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Interactive comment on "Formation and origin of Fe-Si oxyhydroxide deposits at the ultra-slow spreading Southwest Indian Ridge" *by* Kaiwen Ta et al.

Anonymous Referee #1

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The manuscript by Kaiwen Ta et al. presents a rather exhaustive panoply of analytical techniques performed on samples from six exhalative Fe-Si deposits collected during a cruise in the SW Indian Ridge. The authors conclude that their analysis show that these deposits are of low temperature, mainly made of Fe-Si and that there is a strong biological influence in their formation. They also present Sr-Nd-Pb isotope that seem to support their conclusions. The topic can be of major interest for the readers of Biogeosciences. However, my opinion is that the manuscript needs major and complete rewritting before being considered for publication – is too repetitive, phrases are vague and is not clearly shown what these techniques really add to the state of the art. Writing is extremely repetitive and the text should be checked by an English-speaking specialist. Also, I have the feeling that the authors have used different exciting and novel techniques but without having a clear focus in what they try to show. I would suggest to careful evaluate if the use of these techniques adds something to the interpretation of these rocks that could well easily done with some basic geology and a conventional petrographic-chemical analysis. Finally, I have serious doubts that the authors are able to prove that these structures found in the iron oxydehydroxyde deposits and silica precipitates represent fossilized microbes despite your are within the life thermal window. By aware that inorganic silica growth, just an example, can mask organic textures (see, for example, Garcia Ruiz et al 2017, Science). For being sure that these structures represent past organic activity you must show TEM images and/or some stable isotopes indicative of biogenic-promoted redox equilibria. If in active sites, you should try some geomicrobiological studies. Finally, all the radiogenic isotope geochemistry needs some reinterpretation. Pb isotopes are not just indicative of major hydrothermal activity -that is saying nothing in terms of radiogenic isotope geochemistry. The statement that Sr-Nd isotopes "were closely related to interaction between hydrothermal fluids and seawater" is also ambiguous. Obviously, there must a significant part of the Sr inherited from seawater but the hydrothermal fluids must transport some also. Nd is unlikely to be derived from seawater and perhaps the Nd isotope signature should be controlled by the hydrothermal fluid – mixing diagrams are fundamental for this discussion. But a key unresolved question is where the deep fluids come from? Probably they are equilibrated with oceanic crust but this needs to be discussed. Please check ambiguous phrases such as "appropriate solvent" or be aware of the analytical error when quoting stable isotopes – you cannot go to the second decimal. Also, you cannot go to the second!! decimal when calculating isotope temperatures. Errors here are usually above $\pm 20^{\circ}$C. You have to explain how this was calculated. The same holds true for Pb isotopes. . . 4th decimal!! Please, have all these data checked by an specialist in isotope geochemistry. You say that positive eNd values are indicative of a mantle derivation – that is ok but you can say a lot more with your data. And what about the negative values? Your reservoir looks really heterogeneous and this ample range of eNd values need to be discussed. The same for Sr isotopes. Your range of data is extremely variable, is not a “slight variation” going from 0.7079 to 0.7091 and you need to explain this – not done in the manuscript. Also, you are talking about oxidized systems and you quote pyrite by XRD. How abundant is the pyrite? Where it is located? Is it the primary mineral that has been extensively oxidized? Or pyrite is just a local precipitate in a more anoxic setting? The low S contents today do not prove that these rocks were originally precipitated as sulphide rocks and later being oxidized. You must have stronger arguments. These questions need to be solved by just careful observations before performing a batch of uncontrolled analytical techniques. Also, you must try to interpret all your results, even if contradictory, not just some of them. Unless you unambiguously prove direct or indirectly, that the structures are microbial the major conclusions of the paper should be considered just an attractive but plausible hypothesis. Don’t go too far into speculative conclusions before being sure of that. The discussion needs to be completely rewritten but probably the aforementioned aspects need to be solved before getting into a thoughtful review.

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