

Peer Review

Review of: "Microbial Mediation in Gypsum Dissolution and Its Role in Evaporitic System Transformation in Northern Chilean Salt Flats"

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Dear authors, I have evaluated the manuscript entitled "Microbial Mediation in Gypsum Dissolution and Its Role in Evaporitic System Transformation in Northern Chilean Salt Flats". I consider that the study is scientifically sound, methodologically robust, and makes a relevant contribution to the understanding of microbe-mineral interactions in evaporitic systems. The experimental set is well conceived, the analytical approach is appropriate, and the results clearly demonstrate the importance of microbial activity in modulating gypsum dissolution and secondary mineral precipitation under controlled conditions similar to natural environments. The manuscript is therefore suitable for publication after minor revisions, which are mainly related to organisation, clarification, terminology, and completeness of references. The main comments are listed below, and detailed comments are available in the attached pdf file.

1. Title: The expression "evaporitic system transformation" in the title is somewhat vague. A slight rephrasing is recommended to clarify the intended meaning and better reflect the geomicrobiological processes addressed in the manuscript.
2. The Introduction would benefit from being rewritten as a more cohesive and continuous text. The current subdivision fragments the research scope. In particular, the content presented as Sections 1.1 and 1.2 should be simplified or redistributed, while Section 1.3 contains the material that most clearly functions as an effective Introduction. Overall, the Introduction should focus more directly on evaporite-microbial interactions as a system-level process, rather than emphasising a single mineral phase at the outset.

3. Several passages in the Introduction require additional references to strengthen the discussion of evaporitic processes, salt crust dynamics, and microbial mediation. Well-established sedimentological and evaporite-related studies (including classic and recent works on salt crusts, dissolved evaporites, and hydrological control of salt flats) should be incorporated to better contextualise the research problem.
4. The manuscript occasionally uses the term “lagoon” for inland saline water bodies. Since the studied environments are continental and not tidally connected to the sea, the term “lake” should be used consistently throughout the text.
5. Descriptions of the Salar de Llamara, Salar de Pajonales, and Salar de Gorbea should be moved to a dedicated Geological Setting section, while explanations regarding sampling strategy and site selection should be transferred to the Methods section. This reorganisation will improve clarity and logical flow.
6. Since the samples were collected several years prior to experimentation, additional clarification is needed regarding their conservation, potential geochemical stability through time, and how representative they remain of current field conditions. It would also be useful to indicate where within each salt flat (e.g., centre vs. margins) the samples were collected, given known geochemical gradients.
7. The Methods section is generally clear and well-written, but minor additions are recommended. These include providing key SEM-EDS acquisition parameters (such as magnification ranges, beam conditions, and spectral resolution) and making saturation index calculations available, preferably as Supplementary Material.
8. Some figures would benefit from clearer labelling, including arrows highlighting key mineral phases and globular or lenticular structures discussed in the text. Additionally, at least Table 2 appears to have misaligned or mixed columns and should be carefully checked and corrected. Interpretative statements currently included in tables should be moved to the Discussion section.
9. A few sentences require rephrasing for clarity, particularly where causal relationships are implied (e.g., environmental controls vs. responses such as electrical conductivity). Minor repetitions should be removed, and isolated wording issues should be corrected to improve readability.

In conclusion, the manuscript presents high-quality experimental data and a compelling interpretation of microbial roles in evaporitic mineral systems, with implications for sedimentology, geomicrobiology, and astrobiology. The recommended revisions are minor and primarily editorial or organizational in

nature. I therefore recommend acceptance after minor revisions. I hope that my comments are useful to you, and I wish you the best of luck in your research.

Best regards,

Alexandre Ribeiro Cardoso

Attachments: available at <https://doi.org/10.32388/30VU7T>

Declarations

Potential competing interests: No potential competing interests to declare.