EXPANDING THE DISTRIBUTION OF SHOCKED MINERALS AT THE SANTA FE IMPACT STRUCTURE (NM, USA).

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Introduction: The sedimentary record of an eroded impact structure preserves direct evidence of the impact event in sedimentary deposits, including at tectonized and eroded impact structures, such as the Santa Fe impact structure. Shocked minerals such as zircon, quartz and monazite have been previously reported to survive distal fluvial transport in modern alluvium and colluvium at distances ~750 km [1] and up to ~2000 km [2] from the Vredefort Dome (South Africa), and in Holocene glacial deposits at Sudbury (Canada) [3]. Detrital shocked minerals such as zircon, apatite, and quartz have been previously reported to occur in the Santa Fe impact structure [4,5,6,7]. Here, we report the occurrence of detrital shocked minerals, such as zircon, apatite, and quartz from both sediments and rocks, in all directions from known shatter cone locations at the Santa Fe impact structure [8].

Area of study: The Santa Fe impact structure is a highly tectonized and eroded impact structure located near Santa Fe, New Mexico, USA. The geology at the Santa Fe impact structure includes Paleoproterozoic rocks such as amphibolites, felsic volcanic rocks, and granitoids. The age of impact has been estimated to range from 1200 – 350 Ma, and its original diameter is estimated to range from 6 – 13 km, based on shatter cone distribution [8]. However, both the age and diameter of the impact are poorly constrained.

Samples/Methods: Sand grains from heavy mineral concentrates from a total of seven samples of colluvium and alluvium were hand-picked and placed onto scanning electron microscope (SEM) stubs. Detrital grains of zircon and apatite were surveyed using SEM methods (SE, BSE) to search for diagnostic shock features, such as planar fractures, on grain surfaces.

Results: A total of 1669 zircons were surveyed, yielding 4 confirmed shocked grains (4/1669 = 0.2%). A total of 1070 apatites were surveyed, yielding 26 shocked = grains (26/1070 = 2.4%). Shocked quartz was also identified in bedrock away from known shatter cone localities.

Discussion: This study extends the occurrences of shocked minerals and rocks beyond known shatter cone localities. We have documented the occurrence of detrital shocked zircon and apatite in samples 0.4 km south of Hwy 475, on the west side of Chamisa Trail, and 1.7 km north of Hwy 475, all from areas where previously documented shocked bedrock could not have contributed to sediments. Estimates of crater diameter (6 – 13 km) have been previously calculated from scaling laws based on a 3 km diameter central uplift, derived from shatter cone distribution [8]. With new occurrences of detrital shocked minerals and rocks, the size of the Santa Fe impact sturcutre will most likely increase.

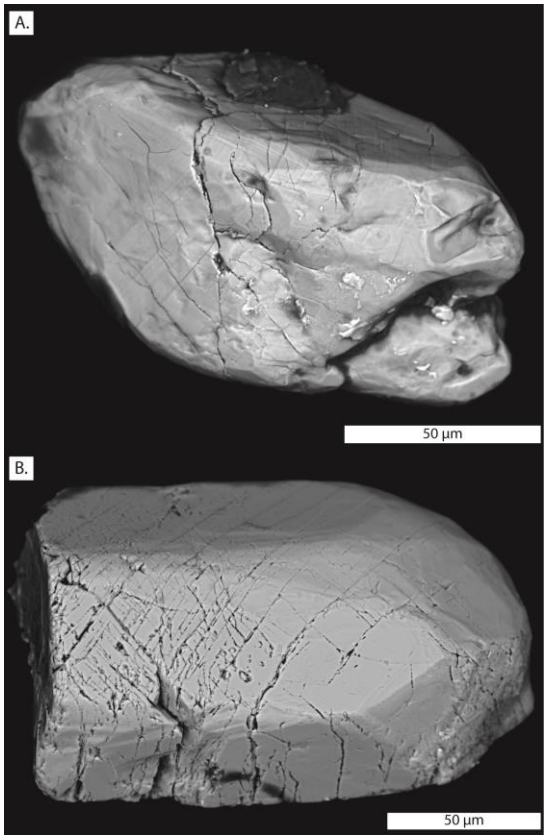

Figure 1. BSE images of (A) detrital shocked zircon and (B) detrital shocked apatite from the Santa Fe impact structure.

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