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Dynamics of Vredefort: Evidence for late emplacement of granophyre

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A vein of pseudotachylitic breccia was found within a xenolith (presumably of the Outer Granite Gneiss (OGG) [1]) within an outcrop of Vredefort granophyre at Daskop. The xenolith is 5 cm in diameter and is crosscut by a 5-7 mm thick pseudotachylitic vein. A 2 mm thick sheared and mylonitized zone occurs around the pseudotachylite vein in the host xenolith; however, the pseudotachylite itself does not seem to be sheared.

The pseudotachylite contains clasts of the host matrix that are mostly concentrated close to the edge of the vein, which is a characteristic feature of frictional melt [2]. Clasts are generally aligned parallel to the vein walls and mostly represent quartz grains of various deformation stages.

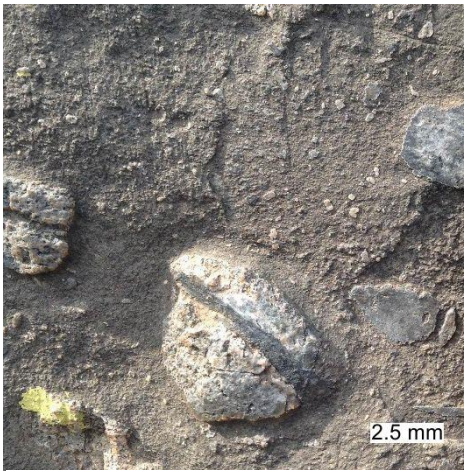

Figure 1: Clast of pseudotachylite bearing granite inside of granophyre dike.

Within the granite fragment and in the pseudotachylite, quartz grains are strongly deformed. Some demonstrate undulatory and/or mosaic extinction, granular textures, or subgrains; one quartz grain in the granite reveals 3 sets of planar deformation features (PDFs), indicating that the host granite must have undergone shock deformation prior to emplacement within the granophyre [3]. This strongly suggests that the pseudotachylite was formed due to shock deformation, and was not a pre-Vredefort feature of the granite.

Handheld XRF analyses clearly show that the pseudotachylitic vein has a similar composition to the host granite, and that both of them compositionally differ from the granophyre. The pseudotachylite also differs from the host granophyre by its color, structure and petrographic features.

The findings reported here demonstrate that pseudotachylitic breccia formed prior to incorporation of the OGG fragment into the granophyre. This shows that the processes that resulted in the generation of the granophyre must have been taking place at a late stage in the formation of the Vredefort impact crater, and that the pseudotachylitic breccia was formed in a comparatively early stage. Previous analysis has suggested late-stage formation of the granophyre [4]; this study is consistent with the interpretation that the granophyre formed as one of the final stages of development

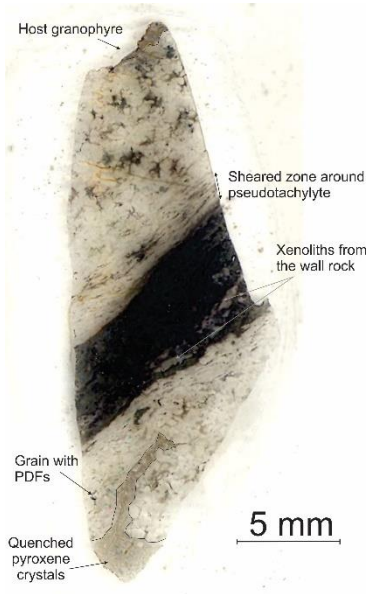

Figure 2: Annotated thin section of pseudotachylitic vein.

of the impact structure.

[1] Hart R et al. (1990) Chem. Geol. 82:21-50.
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[3] Ferrière L and Osinski G (2013) In: *Impact cratering: Processes and products*: Wiley-Blackwell, Chichester. 106-124.
[4] Reimold U and Colliston W (1994) GSA Special Paper 293:177-196.