

## ***Interactive comment on “Influence of distributary channels on sediment and organic carbon supply in event-dominated coastal margins: the Po prodelta as a study case” by T. Tesi et al.***

**T. Tesi et al.**

tommaso.tesi@bo.ismar.cnr.it

Received and published: 11 January 2011

Reviewer #1 went over the manuscript providing important suggestions and inputs. The redundant information was removed in order to shorten the text as requested.

### **SPECIFIC COMMENTS**

1) The abstract seems very long and could be shortened. For instance, the paragraph starting line 1, page 7851, could be moved to Background. It is also not clear from the abstract that suspended material was collected both from the river before it branches into the several channels of the delta, and from off the mouths of the delta channels.

C4687

The abstract was shortened and we added details on the sampling in the river

2) Section 2.1, page 7854, line 19 ff: How were these numbers generated? Describe methods or give reference.

We added a few references

3) Section 3.1.2, page 7858, line 3 ff: How is complete detachment of particles from the filters ensured?

We visually checked all filters to ensure complete detachment. This method was tested by Tramontano & Church (Limnology and Oceanography 29,1339-1341, 1984). We added this latter study as reference that shows particles recovery over 97% with suspended sediment in estuaries.

4) Section 3.2.2, page 7860, line 9: What is “Cut, FA, and DA”?

Cut, FA, and DA are other CuO-oxidation products that we did not use in this study. Therefore we took them out from the text.

5) Section 3.2.3, page 7860, line 22: Why was 3.9  $\mu\text{m}$  chosen as the boundary between clay and silt, and not 2  $\mu\text{m}$ ?

This boundary is somehow arbitrary in literature where you can find both 2 and 3.9  $\mu\text{m}$ . However, the most used boundary seems to be 3.9  $\mu\text{m}$  (i.e., 1/256 mm corresponding to +8 phi).

6) Section 5.1, page 7867, line 6 ff and page 7868, lines 16ff: What is the mechanism behind the described flocculation process? Is it related to salinity? If a certain salinity threshold has to be crossed in order for river-transported particles to flocculate and settle, this would also be a good explanation why during peak discharge almost no deposition of suspended material was observed in the regions with lowest salinities (central and southern prodelta).

This is an interesting interpretation to explain the lack of accumulation in prodeltaic sed-

C4688

iments. However, the water column was particularly clean despite the high discharge this is why we pointed toward settling processes occurring in shallow sediments or within channels to explain both reduced accumulation and low suspended sediment concentrations.

7) Section 5.1, page 7868, paragraph starting line 27: What is the source of the suspended particles transported through the delta? Is it expected to be composed of eroded soils and riverbank material from upstream, or is the suspended load expected to mainly consist of re-suspended sediments from the delta channels? How does the composition of suspended material differ between the river at Pontelagoscuro and off the delta? Why is all the organic matter found in suspended material so radiocarbon depleted?

It would be really interesting to address these questions dealing with the source of particles within the drainage basin. However this goes behind the scope of this study and we do not really have all information to answer. For example, we lack key details on sedimentological and biogeochemical features of the flood plain.

The radiocarbon age reflects the pre-aged origin of soil-derived OM as well as the potential contribution of fossil OC (Drenzek et al., A new look at old carbon in active margin sediments, *Geology*, 37, 239-242, 2009). In addition, phytoplankton growing in prodeltaic conditions is significantly affected by the aged CO<sub>2</sub> that derives from terrigenous OC mineralization Chanton, J. P.: Plankton and dissolved inorganic carbon isotopic composition in a river-dominated estuary: Apalachicola Bay, Florida, *Estuaries*, 22, 575-583, 1999). This latter CO<sub>2</sub> is more depleted in <sup>14</sup>C and <sup>13</sup>C relative to atmospheric reservoir. As a result, phytoplankton can exhibit aged radiocarbon values despite his recent formation. Similar mechanisms occur in upwelling regions where aged water mass supply <sup>14</sup>C depleted CO<sub>2</sub> to the surface ocean (Eglinton, T. I. et al. Variability in radiocarbon ages of individual organic compounds from marine sediments. *Science* 277, 796–799, 1997).

C4689

8) Section 5.3, page 7872, lines 3 ff: What about redistribution of fine-grained material from the Tolle channel mouth out into the prodelta to the position of the core? If Tolle is more similar to an estuary, high water energy (e.g., tidal energy) should occur at the mouth and cause regular sediment sorting. Please discuss.

The radiograph displays unambiguous evidence of settling from the turbid plume such parallel bedding. If other processes driven by wave energy or tide occurred, they would have resulted in a different stratigraphy (e.g. ripples, erosive features). These mechanisms might be potentially important but only after the emplacement as during the flood event both tide and wave energy were particularly weak.

9) Section 5.3, page 7872, lines 15-17: "sediment texture ...is mainly driven by the delta architecture: : :." This seems to me like a chicken-and-egg problem: The delta architecture should be the result of which sediments are deposited under a certain current regime, while of course the current regime later on is dependent on the channel geometry. Cause and effect are not clear.

To explain the current morphology of Pila and Tolle mouths we added more details about the history of these channels.

10) Section 5.6, whole paragraph: The paragraph reads a bit like the authors don't believe that lignin phenol data provide any additional insight. Please make clearer the added value that is taken from these biomarker analyses.

The whole paragraph was removed and partially merged with section 5.4.

11) Section 6, page 7878, lines 2 ff: Are there data on flow velocities in the southern distributaries? This might help in stating the conclusions more clearly. Unfortunately flow data are not available

12) Section 6, page 7878, lines 18 ff: The stimulation of phytoplankton by river discharge is not discussed in the text and is first mentioned in the summary. Please discuss evidence in the main text.

C4690

This topic was intensely discussed in the mixing-model where we estimated the relative fraction of allochthonous and autochthonous OC (Section 5.5).

### 13) TYPOS/GRAMMAR ERRORS/EDITS

The text was revised according to the following comments:

- 1) Title: Please change “organic carbon” to “organic matter”, as the former is just an operational term
- 2) Page 7850: Line 1: insert “of” after “North” Line 4: (Northern Italy)
- 3) Line 7: in the sediment record Line 11: replace “whereas” with “and”
- 4) Line 15: here and throughout the text: biomarker analyses (biomarker in singular)
- 17) Line 20: insert “,” after periods, replace “whereas” with “and”
- 5) Page 7851: Line 1: replace “In spite” with “Although”
- 6) Line 2. . .did not exhibit... Line 7. . .not sufficient to be preserved as distinct layers.
- 7) Line 9-10. . .we estimated event layers of 17 and 6 cm thickness, respectively.
- 8) Line 16: replace “architectures” with “bodies”
- 9) Page 7852: Line 24: replace “have been” with “has been”
- 10) Page 7853: Line 1: replace “river-born” with “river-borne”
- 11) Page 7854: Line 13. . .two discharge peaks,... Line 14: Replace “Although” with “In spite of”
- 12) Line 15. . . by reservoir management...
- 13) Line 21. . . in variable with...
- 14) Page 7855 Line 1: Only the relative contribution of fresh water exiting through Pila dropped, the absolute value likely increased during the flood event. Rephrase.

C4691

- 15) Line 19. . .:previously published studies, we occupied the same station...
- 16) Line 24: delete “the” before “significant
- 17) Line 25. . .temperature rising since. . .
- 18) Line 26. . .heavy precipitation...(Singular)
- 19) Line 27: replace “coexistence” with “co-occurrence”
- 20) Line 28: Later in the text, the peak of the flood event is always dated 1 May.
- 21) 7856: Line 9: delete “the” before “Northern”
- 22) Line 20/21: replace “nominally” with “at the”
- 23) Line 22: here and in the following text: replace “weighted” with “weighed” Page 35)
- 24) 7857: Line 1: replace “calculate” with “determine”
- 25) Line 6: transferred into plastic tubes and centrifuged.
- 26) Line 7 and Page 7858, line 6: replace “grind” with “ground”
- 27) Line 11: insert “the” before “distance”
- 28) Line 12: replace “Considering” with “Assuming”
- 29) Line 15: insert “by” before “adding”
- 30) Page 7858: Line 3. . .vigorously shaken until complete detachment. . .
- 31) Line 12: insert “deposits from” before “the October 2000 flood”
- 32) Line 19: insert “had” before “dropped”
- 33) Page 7859: Line 1: insert “the” before “mean”
- 34) Line 8: insert “of the” before “scale”
- 35) Page 7860: Line 8: “Phenol” biomarkers (phenol in singular)

C4692

- 36) Line 15: Give reference for the 5-point BET method.
- 37) Page 7862: Line 5: replace "shown" with "reported"
- 38) Line 14: here and throughout the text: use "isotopically enriched/depleted", not the colloquial expressions "heavy" or "light"
- 40) Page 7863: Line 5: replace "not enough" with "too small"
- 41) Line 9...the northern region...
- 42) Line 10...Gnocco/Goro distributaries...
- 43) Line 13....the northern prodelta...
- 44) Line 14: insert "the" before "Pila"
- 45) Line 15: insert "the" before "center", replace "south" with "southern"
- 46) Page 7864: Line 5: Do the OC and TN values refer to suspended material? Please specify.
- 47) Page 7865: Line 17: replace "however" with "therefore"
- 48) Page 7866: Line 17/18: "they will be compared". In this paper or elsewhere? Could not find this very interesting comparison in this manuscript.
- 49) Line 24: insert "in" before "event-strata"
- 50) Page 7867: Line 6: insert "a" before "flocculation"
- 51) Page 7869: Line 28: relatively modest:
- 52) Page 7870: Line 6: insert "the" before "seabed"
- 53) Line 23: replace "stratigraphy" with "sediment"
- 54) Page 7871: Line 5:...the northern region

C4693

- 55) Line 18: Is the surface plume off Tolle meant? Please specify.
- 56) Line 24: delete "to" before "highlighting"
- 57) Page 7872: Line 11: insert "water" before "samples"
- 58) Line 13: : : the northern prodelta: : :
- 59) Line 14: insert "to" before "the central"
- 60) Line 21: insert "the" before "coarse"
- 61) Page 7873: Line 2/3: mono-layer equivalent
- 62) Line 6: replace "coated" with "coatings" Line 11: replace "proxy" with "proxies"
- 63) Line 15: replace "sampled" with "samples"
- 64) Line 18: replace "a diverse proportion" with "different proportions"
- 65) Line 19: replace "apply" with "applied"
- 66) Line 21: delete "it showed"
- 67) Line 23: delete "an" before "enriched"
- 68) Line 27: replace "chance" with "possibility"
- 69) Page 7874: Line 9: change word order to "higher relative opal contents"
- 70) Line 14: typo in "estuarine"
- 71) Line 20: replace "At the" with "On"
- 72) Page 7875: Line 4: insert "to be" before "relatively"
- 73) Line 9: reword "fresh-sea water mixture"
- 74) Line 18: insert "An" before "averaged"
- 75) Line 22: converted into Page 7876: Line 7: southern prodelta

C4694

- 76) Line 10: reword to read: "However, different from the Pila region, the central...."
- 77) Page 7877: Line 20: The following are...(singular)
- 78) Line 23: replace "after" with "beyond"
- 79) Page 7878: Line 2: replace "The trapping processes" with "These trapping processes"
- 80) Line 3: southern prodelta
- 81) Line 14: replace "decreasing" with "decrease"
- 82) Line 15: northern prodelta
- 83) Line 16: replace "stratum" with "layer"
- 84) Line 26: phenol concentrations (Singular)

Figure, captions, and tables

1) Tables: There are 8 tables reporting all sediment properties measured during this study. Some of these could be moved to a supplement section and/or combined (e.g., Tables 3 and 4; Tables 5 and 8).

Tables 5 and 6 were combined. In addition, we would like to point out that the interdisciplinary nature of this study requires a relatively high number of tables.

2) The last column in Table 6 is labelled "Oct-2000 flood thickness", whereas the caption specifies this to <sup>7</sup>Be penetration depth for the October 2000 flood, which would be comparable to the column labelled <sup>7</sup>Be. Please revise to be consistent.

Caption was corrected

3) Table 7 is printed in very small font and hard to read.

Font was slightly increased

C4695

4) Figures: Figure 1: Core labels in the inset are too small to read. Caption should read: (a) Satellite image of Northern Italy and the Po river drainage basin... (b)...Stations were grouped into subregions: north, center, south.

Core labels were increased. Caption was corrected.

5) Figures 4 and 5: Scale labels are very small and hard to read.

Scale labels were increased in Fig 4 and 5.

6) Figure 6: Are the radiographs arranged such as to imply correlations between the sediment layers? If so, dashed lines indicating the suggested correlation could help guiding the reader's eye.

A dashed line was added to show similar features in the sediment record

7) Figure 7: Please also indicate <sup>7</sup>Be penetration of May 2009 core. There is an inconsistency between the caption (core collected on 30 April 2009) and the figure legend (May 2009 flood).

<sup>7</sup>Be penetration was added in the caption (i.e. no penetration). Labels were corrected.

8) Figure 8: In the caption, please spell out the meaning of parameters (e.g., SA, D50, etc.)

Done

9) Figure 9: The two panels should be displayed on the same horizontal scale to facilitate comparison. Grain-size analyses were carried out on sediments and suspended material using two different methods (Sedigraph vs Coulter counter) having a different range. Therefore, if we used the same scale, the bottom panel would turn out considerably squeezed. This is why we decided to show boundaries between size-classes in the figure to guide the reader.

Caption: 1) "...sediment cores". (b) Grain-size distribution of surface water suspended

C4696

sediments at . . .

Corrected

2) Figure 12: Typo in caption (Blue and red bars represent samples. . .)

Corrected

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/7/C4687/2011/bgd-7-C4687-2011-supplement.pdf>

---

Interactive comment on Biogeosciences Discuss., 7, 7849, 2010.

C4697