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Structural and geochronological constraints on the evolution of the eastern margin of the Tanzania Craton in the Mpwapwa area, central Tanzania

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ABSTRACT

A study of the position, nature and geochronology of the eastern margin of the Tanzania Craton near Mpwapwa yields new constraints on Archaean to Neoproterozoic orogenesis of central Tanzania. The eastern part of the craton comprises typical Neoarchaean grey granodioritic orthogneisses dated with the LA-ICP-MS method by U–Pb zircon at ca. 2.7 Ga. A gradual eastward increase in strain in these rocks culminates in a 1–2 km wide, locally imbricated, north–south-trending, ductile thrust/shear zone with an oblique top-to-the-NW sense of movement. East of the craton-edge shear zone, high-grade supracrustal rocks are termed the "Mpwapwa Group" in view of uncertain regional correlations. There is an apparent lithological zonation of the Mpwapwa Group parallel to the craton margin shear zone. In the west, the group consists of typical "shelf facies" metasedimentary rocks (marbles, calc-silicates, quartzites, etc.). U–Pb dating of detrital zircons from two quartzites reveal only Archaean detritus, constraining their maximum depositional age to <ca. 2.6 Ga. The shelf rocks pass eastwards into semi-pelitic gneisses interlayered with bimodal mafic-felsic gneisses, which may have volcanic protoliths and are intruded by multiple mafic sills. Dating of a felsic gneiss showed it to probably be a Neoarchaean rock which underwent Palaeoproterozoic metamorphism during the Usagaran event at ca. 1930 Ma. This date likely represents initial juxtaposition of the (Archaean) Mpwapwa Group against the Tanzania Craton. Consequently the Group are not considered to be stratigraphic correlates of the Usagaran Konse Group or Isimani Suite seen further south, but rather form part of the Neoarchaean crust of the "Western Granulite" terrane of the East African Orogen. The Mpwapwa Group was intruded by weakly foliated biotite granite at 1873 ± 31 Ma. Zircons in the granite have metamorphic rims dated between 550 and 650 Ma that grew during the East African orogenic event.

Distinctive para- and orthogneisses, including charnockite dated at 2707 ± 21 Ma, outcrop in the southern part of the area. A sliver of southern tonalitic orthogneiss, entrained in the craton margin shear zone, is an igneous rock of probable early Palaeoproterozoic or Archaean age (>ca. 2300 Ma) with a strong metamorphic overprint at ca. 1960 Ma (zircon), confirmed by a metamorphic titanite age of ca. 1990 Ma, again believed to date the initial phase of craton-margin shearing and juxtaposition of the Archaean crustal blocks. The role of the Neoproterozoic East African orogeny in the evolution of the craton margin is unclear, but the geometry of the shear zone, the presence of Neoproterozoic zircon rims in the Palaeoproterozoic granite and published studies from nearby, all suggest that the latest movements on the shear zone may be Neoproterozoic in age and that the structure may represent the local western front of the East African Orogeny.

1. Introduction

The relationships between the Archaean Tanzania Craton in Central East Africa and its surrounding Proterozoic mobile belts have attracted considerable interest since the late 1950s, but many questions remain unanswered. The south-western to south-eastern margins of the craton are wrapped around by the accreted Palaeoproterozoic Ubendian-Usagaran orogenic belt system (Fig. 1). The eastern margin of the Usagaran belt was, in turn, intensely reworked during the Neoproterozoic "Pan-African" East African Orogeny (EAO; Stern, 1994), such that the precise northerly extent of the Usagaran belt along the eastern margin of the craton has been

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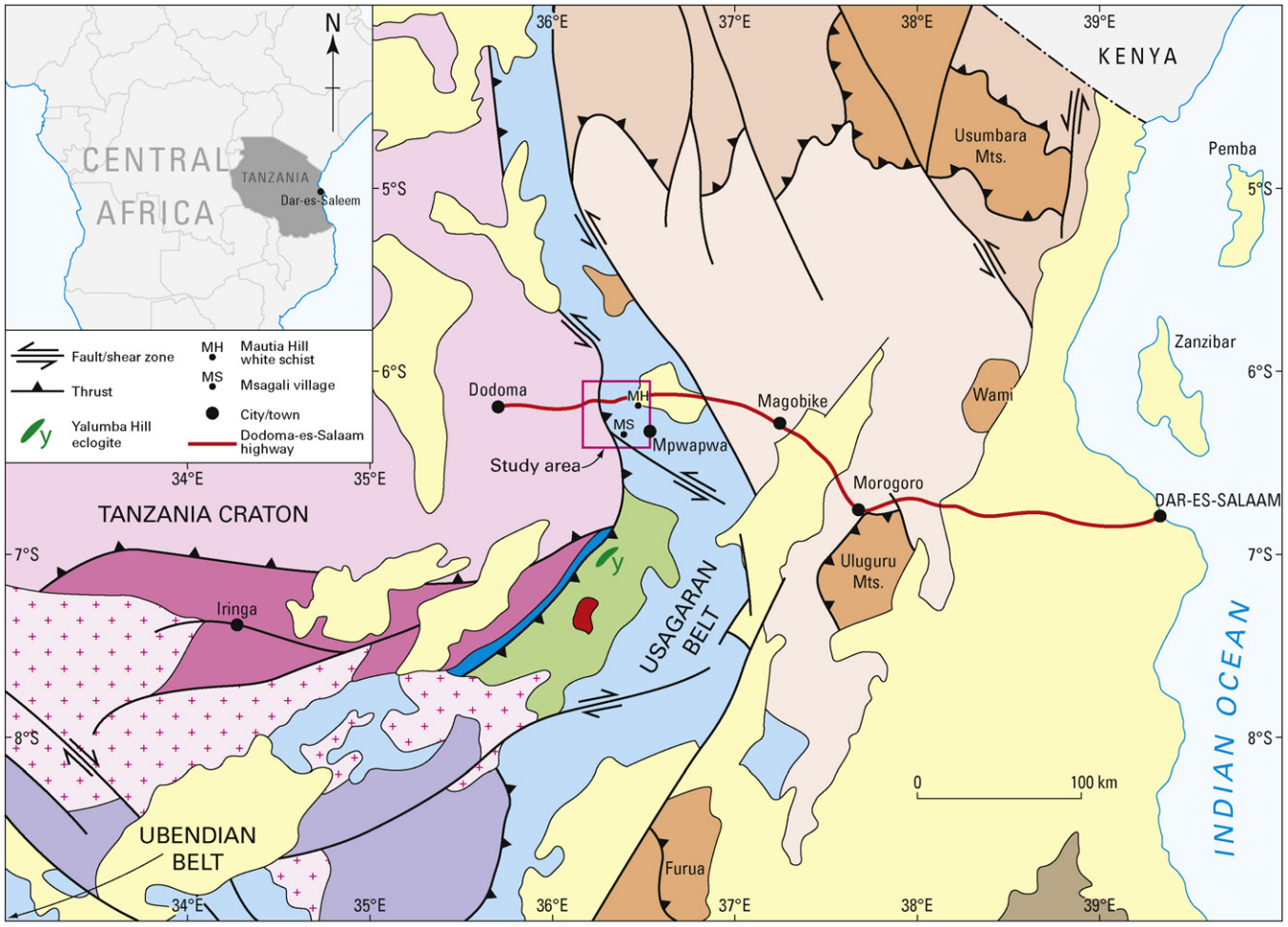

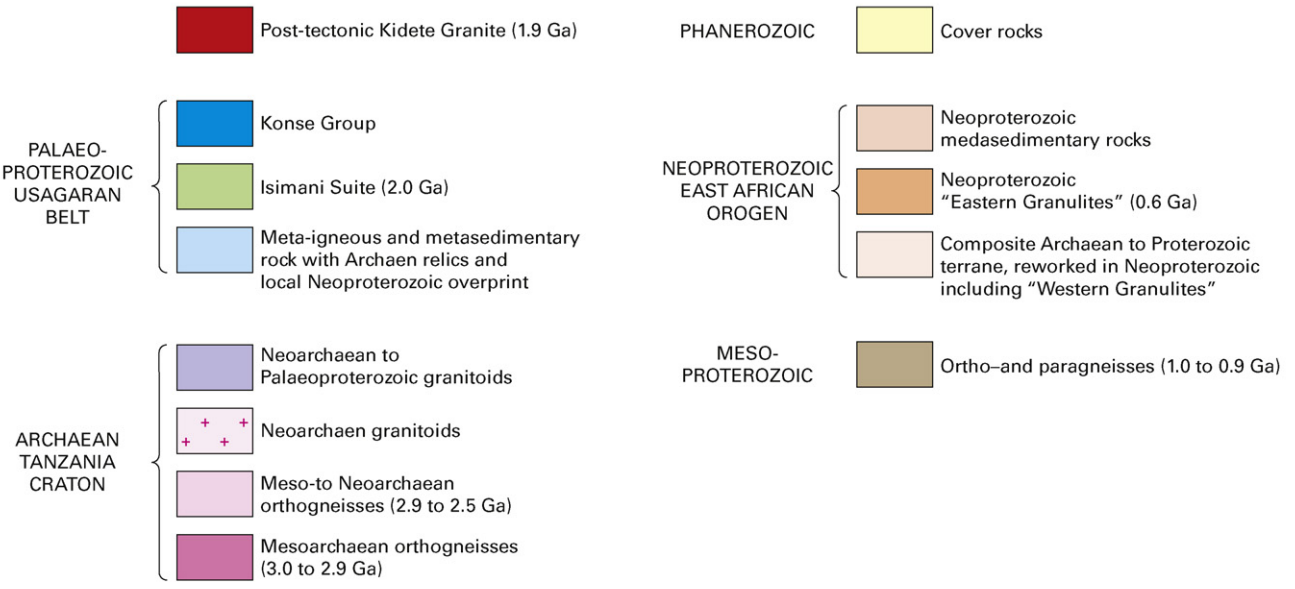

Fig. 1. Regional geological setting of central-eastern Tanzania, following the compilation of Pinna et al. (2004), with the study area shown.

shown in different positions by various researchers. Similarly, the location of the western margin of the EAO has been shown in various positions by various authors and the age of the poly-deformed rocks involved has been shown to be highly complex.

In none of the previous studies has detailed fieldwork along the putative eastern craton boundary been conducted, an omission that this study seeks to redress. Fig. 1 shows the location of the study area, some 60 km east of Dodoma, central Tanzania, along with the broad geological units. The main questions that this study sought to answer were:

(1) Where is the eastern margin of the Tanzania Craton?