The role of the Ranotsara Zone in southern Madagascar for Gondwana correlations *Poster*

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Introduction

The Precambrian basement of southern Madagascar was reworked at high-grade metamorphic conditions during the East African Orogen (EAO of Stern, 1994) that formed during assembly of Gondwana in late Neoproterozoic/early Paleozoic times. At the end of the EAO, Madagascar is generally thought to be sandwiched between southern India and eastern Africa. Constraints on its paleoposition are often inferred from similarities in structural features on now dispersed continental fragments, in particular high-strain zones. Major zones with (sub)vertical foliation planes can be traced over hundreds of kilometres in southern Madagascar (Fig. 1) and have been interpreted as major vertical ductile shear zones (e.g. Windley et al. 1994; Martelat, 1998). The NW–SE trending Ranotsara Zone (dashed rectangle in Fig. 1) is regarded as an intracrustal mega strike-slip shear zone with a sinistral sense of shear that formed at the end of the Proterozoic (e.g. Nicollet, 1990; de Wit et al., 2001). A large number of studies have used the Ranotsara Zone to propose Gondwana reconstructions. The Ranotsara Zone has been correlated with various ductile shear zones in southern India, e.g. with the Bhavani Shear Zone or the Moyar Shear Zone (Katz & Premoli, 1979), the Palghat-Cauvery Shear Zone (de Wit et al., 1995), the Karur-Kamban-Painavum-Trichur Shear Zone (de Wit et al., 2001; Ghosh et al. 2004) or with the Achankovil Shear Zone (Windley et al., 1994; Martelat, 1998).

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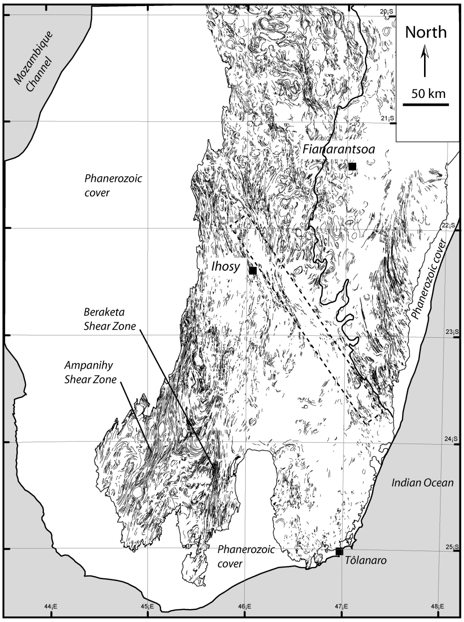

Figure 1: Foliation traces in the Precambrian basement of southern Madagascar. The dashed rectangle outlines the Ranotsara Zone that previously has been interpreted as a mega strike-slip shear zone and has been used in Gondwana correlations.

Within Madagascar, the Ranotsara Zone has been correlated along strike with the more N–S trending Bongolava Zone in central-western Madagascar (Hottin 1976), and the Bongolava-Ranotsara Zone has been further traced into the Surma Shear Zone (Windley et al. 1994) and its along-strike continuation, the Aswa Shear Zone in eastern Africa (Müller 2000). Chetty (2003) suggested that the Ranotsara Zone is

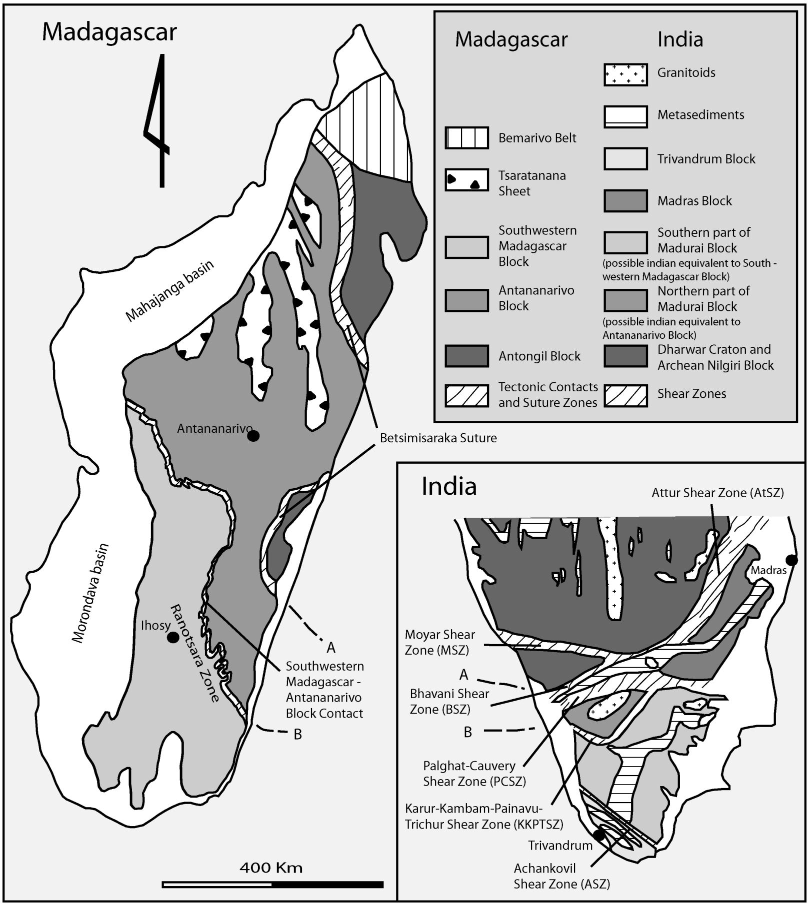

Figure 2: Major tectonic units in Madagascar and southern India. The dashed lines, numbered A and B, indicate possible correlations between ductile shear zones in Madagascar and India. Tectonic units in northern Madagascar are after Collins et al. (2000). The southwestern Madagascar block probably consists of different tectonic units comprising rocks that are predominantly of Proterozoic age. Shear zones in southern India compiled after Meissner (2001) and Ghosh et al. (2004).

not only a mega shear zone, but also a terrane boundary separating a region with Archean crust to the north from a region with Neoproterozoic crust to the south. Our remote sensing and field studies of southern Madagascar indicate that the Ranotsara Zone is neither a major terrane boundary nor an intracrustal mega strike-slip shear zone and therefore can not be used as a 'piercing point' in Gondwana reconstructions. In the immediate vicinity of the Ranotsara Zone, the basic regional pattern consists of a high-grade gneissic foliation produced during one or more deformation stages (grouped in D_1), which is refolded during a D_2 phase of upright folding with subvertical axial planes. The steeply dipping composite foliation traces generally strike N–S, except in the Ranotsara Zone where they are 'sinistrally' deflected into a NW–SE orientation. Subhorizontal NW–SE trending lineations in the Ranotsara Zone have been previously interpreted as stretching lineations and used as evidence for the presence of a major strike-slip shear zone. However, detailed field studies indicate that subhorizontal lineations in the Ranotsara Zone are in fact intersection lineations and hence do not represent evidence for a tectonic transport direction. In addition, there is no evidence for a gradient in shear deformation gradient across the Ranotsara Zone nor is there a newly developed foliation parallel to it. Lithologies can be traced across the Ranotsara Zone and are — as the composite foliation traces — slightly deflected. In addition, the Precambrian basement rocks in and around the Ranotsara Zone are affected by brittle faulting that is often parallel to the gneissic foliation. Apatite fission track data also indicate that brittle reactivation occurred along the Ranotsara Zone (Seward et al. 2004).

In satellite images it is often difficult to distinguish brittle from ductile lineaments, and especially along the Ranotsara Zone previous workers may have interpreted brittle lineaments as evidence for an along-strike continuation of the ductile Ranotsara Zone towards the SE. Although the Ranotsara Zone can not be used for correlating Madagascar with other continental fragments of Gondwana, a major ductile shear zone further N appears to be useful for Gondwana correlations. This shear zone brings metasedimentary rocks of the Ikalamavony Group and Itremo Group (both part of what we refer to as the southwestern Madagascar Block) in contact with the Antananarivo Block (Fig. 2) and was subsequently affected by the D_2 phase of upright folding (Fig. 1). Preliminary mapping and interpretation of existing geological maps indicate that this tectonic contact remains N of the Ranotsara Zone and can not be traced across it. This suggests that both the Antananarivo Block and the Antongil Block further east (the latter has affinities with the Archean Dharwar craton in India) are restricted to the area N of the Ranotsara Zone and may have acted as an indentor during (transpressional?) Gondwana assembly producing a syntactical bend (flexure) across the Ranotsara Zone. On the basis of this tectonic interpretation we propose that the contact between the Antananarivo Block and the southwestern Madagascar Block can possibly be traced into the Karur-Kamban-Painavum-Trichur Shear Zone in southern India (Fig. 2).

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