U-Pb zircon geochronology of the North Pole Dome adamellite in the eastern Pilbara Craton

*Hisashi Asanuma[1], Hideyuki Obayashi[2], Yusuke Sawaki[1], Shuhei Sakata[3], Kazue Suzuki[4], Kouki Kitajima[5], Takafumi Hirata[4], Shigenori Maruyama[1]

1. Tokyo Institute of Technology, 2. Kyoto University, 3. Gakushuin University, 4. The University of Tokyo, 5. University of Wisconsin

Supracrustal rocks around the North Pole Dome area, Western Australia, provide valuable information regarding early records of crustal growth, surface environments and biosphere. Owing to the occurrence of the oldest known microfossils, the North Pole Dome area has attracted interests from many researchers. The Paleoarchean successions (Warrawoona Group) in this area mainly comprise mafic-ultramafic greenstones with intercalated cherts and felsic lavas. Previous age constraints on the succession have been mainly based on zircon U-Pb geochronology of felsic rocks (e.g., adamellite, rhyolite and tuff). However, most zircon grains have suffered from metamictization and contain anomalously high contents of common Pb, which makes interpretation of the U-Pb data complicated. Actually, previous zircon U-Pb data were highly scattered even plotted on Concordia curve within their analytical errors. In order to provide more convincing chronological constraints, we attempted to acquire U-Pb Concordia ages, which had been widely accepted as the best estimate of U-Pb age with the smallest uncertainties.

The North Pole Dome adamellite intrudes into the bottom of the Warrawoona Group, and most zircons separated from the adamellites (95NP207 and 96NP208) suffered from severe metamictization. We selected less metamictized domains using a pre-ablation technique in conjunction with elemental mapping and then conducted *in situ* U-Pb isotopic analyses with a laser ablation inductively coupled plasma mass spectrometry. Most analyzed domains contain certain amounts of common Pb ($^{204}Pb/^{206}Pb > 0.0001$), whereas we have obtained three and five concordant data points with less common Pb ($^{204}Pb/^{206}Pb < 0.0001$). These concordant data-sets yield Concordia ages of 3445 ±23 and 3454 ±17 Ma, respectively. Although these ages are almost similar to those from previous reports, the new ages are based on more reliable data with the smaller errors owing to avoidance of metamictized domains. These ages constrain the intrusive age of the North Pole Dome adamellite and the minimum depositional age of the Warrawoona Group and indicates that the microfossils discovered in this area had appeared by *ca.* 3454 Ma. In addition, a single xenocrystic zircon grain with less common Pb ($^{204}Pb/^{206}Pb < 0.0001$) shows a $^{207}Pb/^{206}Pb$ age of *ca.* 3545 Ma, supporting the idea that the sialic basement of the Pilbara Craton existed prior to 3500 Ma.

In general, old zircon grains often suffer from metamictization and contain detectable level of common Pb, which are unsuitable to constrain precise igneous ages of the host rocks. In contrast, the *in situ* U-Pb zircon dating combined with the pre-ablation technique can obviate to measure such metamictized domains, and has the potential for yielding precise and accurate geochronological data even from metamict zircons.

Keywords: North Pole Dome, U-Pb zircon geochronology, Metamict, Common Pb, U-Pb Concordia age

