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Spatio–temporal evolution of Mesoproterozoic magmatism in NE Australia: A revised tectonic model for final Nuna assembly

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The tectonic forces that drove the 1550–1490 Ma granitic magmatism c. 50 million years after the final assembly of the Proterozoic supercontinent Nuna in NE Australia have remained elusive. Collision between the eastern Australian proto-continent (Mount Isa Inlier, MTI) and the western Laurentian Georgetown Inlier (GTI) occurred at 1600 Ma [1], and was associated with a west-dipping subduction, with the MTI (NE Australia) as the upper plate and the GTI (NW Laurentia) as the lower plate. Dominant S- and I- type magmatism is confined to the lower plate (GTI), while I- and A-type granites intruded further west (inboard) the Australian upper plate (MTI).

Structural studies in the GTI showed that the collisional event involved WNW-ESE (D1/M1) shortening at *c.* 1600 Ma, followed by NW-SE directed extension (D2/M2) at *c.* 1550 Ma [2]. During the D2 extensional stage, a crustal-scale, west-dipping detachment fault system juxtaposed middle- to lower-crustal levels of the GTI associated with the generation of voluminous, 1550 Ma S-type granitic magmas, against greenschist facies upper crustal rocks. From the GTI, an inboard (westward) transition of S-I-A granitic magmatism was accompanied by a westward younging of these plutons, from 1550 Ma until 1490 Ma. This transition from relatively hydrous (S-type) granites in the east to drier (A-type) granites to the west is also supported by increasing zircon saturation temperatures. Recent Lu–Hf analyses of zircon and new in-situ Sm–Nd analyses of monazite in granites show an increasing radiogenic composition trend from the east (GTI) to the west (MTI), which reflects a concomitant westward increase in mantle input. Combined, these features suggest a spatio–temporal evolution of hotter and drier crustal conditions inboard (westward) associated with a progressive lithospheric extension. Classical Phanerozoic extensional collapse, upper plate delamination, and Aegean-style subduction-rollback tectonic models do not account for all of the features of this post-collisional magmatic record. Rather a hybrid tectonic setting between fast-hard Indian and slow-soft Mediterranean collision better explains the attributes of the final Nuna suturing in Mesoproterozoic NE Australia.

References

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