Solid Earth Discuss., 6, C687–C689, 2014
www.solid-earth-discuss.net/6/C687/2014/

Solid Earth
Discussions
Open Access

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.

M. Ledevin et al.

morgane.ledevin@gmail.com

Received and published: 17 July 2014

We thank Axel Hofmann for the helpful review that he provided for our manuscript dealing with the Archean chert dikes from Barite Valley. We are particularly pleased to read that he agrees with our thixotropic model because we know of the extensive work he did in the area. The idea that some cherts are thixotropic is indeed not completely new, but, as the reviewer mentions, little attention has been paid to the geometrical and petrological evidence for the process. We agree that thixotropy is not a new discovery: the main aim of our paper is to provide evidence for such behavior. In the revised version of the manuscript, we will provide a more detailed discussion of our data with greater reference to the cited literature, and we will discuss the following issues:

(1) - the organization of clasts in dikes and possible host rock replacement

(2) - the nature of the slurry (temperature, water content)

(3) - the origin of the fractures

(1) We will provide a more detailed discussion of our observations, and introduce a comparison with observations from Hofmann and Bolhar (2007) and Lowe (2013). We will specifically address the problem of host rock replacement. We recognise that the host rocks are silicified but we will emphasize that there is good petrographic evidence that this occurred before the emplacement of the dikes. Some dark-coloured fragments are indeed present in some dykes but they are not ubiquitous. The black chert in many dykes is homogeneous and contains no trace of fragments. Secondary silicification appears to be limited to more translucent zones, as shown in figure 7c. We agree with the reviewer that "not everything that appears black in the veins represents matrix" but maintain that the black chert fragments can generally be distinguished from the matrix in outcrop. This matrix forms most of the material between the conspicuous white chert fragments and it can be traced from the interior of the dikes into the fine fractures that invade the host rock: this is one of our main arguments for thixotropic behaviour. The other is the uniform thickness of chert veins in the upper and lower parts of dikes. As mentioned in our reply to the first review, we will strengthen this argument with a quantitative analysis of vein thickness which we will include in the revised version of the manuscript.

Although the two dimensions of most outcrops limit our observations, a third dimension can be seen in many of the blocky outcrops (e.g. Figs. 3b, 5, 8, 9).

The veins with colloform or botryoidal textures cut across the dikes or invade their margins. They are younger features that were emplaced at a late stage, or well after, emplacement of the dikes. The fluids that formed these veins did not have thixotropic

SED
6, C687–C689, 2014

behaviour.

(2) As proposed after the first review, the nature of the slurry will be characterized in more detail in the revised version by way of: (i) a combination of petrographic evidence coupled with isotopic data and temperature estimates; (ii) a model of yield strength applied to a mixture of small silica fragments and aqueous fluid.

(3) From the two reviews, it is clear that the discussion on the origin of the fractures (i.e. hydrothermal vs. impact models) obscures the main conclusions we wanted to highlight in this manuscript (i.e. the rheology of fracture-filling chert). We therefore decided to remove this part of the discussion to focus most exclusively on the thixotropy of chert. The possible hydrothermal or impact origin of the fractures will still be included in the geological context of the area.

Finally, the "specific comments" emphasize to need for a more accurate vocabulary, as well as more detailed references to arguments found in the literature. We will follow this advice during our revision of the manuscript.

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