Referee's comments: Black (Arial)

Our replies: Blue (Arial)

Revisions made to the manuscript in response to the referees' comments: Red (Times New Roman).

Descriptions from the original manuscript: Black (Times New Roman)

Replies to Referee #2's comments

Comments on the manuscript: "Water release and homogenization by dynamic recrystallization of quartz" by Fukuda, Okudaira, and Ohtomo

The manuscript describes FTIR measurements in quartz from granitoids deformed to different finite strains. The authors find that the H2O content decreases systematically with different degrees of dynamic recrystallization due to different finite strains. The manuscript is concisely written, to the point, and the conclusions are supported by the data presented. I recommend that the manuscript is published after minor revisions.

We thank positive comments. According to the referee's comments shown below, we have revised the manuscript.

Detailed comments:

Line 34: ad reference: Negre et al. 2021

Done. We have also added it in the reference list.

L35,

Lusk et al., 2021; Nègre et al., 2021).

Line 50: please add "quartz aggregates" instead of "in quartz" to include grain boundaries rather than just grain interiors.

Revised.

L52,

IR spectroscopic measurements of water in quartz aggregates have revealed that

Line 53: better "grain boundary regions" than just grain boundaries, because you consider volumes here (grain boundaries would just be surfaces).

Revised.

L55,

grain boundary regions

Line 78: instead of using “texture”, it would be better to use “microstructure” or “fabric” here. Texture in a deformation context could be confused with CPO. This applies to the whole text.

We have changed “texture(s)” or “textural” to “microstructure(s)” or “microstructural” throughout the manuscript.

Line 155: better: “...host quartz grains...”

Revised.

L215,

host quartz grains

Line 156: some recrystallized regions contain H2O higher than 300 ppm H2O (light blue colors correspond to about 400 ppm H2O in Fig. 6).

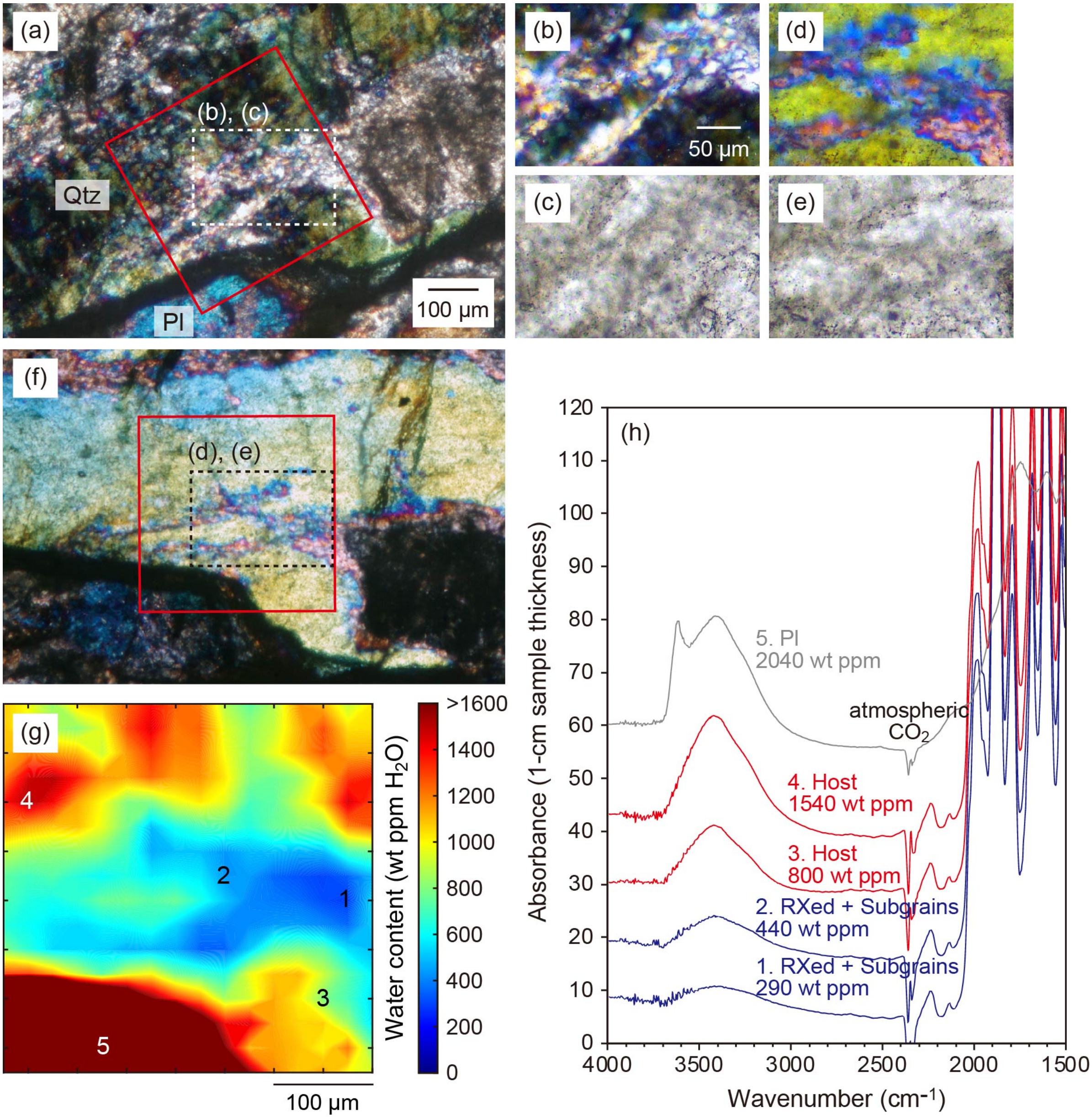
Water contents “higher than 300 ppm H2O” develop “within ~150 μm around host grains”: These regions may be composed of subgrains and were described next. We have clarified these facts as follows.

L216,

In contrast, water contents in the recrystallized regions of >~150 μm away from the adjacent host grains are 200–300 wt. ppm, clearly lower than those in the host grains. In addition, a gradual decrease in water content from the host grains to the adjacent recrystallized regions is observed in some cases; for example, over a distance of ~150 μm from No. 3 (host; 680 wt. ppm in Fig. 7c) to No. 1 (recrystallized region; 210 wt. ppm). In terms of microstructure, this decrease is consistent with the development of dynamic recrystallization from subgrains in and around host grains (Fig. 7a) to recrystallized grains.

Lines 162-166: the “subgrains” could be regions with healed microscracks – it is difficult to see from Fig. 7b. Higher H2O contents in such regions would be consistent with microcracks. Please mention the possibility of microcracks and perhaps discuss them later in the discussion section.

We have added enlarged images for the region including recrystallized grains and possible subgrains. We do not observe healed microcracks even in the enlarge images but the existence of microcracks is not completely denied. Therefore, we have revised as follows.



Revised Figure 7 (Figure 8 in the revised manuscript).

L223,

In another part of the weakly deformed sample (Fig. 8), regions of small grains around host grains widen at certain sample stage angles under a polarizing microscope and subgrains would be included (Fig. 8a–f). Water contents in recrystallized regions probably including subgrains are 290–500 wt. ppm (around Nos 1 and 2 in Fig. 8g and h), slightly higher than those in the recrystallized regions in Fig. 7. These regions look slightly darker under plane-polarizing light, probably because of light scattering by fine grains (Fig. 8c and e). We did not observe microcracks that hold water, at least under a polarizing microscope.

Caption,

Figure 8. IR mapping results for the weakly deformed sample. The sample thickness is 97 µm. (a) Optical photomicrograph under cross-polarized light. The IR mapped area is shown with a red square. The dashed white rectangle depicts the area of enlarged images of fine-grained quartz regions including host grains under (b) cross-polarized and (c) plane-polarized light. Similarly, images (d) and (e) are from (f), where the optical photomicrograph is rotated approximately 30° clockwise from (a).

Line 220: add reference Kilian et al. 2016.

Done.

L289,

Finch et al. (2016), Kilian et al. (2016), and Kronenberg et al. (2020)

We have also introduced the water contents and species in quartz reported in Kilian et al. (2016). Their water contents were significantly lower than those in our study and other previous studies (Finch et al. 2016; Kronenberg et al. 2020). We have added the following sentences.

L307,

Kilian et al. (2016) studied quartz in a granite deformed under amphibolite-facies conditions. In their samples, quartz grains were dynamically recrystallized to a grain size of 250–750 µm mainly by grain boundary migration with a minor contribution by subgrain rotation. Their mean water contents, including intracrystalline OH and molecular H_2O as fluid inclusions in recrystallized quartz, were ~10 wt. ppm, comprising 70%–80% of molecular H_2O and the remainder of intracrystalline OH, and were approximately half of those in the original magmatic host grains. Those values in recrystallized and original grains are much lower than those in other previous studies and in the present study. Thus, water contents in recrystallized quartz grains and host grains are diverse in natural samples; this diversity may depend on deformation conditions, including the equilibrium state of water.