Author's personal copy

Precambrian Research 182 (2010) 187–203

Contents lists available at ScienceDirect

Precambrian Research

journal homepage: www.elsevier.com/locate/precamres

Geological evolution of the Antongil Craton, NE Madagascar☆

D.I. Schofield[a,*], R.J. Thomas[a], K.M. Goodenough[b], B. De Waele[a,1], P.E.J. Pitfield[a], R.M. Key[b], W. Bauer[a], G.J. Walsh[c], D.J. Lidke[d], A.V. Ralison[e], M. Rabarimanana[e], J.M. Rafahatelo[e], T. Randriamananjara[e]

[a] British Geological Survey, Kingsley Dunham Centre, Keyworth, NG12 5GG, UK
[b] British Geological Survey, Murchison House, Edinburgh, EH9 3LA, UK
[c] United States Geological Survey, Montpelier, VT 05601, USA
[d] United States Geological Survey, Denver, CO 80225, USA
[e] Projet de Gouvernance des Ressources Minérales, Ampandrianomby 101, Antananarivo, Madagascar

ARTICLE INFO

Article history:
Received 9 March 2010
Received in revised form 7 July 2010
Accepted 9 July 2010

Keywords:
Madagascar
Archaean
Palaeoproterozoic
Antongil
Geochronology

ABSTRACT

The Antongil Craton, along with the Masora and Antananarivo cratons, make up the fundamental Archaean building blocks of the island of Madagascar. They were juxtaposed during the late-Neoproterozoic to early Palaeozoic assembly of Gondwana. In this paper we give a synthesis of the geology of the Antongil Craton and present previously published and new geochemical and U–Pb zircon analyses to provide an event history for its evolution.

The oldest rocks in the Antongil Craton form a nucleus of tonalitic gneiss, characteristic of Palaeo-Mesoarchaean cratons globally, including phases dated between 3320 ± 14 Ma to 3231 ± 6 Ma and 3187 ± 2 Ma to 3154 ± 5 Ma. A series of mafic dykes was intruded into the Mesoarchaean tonalites and a sedimentary succession was deposited on the craton prior to pervasive deformation and migmatisation of the region. The age of deposition of the metasediments has been constrained from a volcanic horizon to around 3178 ± 2 Ma and subject to migmatisation at around 2597 ± 49 Ma. A subsequent magmatic episode generated voluminous, weakly foliated granitic rocks, that also included additions from both reworked older crustal material and younger source components. An earlier granodiorite-dominated assemblage, dated between 2570 ± 18 Ma and 2542 ± 5 Ma, is largely exposed in xenoliths and more continuously in the northern part of the craton, while a later monzogranite-dominated phase, dated between 2531 ± 13 Ma and 2513 ± 0.4 Ma is more widely developed. Together these record the stabilisation of the craton, attested to by the intrusion of a younger dyke swarm, the age of which is constrained by a sample of metagabbro dated at 2147 ± 6 Ma, providing the first evidence for Palaeoproterozoic rocks from the Antongil Craton.

The youngest events recorded in the isotopic record of the Antongil Craton are reflected in metamorphism, neocrystallisation and Pb-loss at 792 ± 130 Ma to 763 ± 13 Ma and 553 ± 68 Ma. These events are interpreted as being the only manifestation of the Pan-African orogeny seen in the craton, which led to the assembly of the tectonic blocks that comprise the island.

© 2010 NERC. Published by Elsevier B.V. All rights reserved.

1. Introduction

The crystalline basement on the island of Madagascar is made up of a collage of accreted terranes (cratons) ranging in age from Archaean to Neoproterozoic, which lie within the core of the Palaeozoic supercontinent of Gondwana. Most of the terranes were juxtaposed during the late-Neoproterozoic to early Palaeozoic collision of East- and West-Gondwana during the "Pan-African" or "East African" orogeny (EAO; Stern, 1994). The oldest rocks in Madagascar are found in three cratonic blocks known as the Antananarivo, Antongil and Masora Cratons (Fig. 1). The Antananarivo Craton, located in central and northwest Madagascar, is composed of Neoarchean rocks considered to have East African affinities (Cox et al., 1998). In contrast, the Antongil and Masora Cratons, which outcrop on the island's east coast and are considered to be parts of cratonic domains that contain both Meso- and Neoarchaean rocks and have been interpreted by recent workers as having Indian (Dharwar Craton) affinities (e.g. Tucker et al., 1999; Kröner et al., 2000; Collins and Windley, 2002; Collins et al., 2003b; Collins,

☆ Part of this paper were written by US Government employees and are in the Public Domain.

* Corresponding author.
E-mail address: dis@bgs.ac.uk (D.I. Schofield).

[1] Present address: SRK Consulting, Perth, Western Australia, Australia.

0301-9268/$ – see front matter © 2010 NERC. Published by Elsevier B.V. All rights reserved.
doi:10.1016/j.precamres.2010.07.006