Not-so-shocking results from the Jack Hills: An EBSD survey of 10,000 zircon grains for shock deformation

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During the Hadean and early Archean, Earth was heavily bombarded by meteorite impacts [1], yet to date, there is little to no physical evidence of impacts occurring during this time. During hyper-velocity impacts, shock waves travel through bedrock and create diagnostic shock microstructures in zircon (20-30 GPa) [2]. Impact-produced twinning in zircon has been proven to withstand magmatism, metamorphism and sedimentary reworking [3,4], indicating that zircon shocked from early Earth impacts should not anneal and thus be present in Hadean zircon populations such as the Jack Hills, Western Australia. The Jack Hills, includes 3.0 Ga metasedimentary rocks which contain zircon grains ranging in age up to 4.4 [5,6].

A total of 21,000 zircon grains from the W74 metaconglomerate were previously surveyed using backscattered electron imaging (BSE) on external grain morphologies to search for shock microstructures, and none were identified [7]. In this study, a sub-set of 10,000 of these grains were mounted in epoxy and analysed by electron backscatter diffraction (EBSD) orientation mapping, in order to investigate microstructures exposed on polished surfaces.

Results of our EBSD mapping survey to date have not identified diagnostic shock features, including {112} twins or reidite, in the Jack Hills zircon suite. Most Jack Hills grains show minimal evidence of plastic deformation. The magnitude of misorientation is typically <5° in un-fractured grain domains. A detailed summary of microstructural characteristics of grains in our EBSD survey will be presented at the meeting.

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