Comments on the manuscript: «Deformation of feldspar at greenschist facies...» by Hentschel, Trepmann, and Janots.

The manuscript describes low temperature mylonites in quartz-feldspar rocks from the Alps. The rocks represent an example of semi-brittle deformation, and there still is a great lack of data and interpretation of such microstructures. Given that such rocks represent one of the strongest portions of the crust or even lithosphere, it is a very important study for understanding the deformation of these strong rocks in the brittle to viscous transition region.

The analysis of the microstructures has been carried out carefully and with a lot of detail. The data base is excellent and of very good quality. The interpretations are for the larger part sound and justified by the data base. Some concepts need to be clarified and explained better in the text. In particular, the relationship between cracking and recrystallization or low temperature plasticity and recrystallization as presented in the text contain some virtually contradictory or at least inconsistent statements. These will be minor to moderate revisions which are required before publication, which I definitely recommend for this manuscript.

Detailed comments:

Abstract, line 10: Better: "…replacement is interpreted to take place by…"

line 10: Better: "chemical metastability" instead of "solubility difference", as that term is more general

Line 11: omit "in contrast"

line 15: "dislocation glide and strain-induced grain boundary migration" – see general comments and comments below concerning this term

p.3, line 16: Fig. 1 e,g do not exist, only Fig. 1

p.3, line 28: What is the connection of tertiary ages with the rest of this text?

p.4, line 11: insert commas after "argued" and "studies"

p.4, line 14: insert "and" after comma

p.4, line 15. "mineral" instead of "mineralogical" p.5, line 10: Are the grain sizes given as diameters of equivalent spheres or circles? Mean or mode of the grain size distribution? Please state more details of the grain size analysis.

p.5, line 16: omit the sentence: “Feldspar…”. This is a repetition, the situation is better explained below in the text.

p.5, line 17: better: “…and rarely shows perthitic…”

p.5, line 18: better: “…with Ab95-86 is present and in these grains zoisite…”

p.5, line 25: Omit “In contrast” at beginning of sentence

p.5, line 27: “affected” instead of “influenced”

p.6, line 5: better: “…are irregular and rather…”

p.6, lines 7-8: I think that there is some indication for host control for the upper left hand quadrant (compare Fig. 4d with 4f). Many of the new grains have an orientation which is vaguely similar to the clast, whereas this is clearly not the case of the other pole figures (4e, g).

p.6, line 18: The term “sawtooth-shaped” is not very good. Sawtooth usually implies some asymmetry in the teeth shape, like “monoclinic” shapes. Perhaps it is better to use “cuspate-lobate” or just “lobate” as a descriptive term for these microstructures.

p.6, line 19: “into” instead of ”through” K-feldspar.

p.6, line 19: “lobate” instead of “curved” grain boundaries

p.6, line 24: What do you mean by this sentence? That the cracks terminate at the albite grains or that the albite grains are separated from the host clast? Please explain this better.

p.6, line 28: “aggregate” instead of “aggregates”

p.7, line 3-4: better: “…that they represent healed cracks … misorientation rather than subgrains (Fig. 8a).”

p.7, line7: “… (Fig. 8e), particularly for correlated grain boundaries.”

p.7, line 17: space after “compositional” and “which” instead of “whis”

p.7, line 19: omit “which is”

p.7, line 24: “elongated” instead of “lens shaped” (lens is a 3-D term)

p.8, line 23: “of” instead of “on”

p.8, lines 22-23: The apatite inclusions are interesting. It is difficult to see the apatite inclusions in the K-spar in the images of Fig. 6, but they seem to be there in some cases. Is it possible that the apatite inclusions are also present in the K-spar and can be used to mark the former clast outline of the K-spar grains?

p.8, line 24: o.k, the replacement is not directly related to strain, but the stresses will be highest at the grain boundary, so that in a deforming aggregate, the K-spar will be replaced at the highest stress sites. In addition, it is, generally speaking, the higher free energy state of K-spar than albite. Of course, the higher free energy state will result in a higher solubility, but to express it as solubility is a bit unusual as the solubility depends, among other factors, on the fluid composition, which is unknown here.

p.8, lines 29-31. The fact that there are albite grains at the boundary of the K-spar clasts (clear replacement structures, Fig. 5b) and that there are K-spar clasts inside the fractures (Fig. 5d), it is obvious that K-spar is replaced by albite. It may be possible that, in addition to the replacement, some albite might also precipitate from a fluid, but it is not necessarily “more likely” (as expressed in the text) than the replacement, for which there is clear evidence.

p.9, lines 2-3: The bending may well be results of microcracking, as outlined in Tullis & Yund 1987. So, it is not necessarily the result of plasticity.

p.9, line 9: Dislocation glide combined with recrystallization (e.g. strain induced grain boundary migration) constitutes, by definition, dislocation creep. Phrased in the way it is written here, the statement is neither correct nor what you want to say. It should be made clear (also in the following discussion section) that the two events (e.g. cracking or glide of dislocations and the replacement/re- or neocrystallization) are different events or episodic processes, otherwise the combined processes would constitute dislocation creep.

p.9, lines 10-12: I agree with this statement, and you are showing in Fig 11 and 13 that there are chemical differences in grains and overgrowth rims. So, chemical effects will be part of the driving potential.

p.9, 12-14: As pointed out above, the bending may be the result of microcracking. In addition, the discrete boundaries of misorientation are visible in Fig. 7a (lower arrow marks a discrete misorientation boundary), and in Fig. 8a (many sharp boundaries between dark and light blue). Furthermore, the fragmentation of the albite clast is clearly visible in the Figs. 7 and 8). The brittle deformation induces defects, too. So, certainly low temperature glide processes may occur, but the evidence shown documents primarily cracking processes.

p.9, line 28-30: Strain induced grain boundary migration is a recovery or recrystallization mechanism and thus would be part of dislocation creep. Again, as pointed out above, one has to stress the fact that the processes do not occur simultaneously or are not coupled, because dislocation creep is excluded here (for good reasons).

p.9, line 32: The “micro-crush zones” point to an important term in this context: “semi-brittle“ deformation. I think that this term is perfectly applicable and includes the cracking and replacement/recrystallization aspects.

p.10, line 5: omit “in contrast” – this is the start of a new chapter.

p.10, lines 16-18: Myrmekitization typically does not occur below 550C, because an intermediate plagioclase composition is required for that.

p.10, line21-23: Why only precipitation and not partly replacement? The albite replacing K-spar forms randomly oriented grains (Fig. 5).

p.10, lines 28-31: Do you refer to phase mixing by grain boundary sliding? This mechanism is not very effective in producing mixing, and nucleation is far more efficient for that. As you have precipitation (including nucleation?), the mixing in the polyphase material may well be produced by this process. The question is: why is the monophase albite aggregate a single phase material?

p.11, lines 28: It seems necessary to include at least a short discussion about what may cause the difference between type A and B microstructures. As everything is documented carefully and in detail, the reader is left without a conclusion concerning these differences.

p.12, lines1-2: What is the difference between “strain-induced replacement of albite with granular flow” and “dissolution precipitation creep”? The old albite (or K-spar) has to be dissolved in some way, and the replacement corresponds to a precipitation. So, given the fact that chemical changes are involved, it still is a type of dissolution precipitation creep process.

p.13, lines 1-3: same as p.12, lines 1-2.