First of all we greatly acknowledge the two reviewers (Giulio Viola R1 and the anonymous R2) for their comments and suggestions. We are planning a revision of the manuscript following all the points they underlined in order to improve the submitted version of our SE paper. In particular:

Reviewer 1

Comment 1) Abstract: This has to be completely rewritten. As it stands at the moment, it is not a concise summary of the main results of the study and an indication of how the authors used them to elaborate and propose a solid model. It reads instead more like a totally data-barren rationale to a scientific proposal. Only generic statements about the broad theme of viscous-frictional cyclicity are made and no data/hard facts and interpretations thereof are proposed. This has to be changed.

Response 1). We are going to change the Abstract in order to better present our data and the rationale for the scientific proposal of the paper after the general introduction of its subject;

Comment 2) As for the scientific component of the study, I do believe that the authors "read" correctly the available structural evidence and that they interpret that properly to generate a robust evolutionary model. Unfortunately, though, I was disappointed by the level of documentation of the key structural features, which, especially in the case of the microstructural description, is very deficient. Let me elaborate this further by referring to the text of lines 417-427. This is THE CORE of their work. Take this away and the reader is left with nothing to ponder and no model can be elaborated and proposed. Indeed because of the centrality of this suggested reconstruction, the reader needs to be taken in much detail through the available evidence that underpin the proposed evolutionary model. The sequence events 1) to 3) is poorly elaborated and documented, I believe, and the evidence that would demonstrate beyond doubt the cyclicity between the frictional and viscous evolution and the overprinting relationships is, at best, quite poor. Cyclicity is a "hot topic" these days and is being actively described in many scenarios. Not always, though, is the proposed documentation convincing enough. The cataclastic portion of the rock is not documented, for example. The authors should prepare photographic tables documenting the microstructural characteristics of the cataclasite and describe much more accurately the clasts and their compositions. The text, for instance, reports that the clasts are of fractured K-Fs and qtz. What quartz is that? Is it deformed? Is it equivalent to that of the protomylonite (which would help convince the reader of the relative age of cataclasis) or are there also clasts of ultramylonite? Better documentation is needed, in synthesis. When offering the "time" sequence of deformational episodes, Molli and coworkers, moreover, need to list ALL the existing evidence in favour of their hypothesis in a clear and convincing way, such that the readership are not asked to “believe” what they conclude, but can easily come to the same conclusion (easly because of appropriate documentation and clear text descriptions).

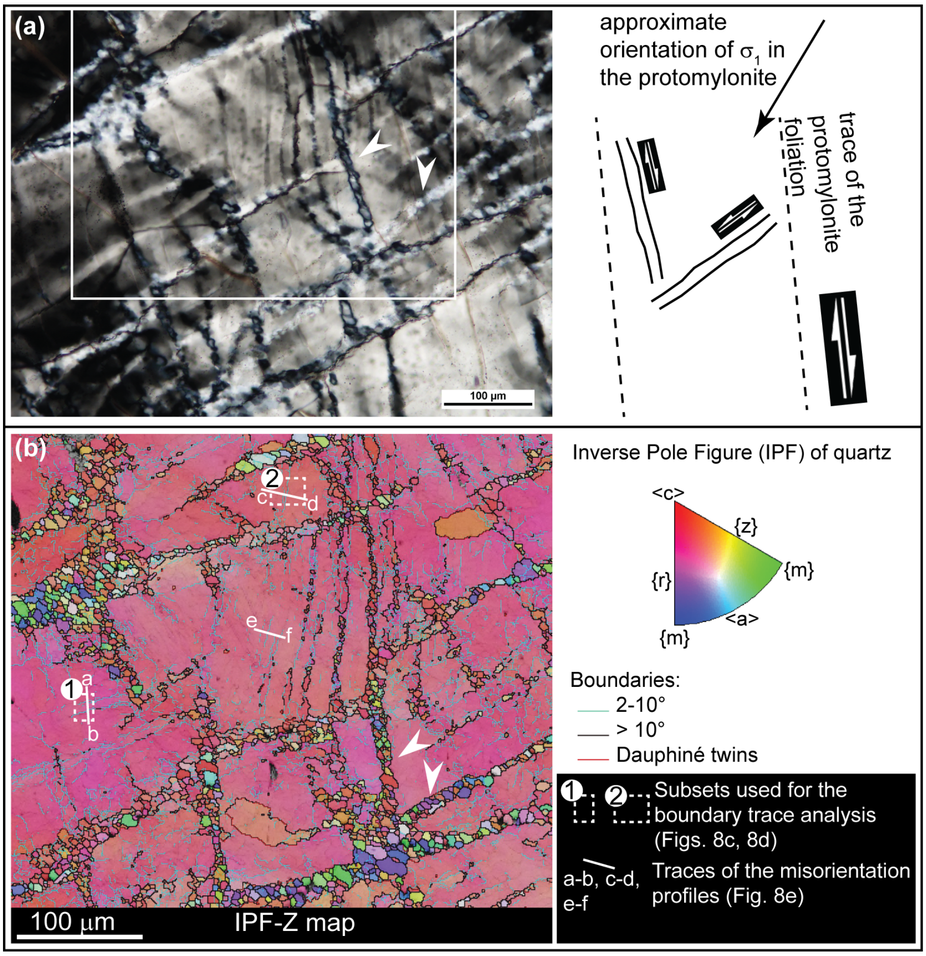
Response 2). We will provide a more detailed microstructural description for the cataclastic portion of the investigated sample to support more clearly the proposed structural characterization and deformation path; in particular, we are preparing an adjunctive photographic table documenting the microstructural characteristics of the cataclasite to support a more detailed description of the clasts, their compositions and internal deformation features. In particular, we will show that quartz clasts in the cataclasite have the same microstrutrual features of quartz in the protomylonitic hosts, and that there are no clasts of ultramylonites (i.e., there is no evidence of brittle deformation after the ultramylonitic stage).

Comment 3) I am intrigued by the discussion about a possible “background” flow stress value that would steer the overall grain size of the dynamically recrystallised quartz in the ultramylonite and in the sealed microcracks. While I follow the reasoning behind this (and share the proposed view), I’d invite the authors to also consider that other factors might control the final grain size of the nucleated grains in the fractures, such as the initial aperture of the (micro)cracks and the starting grain size of potental micro-gauge fragments in the dilatant space of the fractures. Are these (and potentially other factors) relevant? If yes, how? And if they are not, why? A few lines discussing these aspects

Response 3). Before addressing this specific comment, we need to clarify the following two important aspects:

1. Conjugate intracrystalline bands of recrystallized grains with the same microstructure as those reported in this study are a ubiquitous feature in the Popolasca proto-mylonitic granitoid, and are not restricted to this sample only.
2. *Kinematic framework of the protomylonite.* In the old figure 7a, the protomylonite foliation is oriented N-S (subvertical). The c-axis maximum of the host grain is oriented near the pole of the protomylonite foliation and rotated clockwise to indicate a dextral sense of shear in the protomylonite. The dextral sense of shear is coherent with that at regional scale (top-to-the-west). The c-axis orientations of grains in the bands differ from the orientations of the host grains, as shown by our EBSD analysis (old Figs. 7b-d) This difference is consistent with the relative rotation of the c-axes of grains in the conjugate bands, reflecting their respective sense of shear assuming a shortening direction oriented approximately NE-SW in Fig. 7a and consistent with the bulk dextral sense of shear of the protomylonite. In this kinematic framework, the respective sense of shear is dextral in

bands with a subset 2 orientation and sinistral in bands with a subset 1 orientation. The shape preferred orientation (SPO) in the bands is also consistent with their respective sense of shear. Thus, we conclude that (1) the intracrystalline bands of recrystallized grains are effectively conjugate shear bands; (2) they formed during the development of the regional proto-mylonitic foliation of the unit, and not in response to the localized brittle event investigated in the present study, and can therefore be used to evaluate the stress conditions in the protomylonite *prior* to the brittle event; (3) they were overprinted by the cataclastic event forming the brittle precursor of the ultramylonite in our sample. The local kinematic framework of the intracrystalline bands will be clarified in the revised manuscript with a new figure (new Fig. 7a, attached here below).



We agree with the reviewer that factors like the initial aperture of the (micro)cracks and the starting grain size of potential micro-gauge fragments can control the *initial* grain size in the quartz bands. However, the *final* microstructure of quartz in the bands is not cataclastic, but typical of a dynamic recrystallization aggregate with a clear shape preferred orientation (SPO) and crystallographic preferred orientation (CPO). Accordingly, our EBSD analysis suggests that the quartz grains in the intracrystalline bands deformed by dislocation creep on the basal <a> slip system. This is consistent with a microstructural evolution where dislocation creep overprinted fracturing and

neocrystallization along cracks (e.g. Trepmann et al., 2007, 2017). Along cracks, new grains grew by strain-induced grain boundary migration from fractured fragments with a low dislocation density (e.g. Stünitz et al., 2002; Trepmann et al., 2007) and deformed by dislocation creep on the dominant basal <a> slip system, as shown by their CPO and SPO.
In conclusion, our observations suggest that the *final* grain size in the intracrystalline bands represents an equilibrium grain size with the flow stress during crystal plastic flow of quartz in the bands. Thus, they can be used to evaluate the differential stress during dislocation creep deformation in the protomylonite *before* the development of the brittle precursor.

Here below we address the main comments supplied by Reviewer 1 in the annorated manuscript.

Comment GV12 line 253. Why at 90? Are they really conjugate and we are in Tresca's conditions or, maybe, they are not true conjugates? Btw, not clear to me where these are on the microphotograph. Please highlight them.

Response. Please see our reply to the main comment 3). The SPO and CPO of grains in the bands are consistent with the kinematic framework of the protomylonite. We have indicated them with white arrowheads in the new Fig. 7a and 7b.

Comment GV26 line 321. As mentioned in a comment in the intro, you should really introduce this component of the study earlier on. Why did you do EBSD? On what and aiming at what? Please introduce somewhere in the text, up to you where.

Response. We will clarify that the aim of EBSD analysis has been to identify the dominant deformation and recrystallization mechanisms in quartz in the protomylonite and in the ultramylonite, and to derive quantitative grain size data that can be used to evaluate the differential stresses experienced by the rock during dislocation creep deformation.

Comments GV27-GV30, lines 338-347.

Response. We have not observed clear offset across the intracrystalline bands, so that we agree with the reviewer that classifying them as shear bands requires an explanation. As discussed above, the new grains within the bands do show a CPO and an SPO, which we interpret as the result of dislocation creep dominantly on the basal <a> slip system. Thus, the bands accommodated plastic shear deformation, and we have clarified this point in the revised text.
We have modified the original Fig. 7 as suggested by the reviewer. There are two new figures in the revised manuscript: Fig. 7 shows the deformation microstructure of the host crystal, the local

kinematic framework, and the EBSD map; Fig. 8 shows the pole figures, the boundary trace analyses, the misorientation profiles, and the misorientation axis/angle pairs.

Comment GV31 line 392.

Response. In our view the convincing evidence that the two processes are coeval comes from the EBSD data, which is consistent with quartz recrystallization from fractured fragments (subset 2) as well as by progressive subgrain rotation (subset 1). Another supporting evidence comes from the petrology: the mineral assemblage in the protomylonite, cataclasite and ultramylonite is all the same and is typical of blueschist facies conditions. Although this does not demonstrate coeval events, it does demonstrate that the entire ductile-brittle-ductile deformation sequence occurred under fairly constant P, T conditions. We will clarify this in the revised manuscript.

Comment GV36 line 450.

Response. Please see our reply to the reviewer's main comment 3).

Reviewer 2

The submission by Molli et al. is a well-documented case of subduction-related deformation, specifically the sequence of microstructure development that is correlated with HP/LT conditions. The authors describe sequential deformation attributes at a subduction interface that persuasively argue for both brittle and viscous behaviour. The techniques and methodology applied are well established, and I could find no error in them.

Comment 1) I would argue for caution in assigning all ductile localization to brittle precursors. Although this is an extremely common case, it only takes one counter example to disprove it.

Response 1) we completely agree with this comment and will manage the issue consequentely in the revised version of the paper. We do not mean to prove that all ductile localization invariably requires brittle precursors; in the introduction we intend to mention studies that made convincing strong cases for the occurrence of brittle precursors.

Comment 2) … the reliance on quartz microstructures as typically LT or HT warrants care; I have no general problem with the conclusions, but mineral response will be a combination of T, stress, imposed strain rate, etc.

Response 2) we accept these suggestions and will deal more carefully with this issue in the revised version of the paper.

To sum up, we are following all the detailed comments supplied on the appended manuscript in order to strengthen the presentation and argumentation of our paper.