FORMATION OF PSEUDOTACHYLITIC BRECCIAS FROM THE ARCHEAN GNEISS OF THE VREDEFORT DOME, SOUTH AFRICA. T. Mohr-Westheide[1], W. U. Reimold[1], R. L. Gibson[2], D. Mader[3] and C. Koeberl[3], [1]Museum für Naturkunde – Leibniz Institute at Humboldt University Berlin, Germany, [2]School of Geosciences, University of the Witwatersrand, Johannesburg, RSA, [3]Department of Lithospheric Research, University of Vienna, Austria.

"Pseudotachylite" is friction melt formed along faults or shear zones. It is produced by frictional heating, which generally requires sliding velocities consistent with seismic slip. The distinction between "impact" and "tectonic" "pseudotachylite" plays an important role in impact settings, as melt breccias in impact structures often closely resemble tectonic friction melt but may have been formed by different processes: (1) shearing (friction melting); (2) shock compression melting (with or without a shear component); (3) decompression melting immediately after shock propagation through the target / related to rapid uplift; (4) combinations of these processes; (5) intrusion of allochthonous impact melt. Resolving this problem requires detailed multidisciplinary analysis in order to comprehensively characterize the nature of these breccias and to identify the exact melt-forming process(es). In order to distinguish between bona fide "pseudotachylite" and breccias of similar appearance in impact structures of still debated origin we refer in the latter case to "pseudotachylitic breccia" (PTB).

PTB are the most prominent impact-induced deformation in the central uplift of the Vredefort Impact Structure [1, 2]; similar breccias occur in abundance also at Sudbury, Canada [e.g., 3,4]. We present chemical data for small-scale (1 mm – 3 cm) PTB from mafic (dioritic) and granitic host rocks and compare with the chemical compositions of their respective host rocks.

Electron microprobe analysis of PTB groundmass in comparison to XRF bulk chemical analysis of pseudotachylitic breccias and their host rocks revealed that PTB generally displays a close chemical relationship to the adjacent host rock. This confirms that melt was formed from material of the same composition and for mm to cm wide breccia veinlets is of local origin. In granitic environments, the refractory behavior of quartz seems to be the main reason for the slight chemical differences between PTB and host rock. Our first chemical investigations of < 0.5 cm PTBs in mafic host rocks revealed, overall, good agreement between PTB composition of EMPA DFB analysis and host rock composition of XRF. Where notable deviations occur, it is possible to explain this by preferential melting of either plagioclase or hydrous ferromagnesian minerals of different proportions. PTB seemingly occur preferentially in amphibole-rich host rock portions – an observation that confirms the macroscopic observations of [5,6,]. Thus, PTB genesis in mafic host rock seems to be controlled by the mineralogical composition of the target rock. A further factor is likely the melting temperature of minerals involved that determines the ratio at which feldspar and mafic minerals are melted.

None of the analyzed veinlets has yielded any textural evidence supporting a significant influence from shearing /faulting. Our PTBs of up to 1 m width all contain clast populations that represent local lithologies only, with distinct differences between clast population and host rock mineral abundances likely the result of different mechanical behavior and different melting temperatures of the various minerals.

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