

International Association for Gondwana Research Conference Series No. 9, p. 15-16

International Conference on Paleoproterozoic Supercontinents and Global Evolution, IGCP-509, 26-28 October 2009, Indian Statistical Institute, Kolkata, India 700108



The Precambrian Framework of Northern and Central Madagascar

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A four-year regional geological mapping and U-Pb zircon geochronology programme in central and northern Madagascar, completed in 2008 (BGS-USGS-GLW, 2008) focused on re-evaluating the evolution of the crystalline basement of this area within the East Africa-Antarctica Orogenic belt (EAAO). Primary geological mapping (Besairie, 1968-71; Jourde, 1971; Hottin, 1976) of Madagascar throughout the last century showed that the island's crystalline basement comprises a number of major crustal segments separated by tectonic and/or unconformable contacts. Subsequent research (Collins, 2006; Collins & Windley, 2002; Collins & Pisarevsky, 2005; Kröner, 2001; Tucker et al., 1999) confirmed the early work and identified and dated the Archaean Antongil and Antananarivo Domains and Tsaratanana Complex, various Neoproterozoic supracrustal units and the northern Neoproterozoic Bemarivo Domain, the major geological units in our study area. The nature of the boundaries between these units and the details of the tectonic evolution of Madagascar within the orogen remained contentious. Here, we show that all the major crustal segments (including a newly recognised Masora Domain) are tectonically bounded (locally by suture zones) and that they were juxtaposed during three periods of crustal extensional (before 820 Ma to develop the ocean basin of the Manampotsy Complex; between 630 and 560 Ma and at about 510 to 490 Ma) and three periods of compressional tectonics (820-715 Ma; polyphase during the 560-510 Ma period) within a central part of the EAAO. Mesoarchaeoan rocks are confined to the core of the Antongil Domain which is now subdivided into separate northern (Antongil) and southern (Masora) Domains on the basis of contrasting Neoproterozoic lithologies. The Antananarivo Domain preserves Archaean supracrustals that pre-date a major end-Neoproterozoic/early Palaeoproterozoic orogeny with extensive granitoid magmatism. The Tsaratanana Complex, which tectonically overlies the Antananarivo Domain, records the most complex Neoproterozoic sequence of events preserved in Madagascar. The Ankavanana Suite

of mafic rocks dated at about 2147 Ma from the Antongil Domain is the only mid-Palaeoproterozoic magmatic unit exposed in the project area. However, detrital zircon studies of high-grade metasedimentary sequences that tectonically overlie the Archaean units yield Palaeoproterozoic ages. These include the Andrarona Group of the Antongil Domain with a unimodal detrital zircon population of 2355 Ma and the Maha Group of the Masora Domain with detrital zircons with a significant 1.8-1.75 Ga population, in addition to small Neoproterozoic and Mesoproterozoic zircon populations. The Sahantaha Group in the southern Bemarivo Domain contains a detrital zircon population dominated by ca 1.8 Ga zircon grains, and has a maximum age of sedimentation of ca. 1.8 Ga. As with the Itremo Group of west-central Madagascar, the source or sources of the widespread 1.8 Ga detrital grains is not known.

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