

Review of Manuscript Se-214-85

By: K. P. Larson, J.L. Lamming & S. Faisal

Title: Microscale strain partitioning? Differential quartz LPO development in micaceous phyllite, Hindu Kush, NW Pakistan

This represents a reasonably well-written synthesis that illustrates the use of a Fabric Analyser. What needs to be changed is the complete over-use and incorrect use of LPO. The authors are only discussing the *c*-axis crystallographic fabric obtained from quartz, hence CPO. They are not discussing LPO or ODF, which would be the complete lattice data that you can obtain from a EBSD or X-ray techniques. I would suggest the authors should read Law (1990) and see how he uses the term ‘crystallographic fabrics’ rather than CPO. They also should get away from talking about “petrofabric”, this is a very outdated and inappropriate term. Attention needs to be made to cited references; many of these are unnecessary and quite a number of references have been overlooked. Some modifications need to be undertaken on the Figures.

I have mayor concerns about the quality of some of the data and I would recommend that the authors delete Fig 4a (bulk analyses) and play down the significance of their bulk analyses. In light of my reservations about this data I would delete or highly modify any statements about [c]-slip. Further comments are listed below:

Title – This needs to be reworded. In this they should use CPO instead of LPO. There is a tautology – A phyllite has to be micaceous.

Abstract – The last sentence can be deleted as it is already said in first sentence.

Line 23: Replace first three words “Lattice preferred orientation (LPO)” with ‘Crystallographic fabric’ analysis..... Then in rest of manuscript get rid of LPO.

Lines 28-32: Delete all the references to modeling the development of crystallographic fabrics (e.g. Listers papers etc) as these have no relevance to this investigation and are not discussed later in the paper. Only cite papers relevant to current work.

Lines 34-37: Need to cite appropriate references for X-ray and EBSD techniques (e.g. Wenk, 1986; Prior et al. 1999)

Line 38: Reference to Wilson et al. (2003) should be inserted as this was the first paper to describe a pioneering version of the Fabric Analyser that subsequently evolved into the G50.

Lines 45-48: This is not a paper that is modeling “petrofabrics’ (horrible term). This whole sentence needs to be deleted.

Lines 54-57: Delete last sentence as it has no impact and is in part covered by next paragraph.

Line 59: Delete this unnecessary subheading.

Lines 76-78: There appears to be an unnecessary repetition of references. The Buni-Zone pluton is not illustrated on Fig. 1 (a very bland and uninformative geological map).

Lines 83-84: Delete ...”to investigate....area.”

Line 88: Insert ‘grain’ after “coarser”

Methods

Line 100: “geo-oriented” is a horrible term – would delete.

Line 102: Delete “Russell-Head Designs” and instead add a reference to ‘Wilson and Peternell 2011)’ after “Automated FA”

It is no fault of the senior author, but he has been let down by Russell-Head, as he was delivered the lower resolution (glaciology version) of the G50 (that has either 50 or 10 μm resolution); whereas he should have got a 2.8 μm resolution instrument; similar to what Chris Wilson and colleagues now use. I would definitely not give Russell-Head credit here, as the initial instruments were developed in association with Chris Wilson. At this point the author needs to reference Wilson and Peternell (2011), as this paper summarises some of the pros and cons of the two different versions of the G50's. It is regrettable that Larson and other researchers have been waiting for over four years for the 6th version of instrument (G60); which is now overpriced and superseded by recent developments with EBSD analysis.

Line 105: Reword- ‘using X-ray (Wilson et al. 2007) and EBSD (Peternell et al. 2010) methods.’

Line 109: Delete “points” and insert “within’ after “locations”.

Lines 123-127: Delete from here and should be incorporated into “Geological Setting” section.

Line 129: “Textures” is an inappropriate word, should use ‘microstructure’.

Line 3 142-143 (see also comment on Fig 4 caption). People won't know what you are meaning by a non-discriminant sampling grid. You can either clarify this here or caption, it has been discussed in Peternell et al. (2010) and you could give a reference to this paper.

Lines 145-155: This paragraph is a confused description and needs rewriting and a proper evaluation of the data that was collected. I am very concerned here that with your bulk and manually selected data, that you are presenting c-axis data that has an incorrect bias. You are acquiring data from matrix grains, that have a grain size (stated on Line 95 as 52 μm^2), which would be at the absolute limit (probably under) for your version of the Fabric Analyser. If your Fabric Analyser did not incorporate RGB LEDs and appropriate retarder plate then you are going to get a population of c-

axes that are biased to a sub-vertical or horizontal orientation. This has been a problem with all the previous versions of the glaciology instruments.

To alleviate my concerns I would recommend that you delete Fig 4a (bulk analyses) and play down the significance of your bulk analyses.

Lines 167-169: This statement seems far-fetched, the sample is 3 km from fault. In the geological setting the reader is given no idea of strain regime across region.

Lines 170-177: In light of my reservations about data I would delete or highly modify any statements about [c]-slip.

Lines 194-204: Much of this could be deleted

Lines 215-244 and Fig. 5: this section needs to be modified and shortened in light of foregoing comments. It could be combined with lines 205-213.

Discussion needs to be shortened, as there is obvious repetition. Why not combine it with conclusions?

Line 289: Do not use “petrofabrics”

Fig. 1. This is a poor geological map. Need to add some form surface trend lines to give idea of regional trends. Where is Buni Zom pluton?, referred to on line 77? Whole figure needs to be redrafted.

Fig. 2 – Line 311: delete “achsenverteilungsanalyse” as it was used in text.

Line 312 delete “used for petrofabric” replace with ‘analysed’

Lines 313 and 314 insert the actual g s, should be specified after “coarser grain (size); finer grain (size).

Image (b) should be deleted from Figure as it is not adding any additional value to the paper.

Fig. 4. – Line 329 in caption. Needs rewording here – you only collected data in boxed area, rather than whole specimen? I presume you selected 8000 pixel resolution? and geometrical and retardation quality algorithms only gave you 7127 pixels? I would suggest delete bulk analyses as I believe there is a problem during data acquisition.

To clarify figure 4 itself you need to annotate it with headings adjacent to the row of stereograms such as ‘Fine grains’, ‘Coarse grains’ etc

Line 330: “generated exclusively” should be replaced by ‘manually selected’. In the scatter stereonet in (b) I am concerned about the quality of data; I know there are problems with the glaciology version of G50 in distinguishing vertical vs horizontal orientation of *c*-axes.

Additional references (*But delete any of the references not critical to paper, e.g. modeling*)

Law, R.D. Crystallographic fabrics: a selective review...in Knipe, R.J. & Rutter, E.H. (eds) 1990, *Deformation Mechanisms, Rheology and Tectonics*, Geol Soc. Special Publ. 54 pp. 335-352.

Prior et al. (1999). The application of electron backscatter diffraction and orientation contrast imaging in the SEM to textural problems in rocks. *Am. Mineral.* 84, 1741-1759.

WENK, H.-R. 1986. *An Introduction to Modern Texture Analysis*. Academic Press, London.

Wilson, C.J.L., Russell-Head, D.S., Sim, H.M., 2003. The application of an automated fabric analyser system to the textural evolution of folded ice layers in shear zones. *Annals Glaciology* 37, 7-17.

Correct the reference below as it was incorrectly cited on Line 454

Wilson, C.J.L., Russell-Head, D.S., Kunze, K., Viola, G., 2007. The analysis of quartz *c*-axis fabrics using a modified optical microscope. *Journal of Microscopy* 227, 30-41.

Wilson, C.J.L., Peternell, M.A., 2011. Evaluating ice fabrics using fabric analyser techniques in Sørtdal Glacier, East Antarctica. *Journal of Glaciology* 57, 881-894.

Chris Wilson 26th September 2014