GEOCHEMISTRY OF PSEUDOTACHYLITES IN TARGET ROCKS OF THE SUDBURY IMPACT STRUCTURE, ONTARIO, CANADA. Siyamend Al Barazi[1,2], Ulrich Riller[3], and Lutz Hecht[1,2] 1 Freie Universität Berlin, D-12249 Berlin, 2 Museum für Naturkunde Berlin, D-10115 Berlin, 3 McMaster University, School of Geography and Earth Sciences, Hamilton, Ontario, Canada L8S 4K1

Archean and Paleo-Proterozoic target rocks of the 1.85 Ga Sudbury Impact Structure host fragment-rich pseudotachylites. They vary from millimetre-wide veins to hundreds of meter wide fragment-rich zones and are often associated with lithological contacts and faults. The mechanism of pseudotachylite formation in large impact structures is still a matter of debate [1]. Based on previous geochemical analyses [e.g. 2,3], the main formation processes which are currently discussed are shock melting within target rock, in situ cataclastic milling, and friction-induced melting, or a combination of these processes. Our study aims to elucidate if the pseudotachylite matrix can be exclusively derived from the immediate host rock, as required for these processes, or if an allochthonous melt component is involved.

Whole rock chemical analyses were complemented with microprobe analyses (defocused beam) of matrix material to minimize the effect of host rock fragments on matrix composition. Pseudotachylite matrix within granitoid host rocks (n=11) are depleted in SiO_2, Al_2O_3, K_2O, and are enriched in Fe_2O_3, MgO, CaO, MnO, and TiO_2. The opposite trend is observed for pseudotachylite matrix within mafic host rocks (n=3). Pseudotachylite matrix sampled from lithological contacts plot on the mixing line between the adjacent host rocks for major elements with minor deviations for the more mobile elements Na_2O and K_2O. Electron microprobe analyses revealed compositional differences between marginal and central phases of some pseudotachylite dikes in granitoid host rocks. Finer grained dike margins are similar in composition to the adjacent host rock, whereas the matrix composition of the vein centre is more mafic, similar to most bulk analyses.

Trace elements display complex pattern. Significantly Cr-enrichment has been observed for most pseudotachylites, except for pseudotachylite hosted by Nipissing Gabbro. However, sills of Cr-rich Nipissing Gabbro bodies are ubiquitous in Paleo-Proterozoic and Archean target rocks at Sudbury. The contribution of melts from this rock type can account for the observed enrichment of Cr in pseudotachylites. In addition, calculations and estimates of the initial impact melt composition [e.g. 4,5] show elevated Cr contents (about 107 – 190 ppm) compared to most pseudotachylitic host rocks. In summary, an allochthonous melt component is required to account for matrix compositions. Injections of superheated (>1800°C) impact melt or melt derived from Nippising Gabbro into dilation zones and mixing with melt derived from local host rocks can explain the Cr-enrichment in the pseudotachylites at Sudbury.

References: [1] French, B. M. 1998. *Lunar and Planetary Institute, Houston*, LPI Contribution No. 954, pp.120. [2] Dressler, B. O. 1984. *The Geology and Ore Deposits of the Sudbury Structure*, pp.97-136. [3] Lafrance et al. 2008. *Precambrian Research 165*, pp. 107-119. [4] Lightfoot et al. 1997. *Ontario Geological Survey, Open File Report 5959*, pp. 231. [5] Ames et al. 2002. *Economic Geology 97*, pp. 1541-1562.