Shock-metamorphosed zircons discovered in Jack Hills metaconglomerate from the Narryer Gneiss Complex, Western Australia

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An intense flux of asteroid bodies into inner solar system during ca. 3.8-4.0 Ga, called as Late Heavy Bombardment (LHB), has been proposed from impact-resetting ages of the Moon samples. Terrestrial evidence of the impacts in the early Earth is, however, barely identified because of the scarcity of geological unit prior 3.8 Ga. Although previous studies have shown that the Jack Hills metasedimentary rocks contain detrital zircons that yield U-Pb SHRIMP ages ranging from ca. 3.0 up to 4.4 Ga, shock-metamorphosed minerals, a diagnostic indicator for impacts, have not been identified. Here we report shock-metamorphosed detrital zircons from the Jack Hills metaconglomerates in the Narryer Gneiss complex, Western Australia. A total of 14000 detrital zircons were investigated for their external and internal structures using a scanning electron microprobe and optical microscope. The following types of shock-metamorphosed zircons were identified using microstructural features; (1) zircons with curviplanar features, (2) zircons containing single or multiple sets of planar features, (3) zircons exhibiting partly granular microstructures, and (4) zircons with exhibiting fully granular microstructures. Of these microstructures, multiple set of planar feature provided the most diagnostic evidence for an impact origin [1]. They are preserved as annealed (or "decorated") parallel fractures, probably due to post-impact thermal heating and/or regional metamorphic overprint. Shock-metamorphosed zircons have previously been utilized for dating the impact event, which because of the high temperatures involved, results in partial or complete Pb-resetting of the U-Th-Pb geochronometer [2]. Therefore, the shock-metamorphosed detrital zircons discovered from the Jack Hills metaconglomerate would provide significant clues not only for the deciphering the impact history on the early Earth but also for providing physical confirmation of the LHB hypothesis.

[1] French and Koeberl (2010) *Earth-Sci. Rev.* **98**, 123-170. [2] Moser et al., (2011) *Can. J. Earth Sci.* **48**, 117-139.