

Geochronology and structure of the eastern margin of the Tanzania Craton east of Dodoma

Robert J. Thomas¹, Nick M. W. Roberts², Joachim Jacobs³, Alphonse M. Bushi⁴, Matthew S.A. Horstwood² and Abdul Mruma⁴

¹ British Geological Survey, Nicker Hill, Keyworth, Nottingham, NG12 5GG, UK (bthomas@bgs.ac.uk)

² NERC Isotope Geosciences Laboratory, British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK

³ Department of Earth Science, University of Bergen, 5007 Bergen, Norway

⁴ Geological Survey of Tanzania, Dodoma, Tanzania

The precise position, nature and U-Pb zircon geochronology of the eastern margin of the Tanzania Craton has been studied in the Mpwapwa area, some 60 km east of Dodoma, central Tanzania, in a number of field transects over a ca. 45 km strike length of the craton margin. The rocks to the east of the Tanzania Craton in this area either belong to the Palaeoproterozoic Usagaran belt, or the “Western Granulite” terrane of the Neoproterozoic East African Orogen, according to different authors. The eastern part of the craton is underlain by typical Neoarchaeon migmatitic grey granodioritic orthogneisses dated by ICP-MS at 2674 ± 73 Ma. There is a gradual increase in strain eastwards in these rocks, culminating in a 1 to 2 km wide, locally imbricated, ductile thrust/shear zone with mylonites indicating an oblique top-to-the-NW, transpressional sense of movement. East of the craton-edge shear zone, a series of high-grade supracrustal rocks are termed the “Mpwapwa Group”, in view of uncertain age and regional lithostratigraphic correlations. There is an apparent east-west lithological zonation of Mpwapwa Group parallel to the craton margin shear zone. In the west, immediately adjacent to the craton, the group consists of typical “shelf facies” metasediments (marbles, calc-silicates, quartzites etc.). U-Pb dating of detrital zircons from two Mpwapwa Group quartzite samples from this marginal zone contain only Archaean detritus, constraining their maximum depositional age to $> \text{ca. } 2.6$ Ga and suggesting that the group is Neoarchaeon in age. The shelf rocks pass eastwards into garnet and kyanite-bearing semi-pelitic gneisses interlayered with bimodal mafic-felsic gneisses, where the mafic amphibolite gneisses may represent meta-basalts and the felsic rocks may have meta-rhyolite, -granite or -psammite protoliths. Massive garnet-clinopyroxene amphibolite layers in the Mpwapwa Group gneisses may have been intrusive mafic sills and possibly correlate with the Palaeoproterozoic Isimani Suite, which outcrops south of the study area and includes 2 Ga eclogites. Zircons from a quartzo-feldspathic gneiss sample from the bimodal gneisses were dated and showed it to be a probable Neoarchaeon rock which underwent metamorphism during the Palaeoproterozoic Usagaran event at ca. 1950 Ma. This event was broadly coeval with subduction, closure of an ocean basin and eclogite formation further south and led to the initial juxtaposition of the two Archaean blocks. The metamorphism probably dates the tectonic event when the Archaean Mpwapwa Group rocks were juxtaposed against the orthogneissic Tanzania Craton. The Mpwapwa Group was intruded by weakly foliated biotite granite at 1871 ± 35 Ma. Zircons in the granite have metamorphic rims dated between 550 and 650 Ma that grew during the East African orogenic event.

A suite distinctive of para- and orthogneisses, intruded by charnockites at 2705 ± 23 Ma, occur in the southern part of the area, around the village of Msagali. A sliver of sheared tonalitic orthogneiss from this suite, entrained in the craton margin shear zone, is a meta-igneous rock of probable early Palaeoproterozoic or Neoarchaeon age ($> \text{ca. } 2300$ Ma) with a strong metamorphic overprint at ca. 1960 Ma (zircon), confirmed by a metamorphic titanite age, again believed to date at least an early phase of the craton-margin shearing which juxtaposed different Archaean blocks.

The role of the Neoproterozoic East African orogeny in the evolution of the craton-margin area is unclear, but the geometry of the shear zone, the presence of Neoproterozoic zircon rims on the youngest granite lithology and published studies from nearby areas all suggest that the latest movements on the shear zone may be Neoproterozoic in age and that the structure may represent the local western tectonic front of the East African Orogeny as a rejuvenated initially Palaeoproterozoic structure. This study has shown that careful systematic regional mapping of the Usagaran and “Western Granulite” terranes of eastern Tanzania, backed up by focussed geochronology, can probably resolve the highly complex geology into its Archaean to Proterozoic constituents.