

U-Pb monazite dating of the Turee Creek Group sedimentary succession: Implications on the rise of oxygen and glacial events

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The Great Oxidation Event (GOE) between 2.45 and 2.2 Ga has been linked to the onset of multiple global glaciations. The correlation of the different glacial deposits is uncertain because key sedimentary successions remain undated. The Turee Creek Group (TCG) in Western Australia shows evidence for continuous deposition across the GOE, and thus allows examining the nature, rate, and duration of the rise of atmospheric oxygen on Earth. The TCG has a total thickness of ~4 km, from BIF of the underlying Boolgeeda Iron Fm., to glacial diamictites of the Meteorite Bore Member (MBM), quartzite of the Koolbye Fm. and carbonates of the Kazput Fm. The age of deposition is not well constrained and lies between a 2450 ± 3 Ma age obtained for the Woongarra rhyolites at the base of the Boolgeeda Fm. and a 2209 ± 15 Ma on unconformably overlying Cheela Spring's basalts. Three drill cores have been obtained at the Boolgeeda-Kungarra transition (T1), the MBM diamictites (T2) and the Kazput-Koolbye transition (T3).

In situ U-Th-Pb dating of monazite allowed identifying 3 types of monazites. Sub-euhedral and inclusions free m1-type exclusively found in T1 yielded a 2469 ± 14 Ma age. m2-type present in both T2 and T3 display core-rim zonation patterns. Th-rich cores yielded a 2462 ± 16 Ma age in T2 and 2438 ± 14 Ma in T3. Th-poor rims recorded a 1791 ± 10 Ma age in T2 and 1831 ± 16 Ma in T3. Rounded and compositionally homogenous m3-type, which is only present in Koolbye Fm., yielded a 2595 ± 60 Ma age. These preliminary results indicate that the TCG was deposited within a few tens of Myr soon after the Woongarra Rhyolites, thus arguing that the MBM corresponds to the first glacial event. m2-type overgrowth zones are best attributed to a remobilization stage attending the ~1.8 Ga old Capricorn Orogeny. m3-type monazites are interpreted to be of detrital origin and associated with the erosion of the Hamersley Group.