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Interactive comment on "The grain size(s) of Black Hills Quartzite deformed in the dislocation creep regime" *by* Renée Heilbronner and Rüdiger Kilian

Anonymous Referee #2

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In general, I find this paper scientifically relevant and well written. The re-visitation of the analysis of the published experimental data on BH quartzite greatly increases our understanding of the results and provides a new standard for any attempt of correctly comparing natural data (or new experimental data) with these literature experiments. However, this is a two-papers-in-one: one dealing with the methodological aspects of the "textural" analysis; the other dealing with the results of the analysis of experimentally deformed samples of BlackHill quartzite described in previous published papers. Though I agree that the methodological part integrated within the manuscript is important to appreciate the quality and significance of the data, I find this composite paper difficult to read. Some parts dealing with data processing (e.g. section 3.1.-3.3. Preprocessing) are actually a tutorial on how to conduct properly the microstructural and textural analysis. A reader is often tempted to jump across and go directly to the "scien-

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tific" results. I do not actually see the benefit of putting the whole technical description in the main text instead than moving it in an extended appendix. You must be a real affectionate fan to resist the temptation of skip many parts. I have no real solution to suggest on how to modify this part to make it less heavy to read. I leave the authors to decide if the ms aìwould benefit by concentrating on the main results of the analysis of the BH quartzite experiments. The readers interested in performing a proper microstructural study according to the methodological suggestion of this paper could refer the appendix to find the information for their analysis.

Specific comments (mainly typos)

Line 26. is related the kinematic framework and the original grains Something (to) is missing

Line 28: "samples of all regimes" Comment: in line 21, above, the authors refer to dislocation creep regime (singlular). Not clear what the authors means here.

Lines 22 and 30: Not sure that references can be used in an abstract

Line 41. "for numerous studies." Delete: redundant

Line 44. "Kidder et al., 2016), effect" the verb is missing here to be consistent with the other statements

Line 45 Post et al. (dot)

Line 67. Please define the Y axis (and shear zone reference frame) here though, I agree, it should be known by most of the microstructural people.

Line 67. Delete "or"

Line 65-70 This paragraph looks rataher unrelated to the previous and following ones. Please refine the link

Line 76. "measured, using EBSD". Delete comma

Line 79. CIP- and EBSD-derived (insert hyphen)

Line 93- 850°C, 875°C, and 915°C Space before the symbol °C

Line 109 - Pec et al., 2015 (insert a comma)

Line 145 – “while the mostly c-axis based CIP analyses”. Why “mostly”? The CIP analysis is just based on the c-axis

Line 265: “, the” (insert space)

Line 434-436 “Processing and representing the EBSD mapping as c-axis orientation images (COI), shows that both methods, EBSD and CIP, coincide down to the limit of optical resolution of polarization microscopy (Figure 11)”. Actually I can spot some significant (non trivial) differences in the comparison of Fig. 11. For example, in sample w946 the EBDS detects a complete girdle, whereas the CIP misses the Y grains. In terms of “interpretation of the active slip systems” from a qualitative analysis of the pole figure, this difference translates in the inferences that prism <a> was not active based on the CIP analysis. This effect is also present in samples w1092 and w1010 even if to a minor extent. I suggest that the authors make a specific comment on this difference resulting from the different analysis. I do not understand if the difference is explained by the the “second source for differences” cited in lines 443-446.

Lines 486-488. “Plotting these values into the Rf-phi diagram reveals that, the subdomains plot on the equiviscous curve (R = 1), as does the bulk sample by default, while the full domain plots on a curve for a viscosity ratio >1.” Comment: where are these data?

Line 489: “Note, that” (insert space)

Line 489. “remain about 1/3 ofare” (something is missing here)

Line 492. “iso-viscous” (“equiviscous” on line 487)

Line s 492-494. “Such a situation however, requires an additional strain producing

and accommodating mechanism operative throughout the entire sample, a possible candidate being grain boundary sliding." I cannot actually understand why. Could the authors argument better this statement?

Line 540. "Gradient of" (insert space)

Line 556. I find a little weird to find this section placed here. The previous sections dealt with the analysis of the experimental results on BH quartzites, while this looks like a discussion dealing with the method. Again the ms suffers the 2-papers-in 1 nature. I would find more appropriate to move this section to the introductory methodological part.

Line 621 "5.4 The recrystallized grain size in dislocation creep" Comment: same comment as above for the first part of this section.

Line 769. "The c-axis orientation images and pole figures obtained by CIP and EBSD" As emphasized above in comment to lines 434-6, I do not fully agree with this conclusion.

Best regards and congratulations for such a good contribution.

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