

Development of rapid and precise dating method: Applying on chronology in Jack Hills

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Most of the global events, such as formation of magma ocean, core-mantle segregation, crust formation, and/or chemical evolution of atmosphere, could be completed within the first 0.5 Byr of the Earth History, so called Hadean Eon. Despite the great importance of the Hadean Eon, no petrographic record can be found for this stage, and only geochemical information can be derived from small minerals such as zircons or other accessory minerals within zircons (e.g., apatite, muscovite, or biotite). For geochemical studies for Hadean Eon, many pioneering studies have been made based on the isotope geochemistry on zircons collected from Jack Hills and Mt. Narryer, Western Australia. It is widely recognized that zircons collected from these area have been thought one of the most principal clues for Hadean studies. Moreover, further detailed studies have been carried out from small inclusions in zircon crystals. Zircons from Jack Hills contain various mineral inclusions such as muscovite, quartz, biotite, apatite and so on, and about two-thirds of them are muscovite and quartz, probably due to secondary replacement of primary apatite (Hopkins *et al.*, 2008, Rasmussen *et al.*, 2011). Recently, biogenic carbon, as graphite inclusion, was recovered from 4.1 Ga zircon, but an abundance of carbon-bearing Jack Hills zircons of only about 1-in-10,000 (Bell *et al.*, 2015). In addition, the percentage of Hadean zircons to detrital zircons in Jack Hills was as small as 7% (Holden *et al.*, 2009). For these reasons, large number of age data for zircon grains must be defined to derive reliable and objective information concerning the Hadean history of the Earth. To overcome this, we have developed new analytical technique to define precise age data from combination of U-Pb (Pb-Pb) dating method with high sample throughput. We have developed rapid and precise dating technique for zircons using laser ablation ICP-mass spectrometer (LA-ICP-MS), equipped with two Daly ion collectors (Nu Plasma IID, Wrexham, UK). Laser ablation instrument used in this study was ESI NWR193 laser ablation system (New Wave Research, Oregon, USA). Combination of multiple collector-ICPMS system and ArF Excimer laser ablation system enables us to measure Pb-Pb age for the sample within 10 second/spot, and uncertainties in the resulting Pb-Pb age data can be minimized by the multiple-collector system setup. Based on the age determination system using LA-MC-ICPMS technique, we just started to measure Pb-Pb age data from 180 grains of zircons within an hour. In this presentation, difference in the resulting age histogram for the zircons collected from Jack Hills will be discussed, and detailed observation for various inclusions in the Hadean zircons will be demonstrated in this talk.

Keywords: Hadean, Jack Hills, LA-ICP-MS, MC-ICP-MS, zircon, mineral inclusion