A question of time and space: A model approach to the sychronicity of gypsum and halite during the Messinian Salinity Crisis

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This manuscript uses a box model to explore the circumstances under which halite and gypsum could form at the same time in a marginal marine setting. In doing so, the paper addresses a question that has remained unanswered over the last 50 years, since late Miocene evaporites were first identified below the Mediterranean's sea floor with some recent papers on the Messinian Salinity Crisis advocating the synchronous precipitation of halite in the deep basin and gypsum on the margins and other advocating asynchronous precipitation. The three scenarios presented are clearly presented and the modelling, though simple, provides a powerful evaluative tool allowing the authors to conclude that while synchronous precipitation is possible, none of the three scenarios can realistically account for the volumes of evaporites preserved today.

I find the story that has been presented and the model results compelling however there are a couple of issues that I would like the authors to address both to clarify the current focus and to push their model-based thinking a little further than the paper does at present:

1. The box model construction illustrated in Figure 1 shows two-way Mediterranean-Atlantic exchange. It is widely accepted that this configuration probably only applies to Stage 1 of the MSC, when gypsum was precipitated in the marginal basins of the Mediterranean requiring a high sea-level. Stage 2 and 3 are more likely to have occurred with Atlantic inflow but negligible outflow from the Med, consistent with a base level that was below the level of the gateway. Consequently, the main application of this model configuration is Stage 1. This is mentioned in the abstract but is not made clear in the introduction where a description of all three phases of the MSC (L31-39) is followed by a statement about the challenges of shallow-deep water correlation as a justification for looking at synchronous gypsum-halite precipitation (L50-50).
2. The paper concludes that synchronous precipitation of gypsum and halite can only happen in Scenario A when the system as a whole is close to halite saturation. While I accept the statement in the first paragraph of the discussion (L334-339) that the model is not meant to represent "the complexity of the Mediterranean Sea", none the less, it is possible at least to point out the episodes within the MSC that are closet to the model configuration used and consider the implications. For example, some discussion about when within Stage 1 reaching near halite saturation is most likely would enhance the applicability of the results. The strait efficiency required to generate synchronous gypsum-halite precipitation could be evaluated against the Sr isotope ratio data for Stage 1 which progressively diverges from the ocean water curve. This might then enable them to evaluate the duration of the potential overlap between Stage 1 and 2 mentioned in L417-20.
3. Section 3.2.3 (Scenario B) – this section needs a little more explanation of the chemistry and particularly some more information about the chemistry of the rivers that are modelled in Fig. 4 so that the reader can see how their different compositions result in different consequences.

In terms of technical issues, the manuscript could be improved in the following ways:

- Title – suggested tweak “A model approach to the synchronous precipitation of gypsum….”
- Abstract L9 – “different configurations”. A little more clarity about what those configurations are would help here
- Abstract L16 – “salinifying”. Suggested alternative “a timeline for an increasingly saline basin.”
- Figure 2d – for clarity, label the y-axis “salinity difference”
- Figure 3 – both the caption and the text in line 244 state that there should be an “x” showing the present-day Mediterranean on Fig 3a, but I can’t see it.
- Discussion L362 – the word “Dead” is missing before “Sea”
- Section 4.2 L405 – the thickness of the lower Tripoli Unit in the Lorca basin is used to illustrate the likely sedimentation rates resulting from step 3, but that isn’t helpful if you don’t know how thick that unit is…. and I don’t!