

The Ranotsara Zone in southern Madagascar – a “piercing point” for Gondwana reconstructions?

Giese Jörg*, Schreurs Guido, Berger Alfons & Gnos Edwin.

Institute of Geological Sciences, University of Bern, Switzerland

*giese@geo.unibe.ch

During amalgamation of Gondwana in Neoproterozoic to early Paleozoic times, the Precambrian basement of southern Madagascar was incorporated into the East African Orogen (EAO after Stern 1994) and deformed at high-grade metamorphic conditions. Before breakup of Gondwana, its general position is thought to be in between eastern Africa and India. Very often tight-fit Gondwana reconstructions are based on similarities of structural features, in particular high-strain zones which are traced on former adjacent, nowadays dispersed continental fragments.

The Precambrian basement of southern Madagascar is characterised by several broad zones with (sub)vertical, narrow spaced foliation planes, which can be followed for hundreds of kilometres. These zones have been interpreted as major ductile shear zones (e.g. Windley et al. 1994). In contrast to the general N-S trending structural pattern, the Ranotsara Zone in central southern Madagascar trends NW-SE (see Fig. 1). The Ranotsara Zone has not only been regarded as a major intra-crustal mega strike-slip shear zone with a sinistral sense of shear (e.g. Martelat 1998; de Wit et al. 2001), but also as a terrain boundary separating a region with Archean crust to the north from a region with Neoproterozoic crust to the south. Therefore, various studies have used the Ranotsara Zone for correlations with shear zones in southern India and eastern Africa to reconstruct the relative positions of the different continents.

Interpretation of remote sensing data combined with detailed structural fieldwork indicates that the Ranotsara Zone is neither a major intra-crustal shear zone nor a terrain boundary. The regional structural pattern, consisting of a high-grade gneissic foliation, produced by one or more deformation stages (grouped in D1), has been refolded during a later phase of deformation (D2), producing upright folds with subvertical axial planes. Within the Ranotsara Zone the resulting D1/D2 composite foliation and subhorizontal intersection lineation have been “sinistrally” deflected from a N-S into a NW-SE trending orientation. The absence of a newly developed mylonitic foliation parallel to the NW-SE trend and the absence of a strain gradient across the Ranotsara Zone are in agreement with the fact that lithologies are only slightly deflected, but are not cut discordantly and can be traced across the Ranotsara Zone as coherent units. Therefore, the Ranotsara Zone cannot be used as a structural “piercing point” for correlations between southern Madagascar, India and eastern Africa.

North of the Ranotsara Zone a D1 tectonic contact can be identified separating mainly metasedimentary rocks of the Ikalamavony and Itremo units (grouped with supplementary units to the SW in the “southwestern Madagascar Block”) from the Antananarivo Block to the east. The geological units of the southwestern Madagascar Block can be traced across the Ranotsara Zone, whereas the units of the Antananarivo Block (and the Antongil Block, east of the Antananarivo Block with affinities to the Dharwar craton in India) remain north of the Ranotsara Zone. This suggests that the ductile shear zone separating the southwest Madagascar Block from the Antananarivo Block (see Fig. 1) is suitable for Gondwana correlations.

We propose that the Antananarivo Block (and the Antongil Block) acted as an (probably oblique) indenter during collision and amalgamation of Gondwana, causing a flexure (Ranotsara Zone) of the mainly metasedimentary units of the southwestern Madagascar Block in front of a pre-shaped indenter.

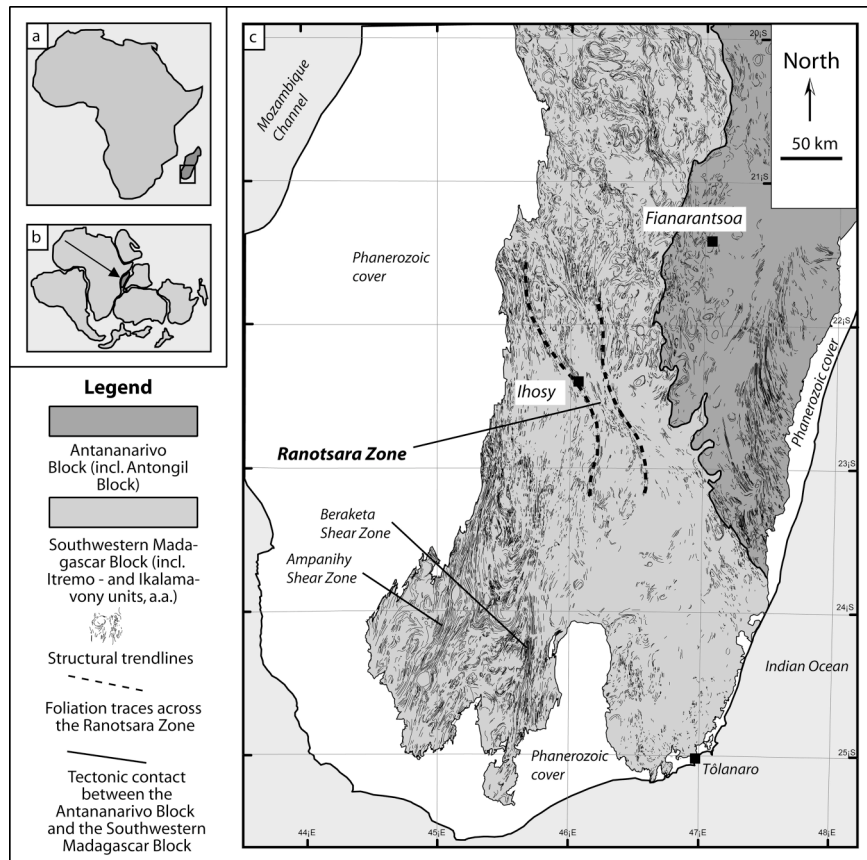


Figure 1a. present day position of Madagascar; b. generalised reconstruction of Gondwana after Lawver and Scotese (1987), arrow indicating the paleoposition of Madagascar between eastern Africa and southern India; c. Foliation traces in the Precambrian basement of southern and central Madagascar. The dashed lines show the flexure of the foliation traces across the Ranotsara Zone. The solid line indicates the tectonic contact between the Antananarivo Block and the southwestern Madagascar Block.

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