



Geological evolution of the Neoproterozoic Bemarivo Belt, northern Madagascar

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ABSTRACT

The broadly east-west trending, Late Neoproterozoic Bemarivo Belt in northern Madagascar has been re-surveyed at 1:100 000 scale as part of a large multi-disciplinary World Bank-sponsored project. The work included acquisition of 14 U–Pb zircon dates and whole-rock major and trace element geochemical data of representative rocks. The belt has previously been modelled as a juvenile Neoproterozoic arc and our findings broadly support that model. The integrated datasets indicate that the Bemarivo Belt is separated by a major ductile shear zone into northern and southern “terrane”, each with different lithostratigraphy and ages. However, both formed as Neoproterozoic arc/marginal basin assemblages that were translated southwards over the north-south trending domains of “cratonic” Madagascar, during the main collisional phase of the East African Orogeny at ca. 540 Ma. The older, southern terrane consists of a sequence of high-grade paragneisses (Sahantaha Group), which were derived from a Palaeoproterozoic source and formed a marginal sequence to the Archaean cratons to the south. These rocks are intruded by an extensive suite of arc-generated metamorphosed plutonic rocks, known as the Antsirabe Nord Suite. Four samples from this suite yielded U–Pb SHRIMP ages at ca. 750 Ma. The northern terrane consists of three groups of metamorphosed supracrustal rocks, including a possible Archaean sequence (Betsiaka Group: maximum depositional age approximately 2477 Ma) and two volcano-sedimentary sequences (high-grade Milanao Group: maximum depositional age approximately 750 Ma; low grade Daraina Group: extrusive age = 720–740 Ma). These supracrustal rocks are intruded by another suite of arc-generated metamorphosed plutonic rocks, known as the Manambato Suite, 4 samples of which gave U–Pb SHRIMP ages between 705 and 718 Ma.

Whole-rock geochemical data confirm the calc-alkaline, arc-related nature of the plutonic rocks. The volcanic rocks of the Daraina and Milanao groups also show characteristics of arc-related magmatism, but include both calc-alkaline and tholeiitic compositions. It is not certain when the two Bemarivo terranes were juxtaposed, but ages from metamorphic rims on zircon suggest that both the northern and southern terranes were accreted to the northern cratonic margin of Madagascar at about 540–530 Ma. Terrane accretion included the assembly of the Archaean Antongil and Antananarivo cratons and the high-grade Neoproterozoic Anaboriana Belt. Late- to post-tectonic granitoids of the Maevarano Suite, the youngest plutons of which gave ca. 520 Ma ages, intrude all terranes in northern Madagascar showing that terrane accretion was completed by this time.

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1. Introduction

Madagascar occupies a critical, central position within the East African Orogen (EAO; Fig. 1). The Bemarivo Belt is the northernmost Precambrian terrane of Madagascar, and one of the fundamental building blocks of the island (Fig. 2). The other major Precambrian terranes that make up Madagascar include the Archaean Antongil Craton, in the east of the island, and the Antananarivo Craton which also largely dates from the Archaean, and which underlies much

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