TECTONIC EVOLUTION OF THE MOZAMBIQUE BELT, EASTERN AFRICA

Cutten, H. N. C.[1], Johnson, S. P.[2] & De Waele, B.

[1] Tectonics Special Research Centre, School of Earth and Geographical Sciences, University of Western Australia, Crawley 6009, Australia; hcutten@tsrc.uwa.edu.au

[2] Institute for Research on Earth Evolution, JAMSTEC, 2-15 Natsushima-cho, Yokosuka-shi, Kanagawa-ken. Japan 237-0061; sjohnson@jamstec.go.jp

The Mozambique Belt forms part of the East African Orogen (EAO) which extends from the Arabian Nubian Shield in the north to as far south as Antarctica. An exhumation gradient is observed along the length of the Mozambique Belt with supracrustal rocks exposed in northern Kenya and mid- to lower-crustal granulite-facies rocks exposed in southern Kenya and Tanzania. Geological information from the high-grade portion of the belt, such as rock lithology, structure, metamorphic grade, igneous-metamorphic- and detrital-geochronology, geochemistry, P-T conditions and P-T-t paths have been archived in a spatial database, the 'East Africa Database' (Cutten, 2004). This database utilizes ArcView and Microsoft Access in order to identify discrete and distinct terranes that have similar geological attributes such as crystallization age and isotopic composition. This has subsequently allowed us to formulate a new tectonic model for the collision(s) leading to the formation of this part of Gondwana.

Two principal domains are identified in the Mozambique Belt. The Western Mozambique Belt (WMB) comprise upper amphibolite-grade gneisses with emplacement ages predominantly between 2970 to 2648 Ma (Johnson et al., 2003) but also as young as 1837 Ma, and represent reworked rocks of the Tanzania Craton and Usagaran Belt. As yet, no Pan-African-aged igneous rocks have been identified in this domain. The Eastern Granulites (EG) are high-grade, arc-derived lithologies with Pan-African-aged emplacement ages ranging between 841 Ma and 632 Ma. Both terranes include Neoproterozoic metasedimentary rocks and on their lithological make-up and current structural position we interpret them to be parts of two different basins, the West and East Mozambique Basin respectively. Nd isotopic data for the WMB give Archean model ages and $\varepsilon_{Nd}(T)$ similar to that of the Tanzania Craton. The EG give 'mixed' model ages that range from 1300 Ma to 950 Ma and give $\varepsilon_{Nd}(T)$ values of –3.1 to 6.7 indicating mixing/assimilation of juvenile mantle-derived material with older crust. The calc-alkaline chemistry, trace and Rare Earth element patterns combined with their isotopic signature indicate that they formed in an arc environment, most likely a continental-margin-arc. The EG can be further subdivided into three distinct domains, now thrust sheets, based on predominant lithotypes: the ‘Anorthosite thrust sheet’ and ‘Typical Eastern Granulite thrust sheet’ which both represent different structural levels of the Neoproterozoic arc, and the ‘Accretionary Wedge thrust sheet’ which represent continental shelf meta-sediments deposited outboard of the arc. Peak metamorphism in the EG is well constrained at ca. 640 Ma with peak P-T conditions of ~10-12 kbar and 750-850°C that formed under an anticlockwise P-T-t path (Appel et al. 1998; Sommer et al. 2003). These rocks underwent a significant period of isobaric cooling (until ca. 585 Ma) before being decompressed and cooled to ~6 kbar – 550°C at ca. 550 Ma. In contrast, the WMB displays a clockwise P-T-t path that peaked at ~11kbar – 750°C (Jöns & Schenk, 2004) at ca. 550 Ma (Cutten et al. submitted) and which displays decompression to ~3kbar – 550°C immediately following peak metamorphism. Here we suggest that the granulite facies, ca. 640 Ma-aged metamorphism that is confined solely to the high-grade rocks of the EG is related to magmatic underplating and magma loading in the arc (as previously suggested by Appel et al. 1998) rather than continental collision. The present-day contact between the EG and WMB is a shallow east-dipping thrust and vergence structures indicate that the EG were thrust over the WMB toward the west. Combined with a complete lack of Neoproterozoic igneous rocks within the WMB, we suggest that closure of the Mozambique Ocean was accommodated by an east-dipping subduction zone below Madagascar, resulting in arc magmatism and formation of the EG. We suggest that collision was initiated at ca. 585 Ma with the onset of decompression and exhumation of the EG ‘hangingwall’ arc-rocks over the WMB ‘footwall’ rocks until collision culminated at ca. 550 Ma with the final, rapid collapse of the orogen.

The somewhat irregular distribution of rocks identified as WMB and EG within the Mozambique Belt demonstrates that the collisional suture between the two terranes is not represented by a simple single fault contact. It is apparent that in some places the hanging-wall thrust sheet has been penetrated by the present-day exposure surface, possibly facilitated by a combination of orogenic collapse and erosion, to expose inliers of basement rocks such as those at Masasi. Equally, the WMB footwall contains imbricate slices and infolds of EG-like rocks such as the granulites studied by Sommer et al., (2003)

References:

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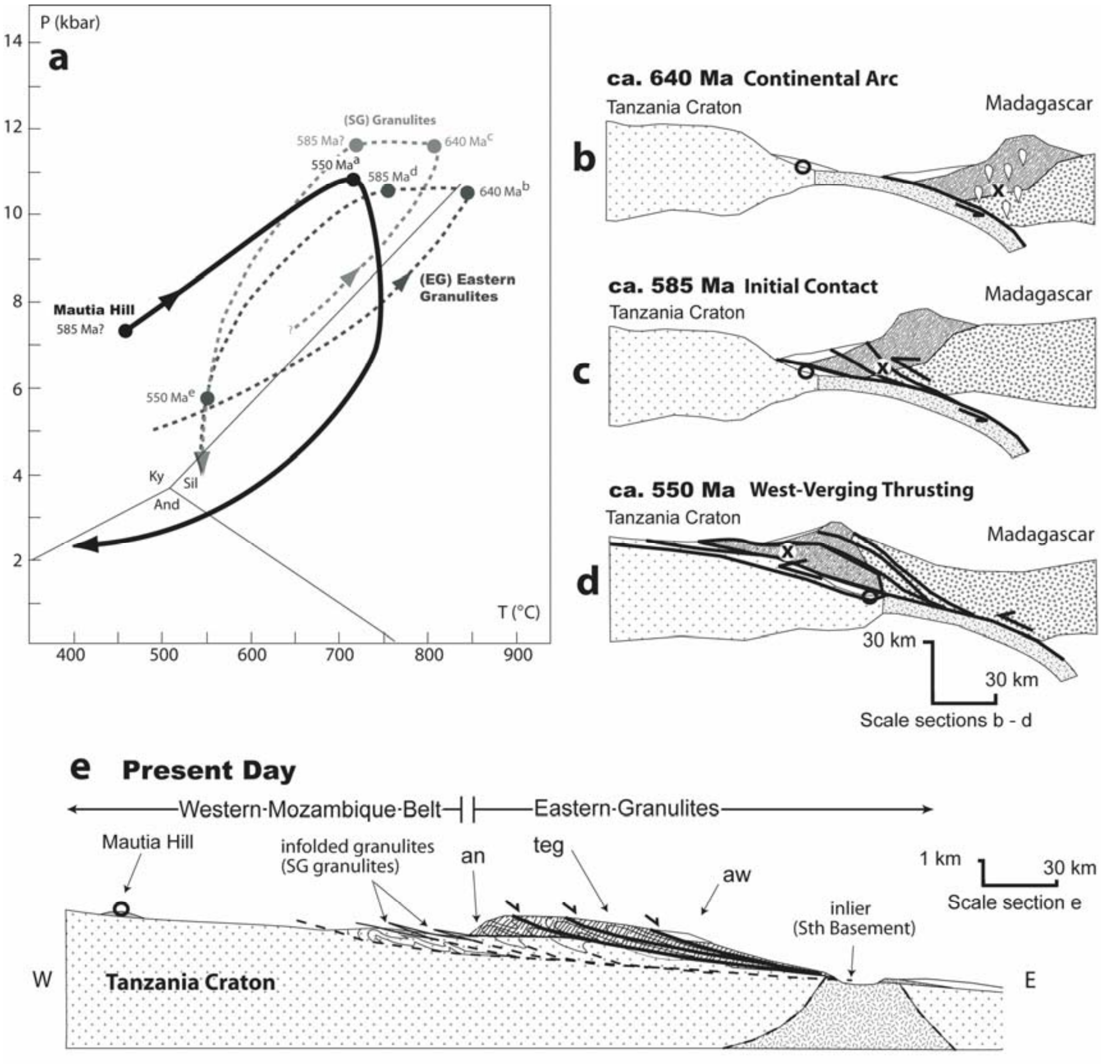

***Fig a.** Pressure-Temperature-time paths for the WMB (Jöns and Schenk, 2004) and EG lithologies (SG-Sommer et al., 2003 and EG Appel et al., 1998). **b-d)**. Cartoon cross-sections illustrating the tectonic evolution of the EAO. **e**). Present-day cartoon cross-section through the Mozambique Belt. The EG form a thin east-dipping thrust sheet that is tectonically imbricated and infolded with WMB gneisses at the base of the thrust sheet. In places the thrust sheet is so thin that basement inliers are exposed such as those at Masasi. Abbreviations: an = Anorthosite thrust sheet, teg = Typical Eastern Granulite thrust sheet, aw = Accretionary wedge thrust sheet.*