

## **Authors responses to referee's comments.**

### **Interactive comment on "Extant shore-platform stromatolite (SPS) assemblage" by Alan Smith et al. Anonymous Referee #1 Received and published: 8 August 2017**

The manuscript "Extant shore-platform stromatolite (SPS) assemble" by Alan Smith et al. observed SPS lithological and geomorphological assemblage and described that SPS are produced by mineral precipitation.

However, the data provided by the authors are not sufficient to support interpretations and conclusions, at least in the way they are described in the manuscript in the present form.

The present data are *definitively publishable* but not to a well-known journal as Biogeosciences.

This paper has been re-written to accommodate the referees comments. In addition new data such as the SPS localities from Luskentyre Bay, Scottish Hebrides has been added. This discovery highlights the global nature of extant SPS.

This is the only growing marine stromatolite environment that can be directly compared to an Archean marine fossil environment, ie Strelley Pool (Allwood et al. (2006). They interpreted the 3.4Ga stromatolite lower boundary as a wave platform. This makes the SPS setting very important and has been highlighted.

The paper title has been changed to reflect that this is a Geomorphological/ sedimentological/ stratigraphical investigation rather than a microbial investigation. This has/ is being done by others (Rishworth et al 2016; Edwards et al., 2017) and published papers are quoted.

The abstract has been changed to reflect this.

The Introduction will has been restructured along these lines;

- Defn of Stromatolites, ie trapped and bound and/ or mineral pptn. State that the Archean are 99% mineral pptn.
- The SPS assemblage is a new extant stromatolite marine environment.
- We have accentuated that SPS are mineral precipitated stromatolites, whereas Shark Bay and Carribean are of the trapping and binding variety. Thus the SPS setting lends itself to a direct comparison with Archean stromatolite occurrences.
- Work has been done on Cape Morgan, South Africa (Smith & Uken, 2003; Smith et al, 2005; 2011) and the Giants Causeway SPS (Cooper et al., 2013) and other SPS from the Eastern Cape, South Africa (Perissinotto et al., 2014; Rishworth et

al., 2016; 2017; Edwards et al 2017) but no attempt has been made for a detailed comparison of all the known SPS occurrences. We do this in this paper.

- This paper compares new SPS discoveries and all known global SPS occurrences to determine similarities and differences. From this we try to distil a SPS Facies Association. As this is work on a new stromatolite setting it has to lean heavily on fieldwork, comparisons and facies analysis.
- This facies analysis is then used to compare with some Archean examples, especially the 3.4 Ga palaeo SPS occurrence at Strelley Pool.

### General comments

1. The microorganisms were prevalent in the Precambrian. Microbial fossils present the cellular structure, which is similar to cyanobacteria and other prokaryotes. But morphological analysis of these microbial fossils is often not enough to obtain the correct information. [this is not required as other papers have been quoted]
2. The acquisition of information would highly benefit from in-situ analytical techniques such as laser Raman spectroscopy, and stable C1 BGD Interactive comment Printer-friendly version Discussion paper isotopes. [This has not been done as it appears to be a distraction but the relevant papers are quoted. The purpose of this paper is to fully describe the SPS geomorphological setting and to indicate its global (Archean and possibly extraterrestrial) occurrence and significance. This is significant biologically but this is not a thrust of this paper.]
3. The potential effect of microbes in the formation of stromatolites should be further discussed. [this paper discusses the geomorphology, and potential stratigraphy, consequently a microbe analysis is not part of this paper.]
4. The scientific methods and assumptions are not valid and clearly outlined, such as when the authors try to discuss SPS preservation potential in the geological record, what is the preservation mechanism? [This can only be done here in a general way as a lot more information would be required. However there is a palaeo SPS example from the Strelley Pool (3.4Ga) Archean stromatolite assemblage and possibly the lower Gunflint Chert. If these are in fact correct interpretations then preservation (irrespective of how) is possible.]
5. The formation of stromatolites requires certain environmental conditions, especially more information about the water chemistry measurements should be provided. [These conditions have been met here. This was not part of this project. Some work has been done and is quoted. A detailed geochem study is presently under way.]
6. Specific comments: These have been addressed.

**Interactive comment on “Extant shore-platform stromatolite (SPS) assemblage” by Alan Smith et al. Anonymous Referee #2 Received and published: 19 August 2017**

In this manuscript the authors compare different stromatolite assemblages along the south-east African shoreline, compare in situ factors under which they form, and evaluate their potential to gain further understanding of Precambrian stromatolite formation as well as their potential as an indicator of previous life on Mars.

While the topic in general is interesting and a comparison of recent and ancient stromatolite formation across different geological **settings may make an important contribution to our knowledge of this field**, the paper appears rather descriptive and lengthy and may benefit from some restructuring and focusing. **[The paper has been more focused.]**

In the first place, I would suggest to modify the title in a way that it at least contains more specific information about this study or reflects the major outcome. **[This has been done and the title changed to:**

**“The Extant Shore-Platform Stromatolite (SPS) Facies Association: A glimpse into the Archaean?”**

Similarly, the abstract appears as a listing of findings of this study. Here, a clear statement of the motivation of this study and highlighting the major outcome in C1 BGD Interactive comment Printer-friendly version Discussion paper one concluding sentence should be added. **[This has been done.]**

The motivation of this work is stated rather clearly at the end of the introduction section. However, especially in the results section, a stronger structuring along the original research objectives would help the reader find their way through this large amount of detailed site information which is provided in the results section. **[This has been done.]**

Although some of the site-related information is already presented in tables, comparison of key features across sites would benefit from a more condensed presentation in tables rather than in text. This way it would be easier for the reader to recognize in which key aspects the different study sites differ and what might be the most important regulating factors for stromatolite formation. This would also help the authors to check carefully if really all the aspects that they provide in the results section are needed for the discussion. **[The tabulated information has been subdivided into a total of 5 separate tables so that the information can be better understood and appreciated.]**

The discussion is already written quite concisely, however, a more direct reference to the objectives stated in the introduction would be helpful. For example, the discussion of the potential of SPS as Precambrian analogues remains rather superficial. **[This has been bene beefed up.]**

In addition, I have two concerns regarding the integration of aspects of microbiology. The authors integrated a longer section about the role of prokaryotes in stromatolite formation and the importance of the competition between prokaryotes and metazoans. However, this aspect is not targeted at all in the results section and only occasionally addressed in the discussion, and I was wondering why it was introduced so thoroughly in the introduction. [I accept this criticism and this section has been reduced. The introduction has been given a much stronger geomorphological and lithological focus. This needed to be more clearly stated at the outset as the referees are clearly expecting a strong biological focus to follow.]

In addition, some of the statements in this paragraph of the introduction (p. 2, l. 5-14) are not correct or are not sufficiently explained. What is meant by the statement that "Prokaryotes, however, do not react well to Metazoan competition"? (p. 2, l. 6). In line 10-11 "...but under contemporary conditions they can only thrive in extreme environments that limit Metazoan competition". Given the fact that you find about 10<sup>10</sup> bacteria per gram forest or grassland soil, this statement does not hold or its meaning in this context here should be clarified. [This has been addressed.]

Specific comments: p. 2, l. 4: "more plausible Precambrian stromatolite analog" - more plausible compared to what? p. 3, l. 25-27: What does it mean that prokaryotes dominate? What about unicellular eukaryotes in such environments? [This has been addressed.]