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Interactive comment on "The rheological behavior of fracture-filling cherts: example of Barite Valley dikes, Barberton Greenstone Belt, South Africa" *by* M. Ledevin et al.

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First of all, we would like to thank the reviewer for comments that we found very useful and constructive. The following paragraphs answer point by point his/her concerns and propose possible corrections to be included in a revised version of the paper.

Author Response to remark 1:

The question of geometry, orientation, thickness and crosscutting relationships of the dikes has been addressed in detail in the recent paper of Lowe, 2013, which is why we focused here only on key aspects and key structures that give evidence of hydraulic fracturing (i.e. jigsaw-fit, burst-out structures) or upward fluid migration (i.e. dike-and-

sill organisation). The purpose was not to re-describe the whole area, but to focus on features that had not been emphasized in previous papers but which provide information about the overall mechanism of formation of the veins. However, the reviewer's comment demonstrates that we should have referred more to the other papers that describe the broad orientation and organisation of the dike system. We will remedy this by adding a new section summarizing the descriptions given in previous studies.

Author Response to 2 and 5:

The geochemical composition of the rocks that now occupy the veins is largely controlled by the clay content in fragments eroded from the fracture walls: it is representative of the silicified country rocks and not of circulating fluids. For the purpose of this study, geochemical data (major/trace elements) were not considered relevant. They will be presented and discussed in detail in a paper we are preparing on the composition of cherts from several parts of the Barberton belt. On the other hand, the petrology of the cherts is given in our paper and this information is crucial to our interpretation. We describe the proportion of various phases (minerals and lithic fragments), the lack of high temperature minerals, the presence of a silica lubricant on fracture walls, etc. We argue that the references to the extensive literature on the characteristics of colloidal media and thixotropic fluids, when compared to our petrographic observations, is sufficient to validate our model of thixotropic behaviour for fracture-filling cherts. We accept the criticism about the lack of quantitative results and will add in the revised version of the paper a model of the yield strength of a mixture of small silica fragments and aqueous fluid that explains the thixotropic behaviour of the fluid.

Author Response to 3 an 4:

These comments call into question the basis of the model we developed, especially the arguments for hydraulic fracturing, and the conclusion favouring an impact-induced hydrothermal system. Hydraulic fracturing is required to explained both burst-out and jigsaw structures (Fig. 5 and 6), and evidence of upward fluid flow is provided by the

SED
6, C507–C509, 2014

dike-and-sill organization of some dikes (Fig.12). Both these observations are more consistent with a hydrothermal system than with open fractures on the seafloor (the model of Lowe, 2013). On the other hand, we believe that the plumbing system did not contain high-temperature fluids. In the revised version of our paper we will expand and emphasize the evidence of low temperatures which resides in the absence of high-temperature precipitates in the plumbing system (such as hematite coatings, sulphide deposits, etc) and the presence of low-temperature forms of silica (e.g. colloform and columnar; Fig.9). We will reinforce our model with isotopic data and temperature estimates that we had planned to include in another paper. δ30Si and δ18O have been obtained by the in situ analysis of microquartz by SIMS.

In summary, we propose the following improvements to the manuscript:

- addition of a section summarizing previous descriptions of dike geometry and spatial organization

- addition of a rheological model based on petrological observations that supports the idea of thixotropy

- addition of a special section on petrographic observations that constrain the temperature of the fluid. In this section we will include silicon isotopic data.

- addition of a section dedicated to a comparison between Barite Valley dikes and well-described impact craters.

Interactive comment on Solid Earth Discuss., 6, 1227, 2014.