FIRST REPORT OF DETRITAL SHOCKED ZIRCONS FROM THE PALEOPROTEROZOIC SUDBURY IMPACT STRUCTURE, ONTARIO CANADA.

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Introduction: Recent studies in South Africa have demonstrated that impact shocked minerals (zircon, quartz, monazite) eroded from the Vredefort Dome impact structure survive post-impact temperatures, uplift, erosion, and distal transport in siliciclastic sediments [1,2,3,4,5]. Here we report the first occurrence of detrital shocked zircons in North America, eroded from the giant Sudbury impact structure. These results confirm a second site where shocked minerals eroded from a Precambrian impact structure are contributing to the sedimentary record nearly 2 Gyr after the impact event.

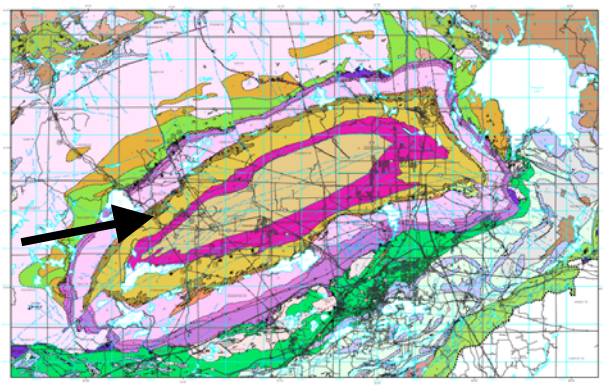

Figure 1: Sudbury impact structure [6]. Arrow points to sample site 10SU06 at Onaping Falls on the Onaping River.

Sudbury impact structure: The 1850 Ma Sudbury impact is one of the largest and oldest identified impact structures on Earth (Fig. 1). The original diameter is estimated at 200 to 280 km [7]. At Sudbury, shocked zircons have been reported in the Levack gneiss [8,9], granitic clasts in the Onaping Fm. [8], and the Murray granite [10]. Planar fractures (PFs) are the most common microstructure in detrital shocked zircons and are readily identified with scanning electron microscopy (SEM) [1,2,3,4,5].

Sudbury sediment samples: The Onaping River cross cuts the NW sector of the Sudbury impact structure and flows south and east before joining the Vermillion River near Dowling. A ~1 kg sediment sample from the modern channel at the base of Onaping Falls (10SU-06) was collected and examined for the presence of detrital shocked zircons. A total of 109 detrital zircons were examined using BSE imaging with an SEM. Of the 109 grains, 5% (5 grains) were confirmed as shocked zircons by the presence of PFs (Fig. 2). The grains range from euhedral to subhedral, and all show evidence of sedimentary abrasion.

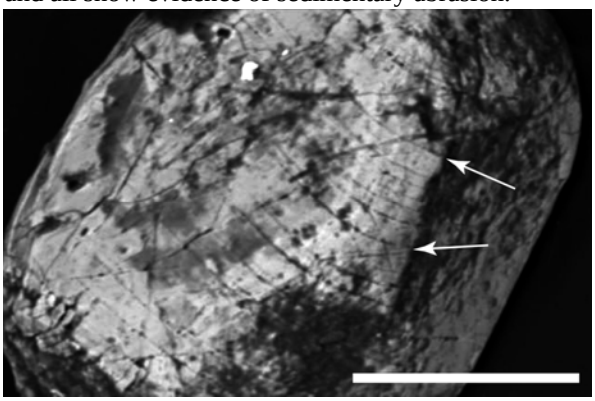

Figure 2: Backscatter electron image of detrital shocked zircon 10SU06-273 from Onaping Falls. Two orientations of PF are visible that cross multiple crystal faces (see arrows). Scale bar is 50 µm.

Discussion: Detrital shocked zircons have been documented in modern siliciclastic sediments in the Onaping River at the Sudbury impact structure. The origin of these grains is likely the Levack gneiss or granitic clasts in the Onaping Fm. These results are the first report of detrital shocked minerals in North America, and the second location where evidence of shocked minerals from a Precambrian impact structure are contributing to modern sediments. These results further demonstrate that shocked zircons in Precambrian impact basins survive post-impact thermal conditions (including formation of the extensive overlying Sudbury Igneous Complex), uplift, erosion, and sedimentary transport to contribute to modern sediments nearly 2 Gyr after the impact event.

References: [1] Cavosie et al. (2010) GSA Bulletin. [2] Erickson et al. (2011) LPSC. [3] Cavosie et al. (2011) LPSC. [4] Erickson et al. (2010) GCA. [5] Cavosie et al. (2010) GCA. [6] Rousell et al. (2009) *Ontario Geologic Survey*, Report 6243, 200p. [7] Grieve et al. (2000) *Annu. Rev. Earth Planet, Sci*, 28:305-38. [8] Krogh et al. (1984), Ont. Geol. Surv. Sp. v1. [9] Ostermann et al. (1996) MAPS. [10] Krogh et al. (1996) AGU Geophys Mono. 95