

## Hadean detrital zircons in the Jack Hills metaconglomerate, Western Australia: Implications for Hadean Earth tectonics

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Hadean (4.56-4.0Ga) rocks are absent on the modern Earth. Yet, the first 600 million years is the most critical and important period of the habitable planet Earth to understand the general interests whether or not the habitable planet can be appeared as only one rocky planet among all planets or satellites in solar system, as we understand through research history. The Jack Hills metasedimentary rocks have long been investigated because of the presence of Hadean zircons back to ca. 4.4 Ga (e.g. Wild et al., 2001; Holden et al., 2009; Valley et al., 2014). Previous research not only for geochronology but also mineral inclusions in detrital zircons ranging in age between 3.0 Ga and 4.4 Ga have given excellent information on the Hadean surface environment. Here we described additional information for the Hadean magma and impact evidence based on mineral inclusions, specifically apatite, to estimate the space environment and host magma which is presumably felsic TTG magma. The result showed plate tectonics must have been operated back to 4.3 Ga because of the presence of TTG magma and possible presence of ocean back to 4.3 Ga because mineral inclusions in Hadean zircon cover various minerals dominated by quartz, plagioclase, K-feldspar, apatite, muscovite, biotite with subordinate amounts of hornblende, rutile, monazite, magnetite, hematite, pyrite and goethite, indicating the host magma must have been granitic composition. To produce the felsic magma similar to the modern Earth plate tectonics must have been already operated. Plate tectonics also needs the presence of thick ocean to cover the mid oceanic ridge.

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