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Solid Earth Discussions

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Interactive Comment

Interactive comment on "Finite lattice distortion patterns in plastically deformed zircon grains" *by* E. Kovaleva et al.

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The authors are grateful to Dr. N. Timms for constructive comments and reasonable corrections to the text, which would be integrated. Some of the specific comments require an answer.

Comment on figures 2-7: "How do you know that the intragrain boundaries are not growth-related rather than deformation-related?"

As we have demonstrated with the figure 2 in the manuscript, CL-zonation has an effect on misorientation of the zircon crystal lattice, but usually the growth-related misorientation is insignificant (less than 0,5 degrees, Figs. 2A,D; 3A in the manuscript). We agree with the fact that growth zoning, as a grain-internal heterogeneity, might also have an effect on post-growth crystal-plastic deformation. However, in the cases that we discuss, subgrain boundaries truncate CL-zonation at the high-angles (e.g. Figs. 3B; 7 in the manuscript; Fig. 1 in the comment). In most cases CL-zonation perform xenocrystic core with concentric overgrowth that does not correspond to the “sectors” defined by the subgrain boundaries in the same grains (e.g. Fig. 1 in the comment). Subgrain boundaries usually truncate the cores and the rims, and do not strictly follow their geometry. Besides, CL-zonation is characteristic for the majority of the zircon grains regardless their cumulative misorientation and degree of strain accomodated by the host rock. Crystal-plastic deformation with formation of the subgrain boundaries in zircon dramatically enhances in the strained rocks, towards the core of the shear zone (Figs. 14 A-B in the manuscript). Even more, we observe crystallographic preferred orientation of the plastically-deformed grains from the strained rock, when the Zrn [001] direction is parallel to the stretching lineation (Figs. 4 and 9 in the manuscript; section 7.2.3; group III-2). In our opinion this is the evidence of post-growth crystal-plastic deformation during shear zone formation. Taking into account all these observations, we suggest that the subgrain boundaries discussed in this manuscript are post-growth features and relate to crystal-plastic deformation rather than are growth-related.

Figure 1. CL-images of grains BH12-07B_15a (A) and BH12-07A_04 (B). CL-zonation is contoured with black lines; subgrain boundary traces are superimposed as white lines.

Comment on figure 15: “Wouldn’t temperature have a greater effect on the mobility of GNDs?”

The temperature is without doubts the controlling factor for GNDs mobility. However, with the figure 15 we are trying to reflect not the difference in GNDs motion rates, but the ratio between GNDs formation and GNDs motion rates. We suggest that this ratio is responsible for differences in finite deformation patterns I-III in zircon grains. This ratio is controlled not only by temperature, but also by strain, strain rate and stress, what we were trying to reflect with the figure 15.

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Interactive comment on Solid Earth Discuss., 6, 1799, 2014.

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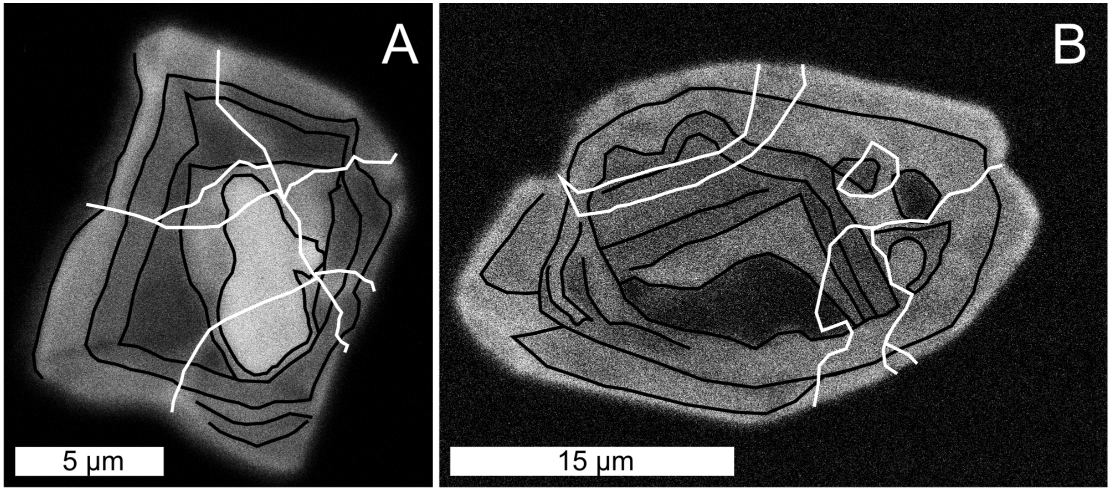

Fig. 1.