oxygen exchange inside the irrigated burrows, which you didn't measure. Please, mention this discrepancy here and in the Discussion. Other examples: The nutrient (or metal) concentrations presented in Figure 2 are the result of total fluxes of these solutes between the sediment including animal burrows and the water column, whereas the ferrous/ferric iron concentrations presented in Figure 4 represent the solute distribution within the sediment only. Of course, you can calculate local rates and then depth-integrated rates from such solute distributions in the sediment (if in steady state), but the obtained rates might considerably differ from total fluxes between sediment including animal burrows and the water column. You correctly call C. crassimanus a typical bioirrigator and therefore you should - whenever necessary - discuss your findings (the total sediment-water

fluxes vs. the depth-integrated rates) in exactly this context. A last comment on this issue: The microsensor profiles and the DET profiles may also represent something slightly different: In the ideal case, a microsensor profile does not intersect a burrow and does not even come close to a burrow, whereas a DET profile may well integrate information from far away and close to several animal burrows due to the larger "diameter" of the probe. In the worst case, there might even be preferential burrowing directly adjacent to the DET probe, a phenomenon often observed at the wall of sediment microcosms. I think that this difference between microsensor and DET probes should be mentioned in your manuscript. P7365 L8: What was the diameter of the luminophores? P7366 L10: When exactly were the DET probes inserted and what was their total exposure time in the sediment? P7369 L10ff.: You don't explicitly mention that burrows were avoided during microsensor profiling. Did you never intersect irrigated burrows during the microsensor measurements? This would surprise me.

Technical comments Title: Can the title be shortened a bit? E.g., "biogeochemistry of littoral sediments of an acidic mine pit lake". Page 7361, Line 19: "extent" P7361 L21: "development of such lakes" is a bit vague. Development in what respect and towards which final state? P7361 L22: "among by other parameters" might be correct, but still sounds awkward to me. P7362 L28: "Rodriguez" P7363 L9: Is Lusatia really in South-Eastern Germany? I would say that Bavaria is located in South-Eastern Germany and Lusatia in Eastern Germany. ïĄŁ P7363 L25: "3rd and 4th instar larvae" or "individuals in the 3rd and 4th larval stage" P7370 L8: I think the term "suboxic" is reserved for the zone between the bottom end of the oxic zone and the upper end of the sulfidic zone. P7372 L15: In this sentence you specifically refer to your acidic lake; please, include this information in the sentence. P7372 L25: the larvae "stayed" in their tubes P7373 L4: "Stief et al." P7373 L15: What do mean by writing "reliable"? P7374 L16: "magnetite" P7374 L20: Maybe turn around this sentence by writing "Mn-oxides can oxidize Fe2+"? P7376 L16: The water was well oxygenated in your experiments, but maybe not in the littoral zone of your study lake. Earlier you wrote that the larvae constructed chimneys in the lake in response to oxygen shortage. Can you please comment on

this? P7377 L8: The old discussion "bioturbation vs. bioirrigation" may have to be revived here. You relate the release of nutrients from the sediment into the water column to the bioturbation activity of the larvae, but isn't it much more related to the bioirrigation activity of the larvae? P7377 L19: "mobilization of adsorbed phosphorus" P7377 L20: "the phosphorus flux remains a matter of controversy" Table 1: It is more common to write NH4-N instead of N-NH4 (and NO3-N instead of N-NO3). Figure 2: Color code: Intuitively, I would expect an open symbol for the sediment cores without larvae, a shaded symbol for cores with intermediate larval abundance, and a filled symbol for cores with high larval abundance. Figure 2: Some of the axes are dotted, while others are not. Meaning? Figure 3: You don't mention PROFILE 1.0 in the legend of Figure 3 (see Figure 4).

Interactive comment on Biogeosciences Discuss., 7, 7359, 2010.