Geophysical Research Abstracts
Vol. 21, EGU2019-11758, 2019
EGU General Assembly 2019

Tectono-metamorphic record of final Nuna assembly and orogenic collapse in the Georgetown Inlier, NE Australia: Insights from multiple P–T–d–t paths

Silvia Volante (1), William J. Collins (1), Eleanore Blereau (2), Amaury Pourteau (1), Zheng-Xiang Li (1), Chris Spencer (1), Adam Nordsvan (1), Jiangyu Li (1), and Matthijs Smit (3)

(1) Earth-Dynamics Research Group, ARC Centre of Excellence for Core to Crust Fluid Systems (CCFS) and The Institute for Geoscience Research (TIGeR), School of Earth and Planetary Sciences, Curtin University, Perth, WA 6845, Australia *silvia.volante@postgrad.curtin.edu.au , (2) ARC Centre of Excellence for Core to Crust Fluid Systems (CCFS) and The Institute for Geoscience Research (TIGeR), John de Laeter Centre for Isotope Research, School of Earth and Planetary Sciences, Curtin University, Perth, WA 6845, Australia, (3) Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, 2020–2207 Main Mail, Vancouver, BC V6T 1Z4, Canada

The final assembly of the Mesoproterozoic supercontinent Nuna was marked by the collision of Laurentia (North America) and Australia between c. 1.6 and 1.53 Ga. The final suture of Nuna has been identified in NE Australia, where the Proterozoic Georgetown Inlier represents the accreted leading edge of Laurentia. However, the structural and metamorphic evolution of the Georgetown Inlier remains uncertain. Here we investigate the orogenic evolution of this final Nuna collisional event using multi-scale petrostructural analysis, thermodynamic modelling, and geochronology.

The Georgetown Inlier is characterised by c. 1.7 to 1.65 Ga metasedimentary and metabasic rocks that have been multiply deformed and metamorphosed, and intruded by c. 1.55 Ga S-type granites. Two pervasive fabrics (S1 and S2) are preserved within low strain domains of retrograde greenschist-facies foliations (S3 and S4). S1 is defined by greenschist-facies assemblages in the west, and by amphibolite-facies assemblages in the central Inlier, while S2 is defined by low-pressure and high-temperature mineral assemblages in the central and eastern inlier. Microstructural analysis combined with mineral chemistry and thermodynamic modelling in the central Inlier suggest prograde syn-S1 garnet growth in staurolite–garnet metapelites occurred at 530–550 ˚C at 5.4–6.4 kbar (core) to 620–660 ˚C at 8.6–9.8 kbar (rim). Garnet Lu–Hf geochronology dates this MP–MT metamorphism at c. 1.6 Ga. During the development of S2, staurolite was replaced by andalusite (M2a), which was pseudomorphed by sillimanite (M2b) in the eastern region, where granites are abundant. Calculations suggest 600–680 ˚C and 4–6 kbar for the sillimanite stage, and syn-S2 monazite yields c. 1.55–1.53 Ga U–Pb ages. Garnet in sillimanite-bearing metapelites is a MP–MT relict as its composition is reproduced in the staurolite stability field and it has a Lu–Hf age of c. 1.6 Ga. Field relationships suggest that the low–pressure stage was part of the regional thermal event associated with granite emplacement between c. 1.56–1.54 Ga. Some S-type granites record retrograde greenschist-facies foliations, and were emplaced late- to post-S2. In the eastern migmatitic complex, partial melting of paragneiss and amphibolite occurred early-, syn-, to post-S2. Peak conditions were estimated at 700–820 ˚C and 7.8–8.4 kbar in paragneiss, and at 750–890 ˚C and 7.0–8.4 kbar in garnet-free amphibolite.

The P–T–d–t paths reconstructed for the Georgetown Inlier thus suggest an early deformation phase (D1) under MP–MT conditions at 1.6 Ga and a LP–HT metamorphic overprint during D2 between c. 1.56 and 1.53 Ga. These results support that the Georgetown Inlier records collisional orogenesis related to the final assembly of Nuna at 1.6 Ga, whereas the subsequent LP–HT overprint is interpreted as orogenic collapse.