

Biogeosciences Discuss., referee comment RC3
<https://doi.org/10.5194/bg-2021-244-RC3>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Review of Humphreys et al

John Pohlman (Referee)

Referee comment on "Dissolution of a submarine carbonate platform by a submerged lake of acidic seawater" by Matthew P. Humphreys et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-244-RC3>, 2021

The study by Humphreys et al is a geochemical investigation of water masses in several sinkholes on the Saba Bank. The authors seek to identify the process that control the chemistry of the waters and relate those to the formation of the sinkhole. There is a lot going on with respect to where the waters originate, how they are altered during their migration through the platform and how waters move from one sinkhole to the other. Multibeam surveys are used to identify gas seeps and density layers. Sensors characterize the physicochemical properties of the water masses, and the analysis of total inorganic carbon, alkalinity, nutrients and silica are carefully integrated to attribute the sources of carbon and dissolution dynamics. Beyond being able to explain how material is transported and altered locally, the key contribution of this study is that they describe a novel mechanism for sinkhole creation that does not involve mixing or meteoric and seawater or sea-level oscillations. In this case, a geologic source of CO₂ is entering the bottom of one of the sinkholes that creates a corrosive solution. The evidence in support of that is very convincing, and their speculation that this may have formed other sinkholes in the area reasonable. To what extent this process is important on a larger scale is unknown. I also appreciate the significance of finding a body of low pH water that may be used as an analog of a more acidic ocean. Indeed this might be a great natural laboratory for such studies.

The paper is well written and thoughtful. With only a few suggested edits and comments, this paper is ready to go. One general recommendation is that calling the deeper portion of Sinkhole N an "acid lake" may be an exaggeration. While a pH of 6.4 is technically acidic, the acidity is very mild.

Specific Comments and Edits:

Line 14: The sentence about how sinkholes are thought to form does not include the

importance of sea-level low stands. A slight edit to incorporate the effect of that process would be helpful.

Line 16: I would have "effects" to "products." I don't think effects accumulate. Products do. Sounds better to me at least.

Line 17: Just say the studies provide insight...aren't all insights new? It sounds less grandiose.

Line 157: Consider adding the OM respiration equation so the stoichiometric ratios are more palpable.

Line 185: Express the volume of the sinkhole as m³ rather than km³. I think most people can visualize that better.

I do not think much more than that needs to be said. This is an excellent paper that I think a lot of people will enjoy reading. Thank you for the opportunity to review it.