

Solid Earth Discuss., referee comment RC2
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Comment on se-2022-11

Bernhard Schuck (Referee)

Referee comment on "Mechanical compaction mechanisms in the input sediments of the Sumatra subduction complex – insights from microstructural analysis of cores from IODP Expedition 362" by Sivaji Lahiri et al., Solid Earth Discuss.,
<https://doi.org/10.5194/se-2022-11-RC2>, 2022

Dear Virginia,

Please find below my review of the manuscript "Mechanical compaction mechanisms in the input sediments of the Sumatra Subduction Complex- insights from microstructural analysis of cores from IODP Expedition-362" submitted by Sivaji Lahiri, Kitty L. Milliken, Peter Vrolijk, Guillaume Desbois, Janos L. Urai. The manuscript is well written and addresses a topic relevant for Solid Earth. I suggest minor revisions and address my main points below. I also provide an annotated version of the manuscript highlighting typos, etc. Please also refer to this file to check on the references – they are a mess and many reference have either not been cited (properly) in the text or provided in the reference list.

Kind regards,

Bernhard

- Although quite prominently presented in the abstract (lines 17 – 21), the change of deformation mechanism from rotation and realignment of clay-platelets dominating in

the shallower section (0 – 28 mbfs) to bending and subsequent sliding / fracturing of clay particles dominating in the deeper sections is not that evident from the observations presented. Maybe a figure presenting evidence for both mechanisms next to each other would support the statement. In addition, the manuscripts describes the change of deformation mechanism observed at 28mbfs but does not elaborate on the underlying reason. Maybe the authors could discuss this aspect.

- In addition to information on clay mineralogy (lines 113 – 121), additional information on bulk mineralogy should be presented, too. What is the bulk composition (not only the clay mineral assemblage)? In this context I have to admit that the information which should be transported by Supplementary data-1 is not clear to me – especially at the position where it is referred to (line 114).
- The fact that site U1480 consists of several holes, whose samples have been used for this study, should already be mentioned in line 94 instead of line 131.
- Section „sampling and methods“: based on the information given, I would assume that sample preparation and analysis in Aachen and Austin was done by Ar-ion cross-section polishing succeeded by SEM investigations (i.e. BIB-SEM) with the main difference between both universities having been the instruments used (BIB polishing device: JEOL vs. LEICA; SEM: Zeiss vs. FEI). Is this correct?
- MAD measurements already performed should be mentioned earlier than in the “results” section.
- Has the mineralogy presented in lines 227 – 231 been determined based on EDX element map / point analysis or is it the outcome of XRD bulk measurements (as presented in lines 113 – 121)? Qtz, Fsp, Cc, Mica und Ill are only five phases – what is the sixth phase mentioned in line 227? How was the detrital origin of the clay-size particles determined (l. 228)? Assuming that information in this paragraph are based on EDX analyses (i.e. no diffraction patterns), I wonder how it was possible to conclude that clay-size particles are dominantly illite, given that XRD analyses reveal the presence of smectite and illite/smectite.
- Given that segmentation of SE2 images only gives pores without additional information on the kind of pore, I wonder how the amount of intergranular pores (>99%) could have been determined and if this value can be considered to be representative or just a qualitative assessment (lines 241 – 242).
- Exchange (1) and (2) in line 254 to be consistent with Fig. 4 and lines 251/252 and 255, respectively.
- Contacts “EE”, “EF” and “FF” should be highlighted in Figures 5, 7 and Supplement 13.
- To be consistent with the information given in lines 281 – 283, a similar information should be given at some point in lines 259 – 267.
- Unfortunately, I was not able to extract the bulk density of the sediment from the reference McNeill et al. (2017) to calculate the vertical effective stress (cf. line 373). Maybe the authors could provide these values in the manuscript / the supplement?
- The statement given in lines 416/417 that “shallow depth samples are richer in smectite compared to the deeper samples” should be somewhat adjusted, because Table 1 shows that it is only true with respect to the difference between Unit I and Unit II, not with respect to Unit III.

Figure 1

- Please ensure that spelling of Ninetyeast ridge on the figure and in the text is identical
- (a) is not a geological map but a satellite image
- Please specify in the caption that (b) shows one of the holes (hole G) of site U1480.
- Please provide orientation and scale of (b) and indicate its extend/location in (a)
- Please explain the meaning of the blue and red lines, respectively, as well as the meaning of „HANP“
- Please provide a scale for (d)

Figure 2

- Please adjust order of figures (a – b – c – d instead of a – c – b – d)
- Please add common title “U1480” and “U1481” for Figures a/b and c/d, respectively
- It appears that porosities at around 1300mbsf tend to increase – is this correct?

Figure 3b

- The straight line indicating the linear relationship should be plotted, too. In addition R2 should also be indicated in the figure.

Figure 4

- Please ensure a consistent spelling of terms introduced in Figure 4 (e.g. silt-adjacent vs silt adjacent, etc.) in the text.

Figure 7

- To me it is not clear which additional information is provided by this figure compared to Figure 6. If you want to keep it, please adjust contrast and brightness, because the

image quality is pretty poor compared to Figures 5 and 6. Irrespective of image enhancement, I suggest to move it either to the supplement or to completely skip it.

Figure 10

- Caption should state that porosity is MAD porosity.

Figure 11

- Please rearrange Figures a – f according to depth. This would help to support the statement of line 439.

Figure 12

- Caption states that there are white and black arrows. However, I cannot see black arrows, so I guess the caption refers to an earlier version of the figure.
- Figure g: while porosity reduction is evident in the four stages presented, I cannot see the described increase in preferred alignment of the long axes of pores, i.e. the pores' long axes appear to already have a preferred alignment in stage one which does not change in succeeding stages. The figure should be modified to emphasize this more clearly.

Table 1: The table should not only present the clay mineralogy but the bulk mineralogy, too.

Table 2: I guess that this table is based on quantitative pore investigations. If so, I suggest replacing the qualitative terminology (i.e. "abundant", "rare", etc.) with the actual values, because an evolution with depth cannot be seen at the moment. In addition, one might consider to shift the table to the supplement.

Table 3: Basically the same as for Table 2. In addition, I suggest to add the meaning of "EE", "EF" and "FF" to the caption.

Supplement 2: More details (i.e. a legend) on the kind of information provided in column G („type") should be provided.

Supplement 8: SN6: I would expect that in this kind of sample pyrite is mostly present as framboidal pyrite. Hence, I am somewhat surprised to see so many large pyrite grains in this figure. However, after comparing this figure with Fig. 5e, grains labelled pyrite appear to be micas. This should be verified.

Supplement 9: SN8 does not seem to correspond to Fig. 6a. SN33: mica is labelled in green instead of red. In addition, please verify that the large grain in the lower right corner is indeed mica.

Supplement 11: This figure should be part of the main manuscript, not of the supplement. Images (a) and (b) are a bit fuzzy, maybe some image processing could enhance that. Please modify the following captions: (b) "pore" instead of "pores", (e) "pore" (as the label on the figure) instead of "fracture".

Supplement 12: To better validate the data presented, the number (N) of segmented pores and grains, respectively, should be indicated, too.

Supplement 13: I suggest including supplement 13 in the manuscript and placing it before Figure 5.

Supplement 15: This should be included in the discussion of the manuscript.

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2022-11/se-2022-11-RC2-supplement.pdf>