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Tracing Earth's first crust with Hf isotopes in zircons from the Narryer Gneiss Complex, Australia

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Witnesses of the infant crust on Earth are rare because no rocks that formed in the fist 500 Myrs are preserved and the only remnants of Hadean material are zircon crystals that survived reworking of their host rocks. In order to unravel the evolution of the Earth's oldest crust, Archean and Hadean detrital zircons from the Mt. Narryer Gneiss Complex were investigated for their U-Pb and Lu-Hf isotope systematics. The U-Pb systematics of six zircons from the Meeberrie Gneiss define an upper concordia intercept age of 3300 Ma and two lower intercepts at ~ 500 Ma and 700 Ma, which we interpret as the formation ages of the gneiss protolith and later thermal overprints, respectively. Corresponding •HfT range from -8.6 to -11.2. Eight zircons from a metasediment from Mt. Narryer show ages from 3.2 to 4.2 Ga with corresponding eps Hf of +3.4 to -7.1. Two zircons from a metasediment from Jack Hills are 4200 Ma old and have •HfT of -0.5 and -2.9. The age distribution and corresponding initial Hf isotopes indicate similar source regions for the Mt. Narryer metasediments and Meeberrie Gneiss. Older (>3.8 old) grains from Jack Hills and the Mt. Narryer metasediments origin from sources that already formed in the Hadean.. The combination of these new data with published zircon data, indicate that crustal growth during the first 500 Myrs occurred more or less continuously by formation of small crustal domains.