NEW MICROCHEMICAL AND PETROGRAPHIC FINDINGS FOR PSEUDOTACHYLITIC BRECCIAS FROM THE VREDEFORT DOME, SOUTH AFRICA.

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Introduction: Pseudotachylitic breccias (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]. Formation of sometimes massive (PTB) in impact structures by (1) shearing (friction melting); (2) shock compression melting; (3) decompression melting, (4) combinations of these processes, or (5) intrusion of allochthonous impact melt has been strongly debated. Our previous results have indicated that formation of very small veinlets involved local melting, likely during the early shock compression phase. We present new chemical data for small-scale (1 mm – 3 cm) PTB from mafic (dioritic) and granitic host rock environs and compare with the chemical compositions of their respective host rocks.

Results: Electron microprobe analysis of PTB groundmass in comparison to XRF bulk chemical analysis of pseudotachylitic breccias and their host rocks revealed that PTB generally display 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, chemical investigations of < 0.5 cm PTB in mafic host rocks revealed, overall, good agreement between PTB composition from EMPA defocused beam analysis and host rock composition from XRF. Where notable deviations occur, it is possible to explain this by preferential melting of either plagioclase or hydrous ferromagnesian minerals of different proportions.

Discussion: Our study on small-scale 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 PTB 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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