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Proterozoic Tectonostratigraphy and Paleogeography of Central Madagascar Derived from Detrital Zircon U-Pb Age Populations

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ABSTRACT

Detrital zircon U-Pb ages determined by SHRIMP distinguish two clastic sequences among Proterozoic metasedimentary rocks from central Madagascar. The Itremo Group is older: zircon data, stromatolite characteristics, and carbon isotope data all point to a depositional age around 1500–1700 Ma. The Molo Group is younger, deposited between ~620 Ma (the age of the youngest zircon) and ~560 Ma (the age of metamorphic overgrowths on detrital cores). Geochronologic provenance analysis of the Itremo Group points to sources in East Africa as well as local sources in central and southern Madagascar but provides no evidence for a detrital contribution from northern and eastern Madagascar nor from southern India. Detrital zircon and sedimentologic similarities between rocks of the Itremo Group and the Zambian Muva Supergroup suggest a lithostratigraphic correlation between the two. The Molo Group has a strong 1000–1100 Ma detrital signature that also indicates an east African provenance and suggests a Neoproterozoic geographic connection with Sri Lanka but shows no indication of input from the Dharwar craton and eastern Madagascar. Central Madagascar was probably juxtaposed with the Tanzanian craton in the Paleo- and Mesoproterozoic, whereas northern and eastern Madagascar were connected to India. Internal assembly of Madagascar postdates Neoproterozoic Molo Group sedimentation and is likely to have occurred at about 560 Ma.

Online enhancements: appendix, table.

Introduction

Polydeformed Precambrian rocks of Madagascar record the Neoproterozoic and earliest Phanerozoic assembly of Gondwana, and Madagascar occupies a central position in the East African Orogen (Stern 1994). Consequently, its highly strained and poorly understood basement has been a focus for understanding the dynamics of Gondwana amalgamation (Handke et al. 1999; Kröner et al. 2000; Nédélec et al. 2000; Collins and Windley 2002; Collins et al. 2003*a*). Sorting out paleogeographic affinities is critical, but deconvolving assembled Gondwana into pre-Gondwana continental elements is difficult because the geology is structurally complex and the geochronologic database is small.

Paleogeographic complexity is evident in Madagascar. There are geological and isotopic similarities between Archean crystalline basement rocks of northern Madagascar and the western Dharwar craton of India (Tucker et al. 1999*b*; Collins et al. 2003*c*), chemical and geochronologic similarities between Neoproterozoic igneous rocks in central Madagascar and Sri Lanka (Kröner et al. 2000), and mid-Proterozoic source-sediment links between central Madagascar and east Africa (Cox et al. 1998). Pro-

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