

Interactive comment on “A 500 kyr record of global sea level oscillations in the Gulf of Lion, Mediterranean Sea: new insights into MIS 3 sea level variability” by J. Frigola et al.

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General Comments

I am always in favor of adding good chronostratigraphic control to sequence stratigraphic studies of continental margins. That is the strongest contribution of this paper. Having said that, I would like to have seen more than one tie between a single dip-oriented seismic section and the borehole in question. Such ties are always ambiguous, given the ambient dip of seismic horizons and navigational uncertainties. The issue of seismic resolution at the tie should also have been addressed.

I do not think the authors addressed the stratigraphic correlations shown in detail; they
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are not “perfect”. Nor do I think they demonstrated with data that the HS sedimentological mechanisms proposed (e.g., DSWC) actually affect silt/clay size distributions as the authors hypothesize that they do.

A Red Sea SL curve is used, with no discussion as to why that is appropriate to the GoL.

Table 1 is barely mentioned, and I don't know why those data were included.

Specific Comments - Individual scientific questions/issues:

p. 6 –

The authors do not explain adequately why Ca variation is related to the fluvial discharge of fine-grained sediments.

p. 7 –

- Are the new “units” bounded by sequence boundaries in all cases? That is not explained.

- It is not clear to me why increases in the silt-clay ratio on the upper slope of the GoL should correspond to a sea-level rise. I do not doubt the cyclicity of this ratio as shown, but my instinct tells me that a decrease in distal fluvial input (caused by such a sea-level rise) would lead to a DECREASE in silt-clay ratio (i.e., more clay) at the outer margin location at which the borehole is sited. If this has something to do with the DSWC mechanism mentioned in the text, that should be more clearly explained. (Some of it is detailed in Fig. 4B, I think, and later on in the Discussion, but more space should be devoted to an explanation.)

p. 12 –

Lines 298-300 – “The excellent time constrain provided by the *G. bulloides* $\delta^{18}\text{O}$ record of the PRGL1-4 borehole demonstrates a perfect peak to peak coupling between sea level variability (as indicated by increases in the silt/clay ratio) and all D-O cycles, in-

cluding the shortest ones.” I think using the term “perfect” in this context needs to be quantified. Further, where are the D-O cycles shown (in Fig. 5 somewhere)? If these are the “grey bars” identified as HEs, I do not think the correlation with silt-clay ratios (Fig. 5C) is perfect.

Figure 1 caption: B) The absolute ages of the designated sequences/reflectors should be made clear. In my opinion, they should be explicitly tied to Table 1.

Figure 2 caption:

Line 571 – “condensed interglacial sequences. . .” A) I would like to know the resolution of the seismic record. The dotted lines in B) do not appear to take that into account; seismic resolution could adversely affect the quality of the correlations with the sediment records shown. Further, what sedimentological characteristics determine the vertical widths of the grey lines associated with the MIS intervals shown?

Figure 3 caption:

Lines 576-577 - How was the “central Red Sea relative sea level reconstruction” chosen as being analogous to the GoL? That does not seem obvious to me at all. And the SL curve (Fig. 3C) should be related more specifically to the MIS events in Table 1.

Technical Corrections:

Line 42 – “allowed *researchers* to generate. . .”

Line 49 – “have minimized the possibility. . .”

Line 50 – “to constrain. . . accurately. . .”

Lines 50-53 – suggested rewording – “We suggest that records from continental margins characterized by very high fluvial sedimentation rates, if precise chronology of those depositional units can be constrained, will provide improved resolution and reconstruction of past sea level oscillations.”

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Line 58 – replace “eased” with “favored”

Line 59 – “upper slope, as it. . .”

Line 62 – replace “eased” with “facilitated” The 1st sentence of p. 4 is awkward and run-on and should be rewritten.

Line 67 – “to constrain better. . .”

Line 72 – “are of special interest,. . .”

Line 73 – “to understanding. . .”

Line 78 – “Here, we present. . .”

Lines 79-80 – “, together with. . . , which allow us to identify and precisely date. . .”

Line 85 – “and covers. . .”

Line 88 – “with gentle gradients. . .”

Line 91 – “to the shelf break,”

Line 92 – “the shelf break is located between 120 and 150 m,”

Line 93 – “cut the margin, thus connecting. . .”

Line 97 – “River, while. . .”

Line 104 – “(Millot, 1999), though. . .” The last sentence of this section is run-on and should be rewritten.

Line 117 – “sampling intervals. . .”

Line 125 – “Here, we present...main indicator. . .”

Line 126 – “inputs to the GoL, since. . .”

Line 131 – “120 to 530 ka, the age model. . .”

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Line 133 – “dates, see”
Line 142 – “Ca content, coinciding. . .”
Lines 146-147 – replace “allowed reinterpreting” with “allowed us to reinterpret”
Line 148 – “(Jouet, 2007), instead. . .”
Line 153 – “MIS 13, while”
Line 156 – “*We interpret that* abrupt increases. . .”
Lines 158-159 – “transitions, giving. . .”
Line 163 – “(i.e., during glacial. . .”
Line 186 – “(i.e., with higher. . .”
Line 188 – “(e.g., just a few *sampling* points. . .)”
Line 190 – “i.e., sandy layers. . .”
Line 193 – “rise, and the. . .”
Line 194 – “transitions,. . .”
Line 196 – “periods, as evidenced. . .” “nor and. . .”
Line 198 – “*We suggest that* it is probable. . .”
Line 201 – “winnowing. . .”
Line 207 – “as it happens. . .”
Line 208 – “nowadays at present. . .”
Line 215 – “interfluves, but. . .”
Line 218 – “i.e., during. . .”
Line 220 – “erosive *process* ceased.”

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Line 228 – “e.g.,. . .”
Line 230 – “to use from using”
Line 237 – “, and. . .”
Line 242 – “has been *proposed to work*. . .”
Line 244 – “outbuilding, too.”
Line 246 – “chronostratigraphic framework. . .” “(i.e., excellent. . .)”
Lines 248-249 – “*for disentangling*. . .”
Line 258 – “(Fig. 3), is. . .”
Line 265 – “GoL, since. . .”
Line 266 – “(Fig. 5C and B). *This is* in contrast. . .”
Line 274 – “Henirich *Events*. . .”
Lines 276-277 – “*of establishing*”
Line 280 – “Early evidence. . . *was* obtained. . .”
Line 281 – “that Although *this record* may be. . .”
Line 282 – “variability, an. . .”
Line 283 – “of the record. . .”
Lines 283-284 – “*Additional documentation was provided by the sea-level*. . .”
Line 296 – “precise timing of. . .”
Line 297 – “time constraints. . .”
Line 301 – “CLs, since. . .”
Line 303 – “sand record of Sierro et al. (2009). . .”

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Line 308 – “directly derived, as nowhere has it been shown. . .”

Line 311 – “rises, whether. . .”

Line 315 – “sea level rise, i.e., when. . .”

Line 316 – “could be initiated. . .”

Line 328 – “perfect *robust* match. . .”

Line 329 – “provides clues *for* understanding. . .”

Line 330 – “site, and. . .”

Line 332 – “These *findings have* resulted in. . .”

Line 333- “GoL, following. . .”

Line 345 – “constraint. . .”

Figure 2B – I suggest adding ages/age ranges to MIS 1-13, for ease of comparison of this figure with Table 1 and the text. The temporal resolution of this figure is hard to interpret, as presented.

Figure 3D – (caption) “total fine sand (%) (from Sierro et al., 2009)” The colors in this figure are not obvious and lead to confusion.

Figure 4A – (caption) “basinward migration. . .” Are “fine particles” silt or clay, or both?

Figure 5 – (caption) “MIS 3 period, all. . .”

Line 604 – “*pinpoint*. . .”

Line 610 – “GIS, while. . .”

Interactive comment on Clim. Past Discuss., 7, 4401, 2011.