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Comment

## ***Interactive comment on “Linking process and product in terrestrial carbonates using a solution thermodynamic approach” by M. Rogerson et al.***

**A. Brasier (Referee)**

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Dear Editors,

First, many thanks for sending me this manuscript, and I apologise for unusually long time it has taken me to review it.

The paper presents an interesting and timely approach to understanding controls on tufa and travertine systems that the authors hope will assist with classification. On the borders of chemistry, sedimentology and even microbiology, this is a fascinating topic that is not easy to tackle with clarity for all readers, so it is not surprising that there are some minor to moderate issues requiring resolution.

I agree with Reviewer 1 (Adrian Immenhauser) in that I would like to see the paper

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published, and I think the authors should be able to clean up the manuscript sufficiently for this.

I must also agree with Adrian that there are several issues with consistency and presentation that require resolving. These include how SNI is presented on figures and referred to through the text. But also, sites named as examples (e.g. La Zitelle and Acqua Bora) in the text do not seem to be presented on the figures and in the data tables. If they are there, then the data are hidden under terms like 'Hot Italian spring'. This really needs resolving so that the reader can reproduce the results from the data provided.

Other issues stem from the generalization of facies for each category defined, though that is hard to avoid. I would encourage better description (and perhaps figures) in places though. For example the term 'laminite' is too general for these systems. Are these micritic mud layers? Sparry shrubs? Feather crystals?

As Adrian went through the methods in detail, I have not followed up references on how the equations were derived etc. I suggest that the authors respond to each of Adrian's points here, helping the reader (likely to be a sedimentologist) by explaining how the equations are derived and what they mean.

Overall the issues seem to be with the consistency of this manuscript rather than the basic science, and they ought to be resolvable.

Further specific comments:

Abstract: L3: "associated chemical sediments" needs defining L4: many biological effects are kinetic effects L14: at "high temperature" – you need to give some guidance on what a "high temperature" is. L5&6 (p.339): surely not in isolation?

p.339 L.13: define "other terrestrial chemical deposits". L16: "works admirably for most freshwater limestones" – please give an example.

p.340 L6: "more recent classifications"...I was 9 when this came out (I am now 32).

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L10: I don't recall labwork in Pedley (1990) or Ford and Pedley (1997)? L17-18: not a clear sentence. Discriminating from what?

p.341: L10: Several springs are hotter than 60 degC in e.g. Yellowstone? L17: I'm not sure you can use "tufa" and "travertine" to distinguish between different sources of ions if waters have moved even only short distances subaerially?

p.345 and 346 L25-L2: can these be more clearly re-phrased? L4: which literature? Biological, physical or sedimentological? L7: of minor importance, not minor of importance.

p.346: L25: saccharides?

p.347 L5: precipitation, rather than precipitate L17: deviate, rather than vary? L18: what is "it" that is so critical to understanding past system behavior? L19: remain, rather than remains L23: specifically, rather than specific L26: marine stromatolites?

P.348 Section 1.2.4 is a bit too cryptically written for me. For example: L7: what are "they"? L14: what are "these components"? L18: anaerobic, rather than non-aerobic?

Methods section: Follow up Adrian's comments. In addition, I have been told it is good practice to reserve T for Kelvin, and use t for centigrade. If I were trying to use these equations I would assume therefore that all temperatures should be given in Kelvin? However through the rest of the paper you seem to use deg C (e.g. p. 351, line 19).

p.351: L21: thermophiles rather than thermophyles? Find and replace throughout?

P352 L1-3: this needs sorting out. Perhaps "...further data can be added, and calculations can be performed...equations using calculated parameters..." L6: To simplify these disparate data (data are plural).

p.353 Sections 3.1 and 3.2 general comment: please provide water data and images for the examples you describe. The data tables and figures are not well linked to the text.

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L10: comma after precipitation. Thermophile. L14: “any” is too general. L14-18: split this line in 2? L17: “permitting the reaction”. What reaction? L18: this observation on palisade stands of sparite crystals is interesting. Are you suggesting they result from competitive crystal growth? Can you relate any of this to e.g. Kendall and Broughton (1978)?

P.354: Again – where are the water data and observations on Acqua Bora?

Section 3.2 needs a re-write. You seem to have specific cases in mind, but these are not really illustrated. Show what a whaleback ridge looks like, and how a pinnacle differs from a mound? Lines 12-15: self-contradictory. Deposits may be confined to the immediate vicinity of resurgence points. . . low angle travertine sheets often extend well beyond these resurgence points. This is confusingly written. Do you have examples in mind you could name / illustrate? L15: laminae dominate the deposits; L19 Shrubby laminae are ubiquitous; L22 are all well laminated at centimeter to millimeter scale. There is repetition here and its confusing.

p.355 L12: please define “host waters”. You have just said that “such waters” generally exclude aquatic organisms, but then you say the “host waters” may not be toxic. Are these two different waters?

P.356 L6: “are the most widespread form of terrestrial carbonate” requires a reference. Have you included calcretes in this? I’m not aware of an assessment of total volumes of tufa vs calcretes, but Yaalon (1988; cited in Wright & Tucker, 1990) estimated calcretes cover 13% of total land surface (20 million km<sup>2</sup>). Section 3.4 also generalizes, but this is hard to avoid. Please make it very clear that this is a generalization though, and make a clear statement of refering the reader to papers that do a more thorough job on facies etc.

P.358: L2: 30 deg C is perhaps on the low side? L16: the thick accumulation of “laminites” is not as descriptive as it might be.

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P.359 L.5: echoes Overall, I do think that this paper will be worthy of publication in Earth Surface Dynamics once the issues with consistency are resolved, and I hope I can look forward to reading the more complete final version in print.

Many thanks again for the opportunity to review this interesting manuscript,

Kind regards,

Alex. Brasier (VU University Amsterdam, October 2013)

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Interactive comment on Earth Surf. Dynam. Discuss., 1, 337, 2013.

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