

Interactive comment on “Can Mg isotopes be used to trace cyanobacteria-mediated magnesium carbonate precipitation in alkaline lakes?” by L. S. Shirokova et al.

Anonymous Referee #1

Received and published: 9 October 2011

The paper “Can Mg isotopes be used to trace cyanobacteria-mediated magnesium carbonate precipitation in alkaline lakes?” is worthy of publication in Biogeosciences with minor revisions. This paper is interesting in that it uses a mixture of field and laboratory methods to test a hypothesis at the border of geology and biology. As such is it both timely and of interest to a broad audience.

The paper is well structured. I only found myself lacking appropriate references once (mentioned below).

My major concern with this paper is that it takes the results from experiments with one genus of bacteria (*Synechococcus* sp.) and makes an overly broad statement that

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Mg isotopes do not track biologically mediated precipitation of hydrous Mg-carbonates. ___ Could these results be unique to this particular genus or to cyanobacteria in general? ___ Discussion of the answer to this question is required before this paper should be published. The paper's title should be checked so that it reflects the proper scope of the study's findings.

My second concern is that the abstract does not adequately portray all that is useful in this paper.. If the authors were to rewrite the abstract to include more of the information from the last three pages of the text, it would provide a much more useful synopsis of the article to the would-be reader. I would also suggest that the message in the final two sentences of the current abstract be incorporated at the beginning of the abstract so the most important finding of the article gets to the reader as soon as possible.

General technical comments: 1. The authors use both “magnesium carbonates” and “Mg-carbonates.” They should pick one and use it throughout. I would suggest the latter. 2. $\delta^{36}\text{Mg}_{\text{solid-solution}}$ is confusing. This makes me think of solid solutions. I would suggest $\delta^{36}\text{Mg}_{\text{mineral-solution}}$. 3. The terms “stromatolite” and “microbialite” are used interchangeably both before and after stromatolites are defined as a subset of microbialites. Perhaps the authors could use “stromatolite” only and then define it in terms of microbialites in the site description (6477-17). 4. If this paper is a digital document, why is there an electronic supplement? Can the electronic supplementary material be integrated into the body of the paper? Also if the publication format is landscape, can the portrait figures be rendered in landscape format? 5. I would ask the authors to look at the number they report and take care to keep track of significant figures. In some cases $\delta^{36}\text{Mg}$ has 3 decimal places (e.g. in tables), other times 1. 6. To reduce confusion, I would strongly suggest that the terms “heavier” and “lighter” when used in the context of isotopic values, should be preplaced with “more positive” and “more negative,” respectively. 7. Why do figures 9 & 10 use color when none of the other line drawings do? I would make 9 & 10 black & white too.

Specific technical comments: 6474-2: change “precipitation in both” to “both in” -3,

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change "Salda (SE Turkey)" to "Salda, SE Turkey" -4, "was" to "is" -7, "which were" to "that are" -11, "sp" to "sp."; "the lake water" to "lake water" -13, delete "in these batch reactor experiments" -16: delete "to". If you meant "too", then use "greatly" -22, delete " , within uncertainty," -23, add "DSM-3" after the permil sign. -24, "validate" to "uniquely implicate" 6475-4, move "non-traditional" to before "stable isotopic" -5, change "Mg, Zn" to "Mg, and Zn" -6, "lake " to "such" -7, "it is a major component of the lake water" to "it is often a major component in lake water" -14, "biomineralization" to "(bio)mineralization)"; "Lowenstun" to "Lowenstam" -16, "both ancient and modern" to "lacustrine" -23, "calcium" to "Ca-rich" 6476-1, Perhaps move this sentence about mars to the list of interests in the first paragraph? -11, insert appropriate references after "constrained" -13, "provided" to "provide" -14, "lithology" to "hydrology, chemistry" -15, "suggested" to "suggest" -23, "the lake water" to "lacustrine waters" 6477-7, provide a better definition for "mineral carbonation" -12, "precipitation" to "meteoric precipitation" -11, "The lake" to "Lake Salda" -13, "coastal zone (littoral)" to "littoral zone" -17, "grown" to "growing"; "stromatolites" to "stromatolites" (in quotes) -19, "1-1.5 m2 stromatolites" to "Stromatolites 1-1.5m2 in size" -21, "at the littoral" to "in the littoral zone" -23, define what you mean by "texture" 6478-18, "from the" to "from 1) the" -19, "Burnu, other" to "Burnu, 2) other"; "air-exposed" to "sub aerial"; "and parts" to "and 3) parts" 6479-13, "BLAST)against" to "BLAST) against" -24, "periphyton" to "periphyton" 6480-1, "at precipitating" to "to precipitate" -3, delete "at controlled conditions" -5, "phases" to "compositions" -14, delete "reactive" -20, "shaking" to "stirring" 6481-13, "30-50 ml aliquots" to "Aliquots of 30-50 ml" 6482-5, "Jeol" to "JEOL" -10, "PGT EDX" is not defined 6483-17, "around 8-10°C" to "8-10°C," -18, can you explain why the most significant stromatolite growth occurs during summer? Why did you sample in September if summer is their major growth period? 6484-5, delete "thereby"; what was the saturation state with respect to other minerals mentioned in this paper? -11, "wad" to "were" -13, delete "typical" -14, ExoPolySaccharide" to "exopolysaccharide" -21, delete "(not shown)" 6485-3, "2010" to "2010," -5, I do not understand why $\delta^{26}\text{Mg}$ from stromatolite parts and littoral sands are summarized with one value and a \pm . These should

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be separately reported. It would be preferable to have the reported like the previous sentence with the range of values and not with a \pm . -18, include a chemical formula for brucite; reverse structure of sentence so beginning products are described before final products. -21, "main" to "most abundant" -24, "needle-like" to "acicular" 6486-19, "evidenced" to "showed" -22, "whole cell surfaces (see Fig. 3c) or cell sheaths (see Fig. 3b)" to "cell sheaths (see Fig. 3b) or whole cell surfaces (see Fig. 3c)" -28; define "representative" 6487-15, "0.93-0.84" to "0.84 to 0.90" -17, italicize "Synechococcus" 6488-6, It would be useful for the authors to speculate on dypingite saturation state even if they can't calculate it because it is a major phase precipitated in their experiments. 6489-6, "The isotopic" to "The Mg isotopic" -8, "solution" to "the solution's" -10, "Mg" to "Mg concentration" -18, " as the main mineral of" to "among the minerals precipitating in" -19, delete "void-like," -21, delete "lake" 6490-3, "fluid" to "solution" -7, "weeks)" to "weeks)," -8, Can the authors list the temperatures each study used so the reader can decide if they are "elevated?" -11, "is in agreement" to "agrees" 6491-1, "honeycomb - like" to honeycomb-like" -4, "experiments" to "experiments," 6492-15, "was" to "has been" -27, "of" to "the" 6493-12, "versus" to "and" -19, "incrustation" to "encrustation" -27, "Growth" to "growth" 6495-6, "Mg" to "Mg concentration" -8, "solid" to "mineral" -9, -15, "Salda lake" to "Lake Salda" 6496-3, This is the first mention of Chroococoles. If this is a conclusion of the study, I would like to see some mention of it in the results and discussion portions of the paper. -4, "live stromatolites" to "live Lake Salda stromatolites" -6, delete "we found" -8, "production," to "production was discovered and is generally" -14, "pH" to "pH,"; "state" to "state," -15, "surface" to "surface for mineral growth"; "was" to "were", "cells encrusting" to "cell encrustation" -17, " $\delta^{26}\text{Mg}$ concentration" to " $\delta^{26}\text{Mg}$ " -18, "within uncertainty of" to "to" 6505-Gloeocapsa needs to be italicized at bottom of table. Capitalize "conditions" in table title. 6506-"LIQUIDS" to "IN SOLUTION"; "SOLIDS" to "IN MINERALS" Right-align all the data so the decimals line up. 6507-"LIQUIDS" to "IN SOLUTION"; "SOLIDS" to "IN MINERALS" 6509-scales are too small to read. Perhaps mention them in the text. Labels are clipped. 6510-"incrustation" to "encrustation" 6514-, "0.93-0.84" to "0.84 to 0.90" ESM: Tables

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are formatted differently than tables in the main body of the paper.

Interactive comment on Biogeosciences Discuss., 8, 6473, 2011.