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The metamorphic evolution of the Mozambique Belt in Central Tanzania: new petrological and geochronological data

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The Mozambique Belt (MB) in Central Tanzania (study area: 6°S - 9°30'S and 34°30'E - 38°30'E) is a roughly N-S oriented mountain range and a part of the Pan-African East African Orogen, that formed by the collision of East and West Gondwana. This collisional event was caused by a long-lived subduction system along which island arcs were accreted between 750-500 Ma. The related tectonics led to a west-directed forward propagation of thrusts onto the Archean Tanzania Craton with shallow crustal units in the westernmost parts of the MB and with deep crustal rocks exposed in the eastern hinterland. The thrust propagation formed a Pan-African metamorphic overprint with a gradient from greenschist facies in the west to high pressure granulite facies in the east. The age of the peak metamorphic conditions in the granulite terrains is dated around 640 Ma (Muhongo et al., 2001; Sommer et al., 2003). Between the 2.7 Ga old Tanzanian Craton that served as a rigid indenter and the 640 Ma old MB, a narrow stripe of the Paleoproterozoic (1.8-2.0 Ga) Usagaran Belt is exposed. There only low grade overprint by Pan-African deformation and metamorphism occurred. The granulite exposures are subdivided into Western Granulites and Eastern Granulites with a different retrograde P-T-D evolution after the metamorphic peak around 800°C and 10-12 kbar. The Western Granulites experienced isothermal decompression (ITD) and the Eastern Granulites are characterized by isobaric cooling (IBC) immediately after the metamorphic peak (Appel et al., 1998). Based on combined structural and petrological investigations we could constrain the retrograde P-T-D evolution following these differing retrograde but still high grade IBC and ITD segments. Both granulite provinces show a clockwise shape of the retrograde P-T-D

path, dominated by decompression during final stages of exhumation. The IBC segment of the Eastern Granulites forms a 'beta'-shaped retrograde path accompanied by strike-slip tectonics at granulite facies metamorphic conditions. We interpret this highly dynamic initial cooling stage at a particular depth as a result of lower crustal lateral shear during a time span in which the Western Granulites were already involved into initial thrust emplacement (Fritz et al., 2005). The collisional evolution of the MB is nowadays relatively well-explained. The first part of this Wilson cycle, however, is poorly-understood. The lack of knowledge of initial stages is due to unknown prograde P-T-D conditions as well as to the scarcity of geochronological data in that period. Geochronological work during the past decades revealed several tectonic phases that cluster around 2.0 - 1.8 Ga (Usagaran), 1000-700 Ma (beginning of MB formation), 640-620 Ma (collisional stage, onset of deep seated thrusts and lateral shear), and 580 - 530 (final collision with thrust propagation and exhumation). The worst constrained period in this sequence comprehends the time span between 1000-700 Ma from which only a few data have been published yet (Maboko et al., 1985; Muhongo & Lenoir 1994; Muhongo et al., 2001). In the present geochronological study we focused on the magmatic formation ages of massif type meta-anorthosites, which are tectonically incorporated into enderbitic rocks and migmatic orthogneisses of the Eastern Granulites. Both rock-types, the meta-anorthosites and the surrounding meta-igneous granulites reveal magmatic ages between 950 and 820 Ma indicating large-scale magmatic activity at initial stages of MB formation (Tenczer et al., 2005). These meta-igneous enderbites and migmatic gneisses show island-arc affinity and as a consequence, this magmatic activity represents the beginning of a long-lasting island arc accretion that contributed to the juvenile parts of the MB. With the exception of these juvenile rocks in the Eastern Granulites, the magmatic rocks in the western parts of the MB are predominated by Archean formation ages related to the Tanzanian Craton and contributions of magmatic ages from the Usagaran Belt. The extension of the Usagaran Belt before Pan-African overprint is unclear because the Pan-African granulite facies metamorphism at 640 Ma has led to a complete obliteration of possibly pre-existing Usagaran metamorphic fabrics. However throughout the MB, formation ages around 1.8 Ga can be found. This study is supported by FWF-P15599 and the Swedish Museum of Natural History within the IHP Programme (HPRI-CT-2001-00125).

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