

Interactive comment on “Analysis of deformation bands associated with the Trachyte Mesa intrusion, Henry Mountains, Utah: implications for reservoir connectivity and fluid flow around sill intrusions” by Penelope I. R. Wilson et al.

Anonymous Referee #1

Received and published: 3 August 2020

Dear Authors,

This pre-print provides a nice example of using quantitative fracture analysis at a variety of scales to assess the impact that the growth of a shallow igneous intrusion (made up of stacked sills) has on the abundance and topology of a deformation band network in a porous sandstone. The study should be of interest to geologists assessing fluid flow (hydrocarbon, water, carbon dioxide) in such environments worldwide as well as those interested in wall-rock processes associated with accommodating shallow intrusion volumes. The manuscript is well written and thoroughly illustrated.

Specific Comments:

One specific area that I would like to see developed a bit further is the conceptual model (Fig 9) presented in the final discussion (Sections 5.1 and 5.2). You compare the patterns of deformation you observe at Trachyte Mesa (9b) to those in a forced fold above a normal fault (9a). I hope you can expand this discussion to address how differences between the processes might be reflected in the patterns of deformation observed. The sills have intruded laterally underneath the entire mesa (i.e. see Fig. 12 in Morgan et al., 2008), whereas the forced fold formed over either an upward or laterally propagating fault tip (e.g. White and Crider, 2006). One might therefore expect a structural density greater than the background above the intrusion but not above the footwall of the normal fault. Although your sample transect doesn't appear to extend far enough to directly address this question, it would be nice if you speculated on it a bit in the discussion. Perhaps there might also be differences in the orientations of structures?

I also found it a bit confusing that you mention that Sanderson and Nixon (2015) argue for use of branch attributes (vs length) when characterizing fracture networks (lines 142-143), but then proceeded to focus on length attributes in your discussion of the results (lines 186-189). Perhaps you should drop this point from the earlier discussion or else recast your results to emphasize branch attributes?

Other Minor/Technical Corrections:

Line 45 an 'n' is missing from Sternlof;

Line 56 'implication for' rather than 'on';

Lines 114-116. Please add some estimate of the average (central tendency) orientation of deformation bands and analysis sections here.

Fig 1 caption. Change 'outlines' to 'areas'.

Fig. 6c. It would be nice to have the B22 values for each point annotated somewhere

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on the plot, either in the legend or with the point labels.

Figure 6 caption: Instead of using “log-linear”, which implies that the station numbers have quantitative meaning, reword to “Summary plots showing the log of various fracture attributes at each station”

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