A CONSTRAINT ON SHOCKED MINERAL ABUNDANCE IN THE JACK HILLS ZIRCON SUITE.

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Introduction: Numerous studies have confirmed that 3.0 Ga metasedimentary rocks from the Jack Hills, Western Australia, contain abundances of ~10% Hadean (>4.0 Ga) detrital zircons [1]. Detrital shocked zircons eroded from known impact structures such as Vredefort and Sudbury have been reported in modern siliciclastic deposits [2,3], including distal alluvium [4]. The Jack Hills zircon suite, which contains grains ranging in age from 4.4 to 3.0 Ga [1,5], thus offers an opportunity to evaluate if detrital shocked zircons eroded from Hadean impact structure are preserved. Here we report the results of an SEM survey of 1400 Jack Hills zircons for shock microstructures. No shocked grains were identified, which places a maximum constraint of ≤ 0.07% for the abundance of shocked zircons in the Jack Hills suite, if indeed they are found to be present.

Earth's early impact history: The lack of a terrestrial rock record older than ~4.0 Ga hampers the study of early impact process. The oldest evidence of impact are ca. 3.5 Ga spherule deposits [6], however source craters have not been identified. The oldest shocked mineral is quartz from a 2.6 Ga spherule deposit [7], and the oldest confirmed and well-dated structure is the 2.0 Ga Vredefort Dome [8,9].

Detrital shocked minerals: Shocked minerals provide diagnostic evidence to confirm an impact [10]. Shocked zircons have been shown to survive post-impact thermal conditions, uplift, erosion, and distal sedimentary transport [2-4]. While quartz is susceptible to erosion, shock microstructures in zircon resist annealing [11,12].

Sample/Methods: The studied grains are from sample 01JH13 [13], the same layer as the well-known sample W74 [14]. The rock sample is a clast-supported quartz cobble metaconglomerate. Zircons were hand-picked and mounted on scanning electron microscope (SEM) stubs for backscatter electron (BSE) imaging of grain surfaces.

Results: A total of 1,400 undated detrital zircons were analyzed. Grain morphologies are variable, ranging from euhedral grains with little evidence of abrasion (Fig. 1a) to anhedral rounded grains. No shock microstructures were identified.

Discussion: The absence of shocked zircons allows a constraint of ≤ 0.07% (less than 1 in 1400) to be placed on the abundance of shocked grains in this Jack Hills suite. Of the 1400 grains, 10% were likely Hadean; the maximum constraint for the Hadean grains is thus ≤ 0.7% (less than 1 in 140), if present.

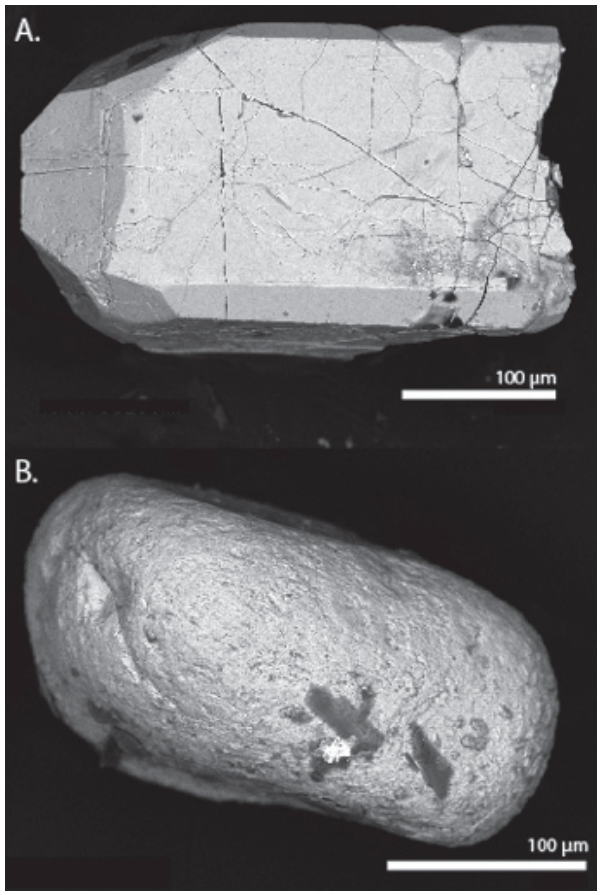

Figure 1. BSE images of detrital zircon grains from Jack Hills sample 01JH13 showing (a) euhedral and (b) anhedral morphologies.

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