Polyphase Neoproterozoic orogenesis within the East Africa–Antarctica Orogenic Belt in central and northern Madagascar

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Abstract: Our recent geological survey of the basement of central and northern Madagascar allowed us to re-evaluate the evolution of this part of the East Africa–Antarctica Orogen (EAAO). Five crustal domains are recognized, characterized by distinctive lithologies and histories of sedimentation, magmatism, deformation and metamorphism, and separated by tectonic and/or unconformable contacts. Four consist largely of Archaean metamorphic rocks (Antongil, Masora and Antananarivo Cratons, Tsaratanana Complex). The fifth (Bemarivo Belt) comprises Proterozoic meta-igneous rocks. The older rocks were intruded by plutonic suites at *c.* 1000 Ma, 820–760 Ma, 630–595 Ma and 560–520 Ma. The evolution of the four Archaean domains and their boundaries remains contentious, with two end-member interpretations evaluated: (1) all five crustal domains are separate tectonic elements, juxtaposed along Neoproterozoic sutures and (2) the four Archaean domains are segments of an older Archaean craton, which was sutured against the Bemarivo Belt in the Neoproterozoic. Rodinia fragmented during the early Neoproterozoic with intracratonic rifts that sometimes developed into oceanic basins. Subsequent Mid-Neoproterozoic collision of smaller cratonic blocks was followed by renewed extension and magmatism. The global 'Terminal Pan-African' event (560–490 Ma) finally stitched together the Mid-Neoproterozoic cratons to form Gondwana.

The supercontinent of Rodinia was created by *c.* 1.0 Ga following end-Mesoproterozoic orogenesis along a global network of Grenville–Kibaran–Namaquan orogenic belts (e.g. Torsvik *et al.* 1996; Dalziel 1997; Kröner 2001; McCourt *et al.* 2006; Li *et al.* 2008). Within *c.* 120 million years of its creation, extensional rift basins started to develop. In some instances these progressed into oceanic basins, partially fragmenting Rodinia into separate crustal plates by the Mid-Neoproterozoic (Unrug 1998; Li *et al.* 2008; Wendorff & Key 2009). Middle Neoproterozoic plate collision and subsequent extension was followed by multiple collisions of smaller crustal plates between *c.* 560 and 520 Ma to form the Gondwana supercontinent (Meert 2003; Collins & Pisarevsky 2005; Bingen *et al.* 2009). The end-Neoproterozoic–Cambrian collisional tectonics resulted in a network of linear orogenic belts, referred to as 'Pan-African' in Africa (Kennedy 1964; Stern 1994; Gasquet *et al.* 2008; Michard *et al.* 2008), including the East Africa–Antarctica Orogenic Belt (EAAO) that can be traced southwards from Arabia through eastern and southern Africa, India, Madagascar and Sri Lanka into Antarctica (Jacobs & Thomas 2004, Fig. 1). Post-collision retrograde metamorphism and shearing continued into Ordovician times (to *c.* 500 Ma; Emmel *et al.* 2006).

Recent work has shown that while all parts of the EAAO shared a common end-Proterozoic to earliest Ordovician geological history (Meert 2003; Collins & Pisarevsky 2005; Bingen *et al.* 2009), the earlier Neoproterozoic tectonothermal events at *c.* 820–720 Ma and *c.* 660–610 Ma recognized in East

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