

Interactive comment on “Pleistocene sediment offloading and the global sulfur cycle” by S. Markovic et al.

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The main result consists of a $\delta^{34}\text{S}$ record of sedimentary barite from the Eastern Equatorial Pacific. The barite was extracted from sediment cores of the Ocean Drilling Program. Furthermore, a mass balance model is presented to simulate the $\delta^{34}\text{S}$ of marine sulphate based on the main sources and sinks. A decrease in $\delta^{34}\text{S}$ of marine sulphate over the last 1.5 Ma is interpreted as result of pyrite oxidation due to offloading of shelf sediments during glacial sealevel lowstands.

The study is interesting to read and certainly an important contribution to the understanding of the sulphur cycle. The text is well written and figures are useful and clear. The interpretation seems well supported by the data and model results, respectively. Nevertheless, I mention a few thoughts that could be discussed in more detail and

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which may improve at the same time the clarity of the manuscript for the reader.

During sealevel lowstand the zones of coastal upwelling would migrate further offshore and hence still be active in burial of pyrite but at greater water depth. As a result the deep water compartment would in fact counteract the effect of sediment offloading on the shelf. Therefore, it would be important to include the effect of changes in pyrite burial in the deep ocean compartment in the sensitivity study.

If a higher flux of sulphide from the shelf occurs during glacial lowstand without compensation by another sink, the sulphate concentration in the ocean would increase. This would then not represent a real steady state. The authors should also discuss how a new steady state would look like if the increased influx of sulphate is compensated somewhere else. Possible sinks could be an upwelling zone that is shifted offshore, or a higher flux into evaporites due to higher sulphate concentration of seawater.

Another sensitivity test would be to change only the Δpyr without the effect of sediment offloading. Likewise, the effect of changes in deep ocean pyrite burial should be visualized alone.

Generally, the Methods chapter includes a lot of discussion. This chapter could be significantly reduced in length if these discussions are moved to Results and Discussion.

Minor comments:

p. 1208, line 14: "... Shipboard Scientific Party"

p. 1208, line 24: The statement that sulphate reduction is not prevalent at the Eastern Equatorial Pacific sites because the sulphate concentration is not depleted is not necessarily true. Blake et al. (2006; Proc. ODP, Sci. Results, v. 201) showed based on $\delta^{18}\text{O}$ data that sulphate is being cycled.

p. 1209, lines 6 – 12: This section should be part of the introduction.

Figures: The time axis should be plotted from past to present from left to right.

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