

Solid Earth Discuss., author comment AC1
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Reply on RC1

Vincent Famin et al.

Author comment on "Deformation-enhanced diagenesis and bacterial proliferation in the Nankai accretionary prism" by Vincent Famin et al., Solid Earth Discuss.,
<https://doi.org/10.5194/se-2021-54-AC1>, 2021

The reviewer's comments are numbered hereafter and our responses are written underneath:

- My main concern is about the number of samples/analyses presented to arrive at the conclusions listed above. Notably, the inference of the increase in illite crystallinity in deformation bands is based on XRD analysis of one sample and analysis of the trace elements in one other sample. This is very limited evidence. In the absence of more supporting data, I feel that the authors should weaken some of their statements and make it clear that they are speculating.

To address this comment we made the following changes:

- Abstract, lines 18-22, the text has been modified to stress that the conclusion of smectite to illite transformation is based on two techniques applied on two samples: "In tandem, one shear zone sample displays a destabilization of smectite or illite/smectite mixed layers and a slight crystallization of illite relative to its sediment matrix, and another sample shows correlated increases in B and Li in shear zones and veins compared to the host sediment, both effects suggesting a transformation of smectite into illite in deformation bands. The two diagenetic reactions of sulfide precipitation and smectite to illite transformation are explained by a combined action of sulfate-reducing and methanogen bacteria, [...]"
- Discussion, section 5.3, lines 284-288, the following sentence has been modified to state the exact number of samples and analyses on which our illitization interpretation is based: "In the only sample studied by XRD (4R-3, 73-76), the shear zone displays a disappearance of smectite or I/S mixed layers, and an increased crystallinity of illite, relative to its host matrix. In the other sample studied for trace elements (21R-2, 82-85), the correlated B and Li enrichments of the six shear zone and six vein analyses relative to the matrix, particularly noticeable in veins (Fig. 11), are two additional arguments suggesting that deformation bands localize smectite transformation into illite."
- At the end of section 5.3, we added the following sentences to admit that our conclusion is still speculative, lines 301-310: "This conclusion is speculative for the time being given the small corpus of data presented here (one shear zone sample analyzed for XRD and twelve trace element analyses of shear zones and veins in another sample). Future work will have to test the reproducibility of these findings and their applicability at larger scale in accretionary prisms."

- Line 30: please add a reference after “in the accretionary prism”.

The following references have been added (line 40):

- For the mechanics of accretionary prisms: Davis, D., Suppe, J., and Dahlen, F. A.: Mechanics of fold-and-thrust belts and accretionary wedges, *Journal of Geophysical Research*, **88**, 1153–1172, 1983.
- For the influence of fluid pressure on shallow seismicity: Moore, J. C., and Saffer, D. M.: Updip limit of the seismogenic zone beneath the accretionary prism of southwest Japan: An effect of diagenetic to low-grade metamorphic processes and increasing effective stress. *Geology*, 29, 183–186, 2001.
- Line 30-31: please add references for the “large amount of work”.

Four already cited reference have been added, lines 42-43 (Brown et al., 2001; Henry and Bourlange, 2004; Pohlmann et al., 2009; Raimbourg et al., 2017), plus one new reference: Kastner, M., Elderfield, H., and Martin, J. B.: Fluids in convergent margins: What do we know about their composition, origin, role in diagenesis and importance for oceanic chemical fluxes?. *Philosophical Transactions of the Royal Society A*, 335, 243–259, doi:10.1098/rsta.1991.0045, 1991.

- Line 81-82: please mention that the specifics of the samples studied can be found in Table 1.

We cannot mention the specificities of the samples lines 92-93 because deformation structures are not yet described at this stage of the text. To take this comment into account, we added “(listed in Table 1)” after “The studied samples...” line 92, and we modified the first sentence of the Methods section to mention that the sampled deformation bands and the analyses performed on them are summarized in Table 1 (lines 122-123).

- Methods section: it would be helpful if sub-sections would be added.

Three subsections have been added: 3.1 X-ray diffraction (line 128); 3.2 Major element maps and quantitative analyses (line 144); 3.3 Trace-element analyses (line 160)

- Line 112: “Secondary” presumably “Scanning” is meant?

Indeed, now corrected line 125

- Line 138: please replace “the analysis on” by “the analysis of”.

Done, now line 155.

- Line 153: please define “BIR”.

BIR-1 is the full name of this reference rock material from USGS. Having checked in many publications, including studies in *Geostandard Newsletter*, the initials of this name are never mentioned (they refer to basalt of the Island Ridge). We replaced “BIR” by “USGS reference basalt BIR-1” in the Methods (line 172-73), in Table A1 and in its caption, and specify that it is run as an unknown (line 173).

- Line 158: please clarify “those samples”.

We removed “those” line 177, and specified that pyrite was found in “all” the samples, line 178, to be consistent with the description of barite, found in only one sample (as said line

191, not modified).

- Line 165: please clarify "indifferently".

We replaced « indifferently » by « both », line 184.

- Line 182: please replace "An example of SEM element map" by "An example of an SEM element map".

Modified by "An example of SEM element maps" (lines 205-206) as there are three maps in Figure 5.

- Line 188: "S" this element is not shown in Figs. 7 and 9.

True, "S" is shown in Figure 5, now added line 211.

- Line 207-208: "This greater compaction is seen in the SEM and XRF maps." Please explain what observations lead to this statement.

The sentence has been modified as follows to be more explicit (line 230): "This greater compaction is indicated by the general increases in element concentrations observed in SEM and XRF maps."

- Line 212: please replace "confirms" by "supports".

Done, line 238.

- Line 257: please replace "show" by "suggest".

Done, line 283.

- Line 270: "reach" should probably be replaced by "obtain".

We prefer to keep the exact term "reach" used by Esnault (2013) cited in this sentence (line 297).

- Line 280: please clarify "their".

We replaced « their concentration » by "the concentration of these compounds", line 315.

- Line 295: please replace "show" by "suggest".

Done, line 343.

- Line 320: please replace "tiny" by "microscopic".

We replaced "tiny" by "small" as deformation bands are not microscopic, line 354.

- Figure 1c: Please clarify the right most part of the figure, notably "Nb". Presumably this is "number", which is usually abbreviated as "Nr".

"Nb" replaced by "Nr" in Figure 1c, and also in Table 2.

- Table 2: the volume percentages are reported down to the third decimal, which seem improbably precise to me. What precision can be expected from the analysis by ImageJ?

The precision of ImageJ depends on the number of pixels in the pictures, as the volume percentage of pyrite is estimated by the total area of bright pixels relative to the total surface of the picture. Our pictures have been taken with a 11 Mpixel camera. The precision is of the fifth or sixth decimal depending on the brightness chosen to represent pyrite. However, we agree with the reviewer that we do not need such a precision, and rounded the numbers to the second decimal in Table 2. The new Table 2 is shown in the supplement file

- Table 3: where is the data from the other 2 samples that have been analyzed by EPMA according to Table 1?

Indeed, one sample (10R-2, 2-12, thin section VFC15) was missing in Table 3. The other sample (21R-2, 82-85) includes in fact two thin sections (VFC3 and VFC4). The new Table 3 has been corrected to include the missing sample and to show the thin sections. The new Table 3 is provided in the Supplement file.

- Table 4: where are the results of the other sample that was analysed by HC-LA-ICPMS according to Table 1?

The two slabs (VFC3 and VFC4) coming from the same sample (21R-2, 82-85) were analyzed. All the results from these two slabs are shown in Table 4. The caption has been modified to explain that the two slabs have been analyzed. Line 162, we also specified that the two slabs VFC3 and VFC4 were used for trace element analyses. The new caption is provided with Table 4 in the Supplement file.

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2021-54/se-2021-54-AC1-supplement.pdf>