Line-by-line comments from Reviewer #1

Line 62 – Change “high density” to “high spatial density”. *Edited.*

Line 65 – Delete “across the island of Holsnøy”. *Edited.*

Line 65-66 – “adjacent to both types of pseudotachylytes” Comment: Until this point, no definition of different types pseudotachylyte vein has been introduced in the manuscript. I guess the authors refer to injection and fault pseudotachylyte veins. Please explain. *We introduced eclogite and amphibolite facies pseudotachylytes in the Geological Setting section. We have edited the text here to clarify that the microfractures are adjacent to an eclogite facies pseudotachylyte 1.3 mm thick.*

Lines 68-69 – “The grains within the microfractures have a crystallographic preferred orientation (CPO) that is controlled by the host plagioclase on either side of the microfracture (Fig. 2)” Comment: honestly, I cannot see how Fig. 2 can support this statement and probably the authors refer to the documentation in Petley-Ragan et al. (2018). I suggest to add 2 pole figures in Fig. 2 and to expand the figure cation. Checking the original photograph of Petley-Ragan et al. it is also apparent that the current Fig. 2 report a colour-coded cumulative map including both plagioclase and K-Feldspar (not stated in the figure caption) and this information is not given. *We have now revised Figure 2 to include pole figures to clearly show the CPO in the plagioclase and K-feldspar grains.*

Lines 76-77: “The mineralogy of the microfractures and their associated reaction products varies locally. Some contain .. quartz and K-feldspar.” Suggested editing: “The microfractures locally consist of quartz and kyanite, or intergrown clinozoisite, quartz and K-feldspar”. *Edited.*

Lines 78-81 – “Microfracture mineralogy is found to depend on the X CO2 of the infiltrating fluid (Okudaira et al., 2016) and the orientation of the microfracture relative to the principle stress (Moore et al., 2019). The detailed evolution of the microfractures is thus dependent on a multitude of factors. Comment: this part should not stay here in the data section: should be moved to the discussion. *This has been moved to a new discussion section of the role of fluids.*

Lines 82-91. “Two microfractures of dominantly... MF2 experienced more shear deformation than MF1 (Petley-Ragan et al., 2018).” Comment: this part is a little confused as includes parts that should be moved to the Method section and parts that should be moved in the introductory part to illustrate the aim of the manuscript. The acronyms MF1 and MF2 are introduced here but are present in Fig. 2 which is cited before in the text at lines 69 and 71. I suggest to move the whole description of microstructures of section 3 after the Method section. *The manuscript has been restructured to take this into account.*

Line 86 – “(Aupart et al., 2018)”. Comment: This citation is not reported in the reference list. *The reference is added to the list.*

Line 89 – “Both microfractures are associated with clinozoisite, quartz and kyanite growth, and only MF2 contains dolomite.” Comment: Actually, Fig. 4 show the additional presence of garnet, ankerite and titanite within the MF1 microfracture-filling aggregate. *The sentence was deleted.*

Line 90 – “The lower J-index, greater misorientations and the presence of secondary fractures indicate that MF2 experienced more shear deformation than MF1 (Petley- Ragan et al., 2018).” Comment: 1) The J-index is not introduced in the manuscript and I really doubt most of the readers are familiar with this parameter. 2) The manuscript extensively refers to the previous work of (Petley-Ragan et al., 2018) that described the microstructures. I think the authors should summarize more properly the previous work without forcing a reader to continuously go back to the published paper. *We have revised Figure 2, removed the J-index comment, and added in text about the relevance of the work done by Petley-Ragan et al. (2018).*

Lines 93-101 – “Methods” Comment: this section does not contain some necessary information: e.g. the method used for the analysis the bulk composition of microfracture filling and the bulk rock composition. The sentence “The mass balance was calculated in MATLAB” does not provide a great information.” Please integrate this chapter with more informative details. *The Methods section has been extensively revised.*

Line 106: “Few grains contain single dislocation walls within their centre.” Comment: Is this visible in the images in Fig. 4? If yes, please indicate the substructure with an arrow. *Dislocations are now labelled in Figure 5 (used to be Fig. 4).*

Line 107-108 – “that have formed a subgrain wall made up of closely spaced dislocations”. Suggested editing: “that are locally arranged to form a subgrain wall”. Comment: Is there a difference between a “single dislocation wall” (line 106) and a “subgrain wall”? *Suggested edit accepted. A subgrain wall is an array of dislocations that form a boundary or wall – it is made up of single dislocations. We have edited the text to help clarify this.*

Line 121 – “The intergrowth” Comment: which intergrowth? *Edited to the Bøggild-Huttenlocher intergrowth.*

Lines 139-140 – “The inheritance of the crystallographic orientation of the host plagioclase and its twins within the grains,” Comment: as commented above, this is not really documented in the current manuscript but is probably referred to the documentation in Petley-Ragan et al., (2018). This information is largely used in the discussion and a proper documentation should be included in the manuscript. *Figure 2 was revised to show the strong CPO.*

Lines 141-142 – “An equilibrium fabric with crystallographic inheritance is generally created by dislocation creep and grain boundary migration”. Comment: I am a little confused by this sentence. The annealed microstructure of the micro-fracture is a process of grain boundary migration to minimize the strain and surface area energy. Not sure why the authors invoke dislocation creep. The inheritance of the host grain CPO could be well explained by annealing of an in-situ shattered microstructure within the microfracture (as actually suggested later in the manuscript). *We agree that the sentence is confusing and have removed the sentence.*

Lines 146-147 – “Dislocation- and grain boundary migration are too slow to have taken place within this time scale”. Comment: this sentence need a reference or an additional support. Actually, Bestmann et al. (2012) described suggested that dynamic recrystallization and annealing did occur in the short-lined transient of thermal anomaly associated with the frictional seismic event. *This part of the discussion is now revised to include both Bestmanns arguments for rapid healing and the possibility, raised by reviewer#2, that the SPO was developed more slowly under the influence of a far-field stress with a principle stress axis approximately normal to the fault surface.*

Line 148 – “.. more rapid recrystallization process”. Comment: more rapid than what? *This part of the discussion is now rewritten with a more proper assessment of the possible time scales involved.*

Lines 146-152. Comment: This whole part need rewriting to better clarify the authors’ thoughts. *See comment above*

Lines 204-205 - It is only until after an earthquake causes wall rock damage that fluids enter the wall rock through coseismic microfractures, and these fluids are likely overheated by the frictional slip (Bestmann et al., 2016). Comment: As discussed in the main comments above, the process of coseismic fluid infiltration is a relevant and intriguing issue that deserves some more estensive discussion. *The role of fluids is now discussed in the Discussion section.*

Lines 208 – “Assuming that elevated temperatures lasted for up to a minute within 1 mm of the pseudotachylyte (MF1), Comment: I suggest to be more quantitative rather than roughly assuming. The temperature evolution in the host rock adjacent to a pseudotachylyte could be modelled. See my main comment above. *A thermal model is now included.*

Lines 209-211 – “At distances greater than 1 cm from the pseudotachylyte (MF2), the wall rock experiences minor heating to a few 10_C above ambient.” Comment: same comment as above. *A thermal model is now included to support this argument.*