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Interactive comment on "Microscale strain partitioning? Differential quartz lattice preferred orientation development in micaceous phyllite, Hindu Kush, northwestern Pakistan" *by* K. P. Larson et al.

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We appreciate the constructive review of our manuscript by Dr. Mancktelow. Below, we respond to the points that he raised.

1) The reviewer expressed concern that the E-W horizontal fabric could be an artifact related to instrument miss-measurement of N-S horizontal c-axes. They later go on to note that such a problem does not exist with EBSD or u-stage analyses. This is not an issue that affects the instrument used for this study.

In earlier versions of similar instruments the problem of determining which extinction quadrant contains the c-axis had not been fully solved. The solution lay in a better determination of the retardation value and resolving the quadrant as a fast/slow problem. The later revisions of these types of instruments – including the one used in this study - are quite robust in determining the retardation and the correct quadrant.

2) Dr. Mancktelow indicates that the variation in quartz grain size "between thicker and thinner quartz layers and versus the matrix almost certainly reflects the pinning effect of second phases". Moreover, he goes on to indicate that in such cases it is not permissible to use a grain-size piezometer in such cases. We completely agree with this assessment – quartz layers in which micaceous material limits/affects the size of the quartz grains cannot be used for grain size-based measurements.

As mentioned in the manuscript we outline three different quartz grain populations. Fine grained quartz in the matrix, and both coarser and finer size populations within a quartz rich lens. The matrix quartz is often completely encased in phyllosilicates (see Figure 3D). We have not used these grains in size-related estimates. The two populations within the quartz rich lenses, however, were used for such determinations. Previously, we did not demonstrate the detailed character of these lenses, which could lead to questions about whether or not secondary phases may be controlling the size of the quartz. To clarify this we have now added a new figure 5 (see supplementary material with this comment for an updated version of the MS) that shows a detailed view (location now shown in Figure 2D) of the coarser and finer grained portions of the quartz lens. While there may be marginally more phylosilicate associated with the finer grained portion the secondary phases do not control the size of the quartz grains. We therefore interpret the difference in grain sizes as originally laid out and explained in the discussion portion of the manuscript. We have also added a comment in the manuscript acknowledging that phylosilicate abundance/spacing could have an affect, but that it does not appear to be the case herein.

3) In his comment Dr. Macktelow indicates that in a shear zone the shear stress on

any parallel layer must be the same and following that, dynamically recrystallized grain size reflecting that shear stress should be approximately constant. We are in basic agreement with this and we acknowledge that we did not provide the context necessary to properly place the specimen in a regional sense. We do not think the specimen is part of a shear zone, but it was collected in a region that is bound by regional-scale faults. This is now indicated as part of the 'Geologic Setting section.' Moreover, as we indicate in the discussion, the size of the grains may reflect a number of different processes or combinations thereof. If it does indeed reflect fundamental differences in strain it may have to do with more localized effects of stress portioning, perhaps related to specimen scale rheology or orientation. Moreover, it could be that only a sub-set of the overall stress is recorded in grain size modification while another component may be reflected in some other process not examined.

4) We agree that the cross-girdle fabrics are defined by a limited number of c-axes (Figure 4D). Ideally, we would have better control, however, these axes represent all of the coarser grains in the quartz-rich lens. As the reviewer points out, a similar pattern may be inferred from a few outlying points in Figure 4C as well, which supports the interpretation. While perhaps not extremely robust, the temperature estimated from the fabric in Figure 4D is consistent with observed microtextures and with the inferred metamorphic grade of the rock (as acknowledged in the manuscript). We feel that the included error of $\pm$ 50 ËŽC likely encapsulates potential deviation from the actual value. Finally, deformation temperature estimates are only used to in calculations of strain rate. If the estimates are off, then the absolute value of strain rate may change, but the relative differences between the values will remain similar, which is more to the point of the study.

Other points: Pursuant to C. Wilson's comments we have used CPO throughout rather than LPO.

We appreciate the suggested references for other 'fabric analysers' and have added them to the manuscript.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/6/C1245/2014/sed-6-C1245-2014-supplement.pdf

Interactive comment on Solid Earth Discuss., 6, 2735, 2014.