Journal of African Earth Sciences 97 (2014) 87–98

Contents lists available at ScienceDirect

Journal of African Earth Sciences

journal homepage: www.elsevier.com/locate/jafrearsci

Tectonic wedging, back-thrusting and basin development in the frontal parts of the Mesoproterozoic Karagwe-Ankole belt in NW Tanzania

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ARTICLE INFO

Article history:
Received 28 January 2014
Received in revised form 22 April 2014
Accepted 23 April 2014
Available online 9 May 2014

Keywords:
Karagwe-Ankole belt
Muyaga Group
Bukoban Group
Structural analysis
Thick skinned thrusting
Mesoproterozoic foreland basin development

ABSTRACT

Structural complexities in the Mesoproterozoic Karagwe-Ankole fold belt in northwest Tanzania have led to conflicting interpretations of regional kinematics and the geodynamic significance of the belt. Structural mapping of an eastern portion of the belt indicates that the regional-scale (>100 km) Mugera-Nyakahura basement inlier may be considered a forethrusted tectonic wedge. Tectonic wedging in the frontal parts of the belt occurred during top-to-the southeast thick-skinned thrusting of the gneissic Archaean basement. The diagnostic feature of tectonic wedging is the reversal of vergence directions of kinematic fabrics on either side of the basement wedge, resulting in hinterland-directed, top-to-the northwest kinematics in front and on top of the wedge. Strain is localised into the often graphitic metapelitic rocks of the Upper Muyaga Group. The mainly coarse-grained clastic Mesoproterozoic sediments of the Bukoba Group represent the foreland, molasse-type deposits of the Karagwe-Ankole fold belt. The only gently folded Bukoba Group is separated from the underthrusted, highly deformed Muyaga Group by a passive roof thrust. This corresponds to the regional-scale asymmetry of the synclinal structure of the Bukoba basin in the frontal parts of the belt. The gentle folding is the result of the underthrusting and lifting of the Bukoba sediments above the basement wedge creating a triangle zone. The kinematics and geometry of the frontal parts of the Karagwe-Ankole belt described here confirm the belt to represent a top-to-the-east and -southeast verging foreland fold-and-thrust belt. The actual timing of deformation is, at present, unknown, but regional-scale kinematics and the metamorphic zonation are compatible with an origin of the belt during convergence between the Congo and Tanzania Cratons in the west.

1. Introduction

South-Central Africa is transected by a system of Meso- to Neoproterozoic (1.4–1.0 Ga) orogenic belts, collectively referred to as the Kibara orogenic system (Cahen et al., 1984) (Fig. 1a). These belts record the amalgamation of the Archaean Congo, Kalahari and Tanzania Cratons and smaller continental fragments to form part of the supercontinent Rodinia by ca. 1.0 Ga (Fernandez-Alonso et al., 2012, and references therein). The "Kibaran knot" (De Waele et al., 2003) of orogenic belts in Central Africa is far from being untied and the overall geodynamic settings and correlation between belts are still controversial (e.g. Tack et al., 2010 and references therein). There are currently two main schools of thought to explain the geological evolution of Kibara (sensu lato) belts. More conventional models interpret Kibara-age belts to document basin formation in the Mesoproterozoic, followed by the prolonged subduction and convergence and associated arc formation, episodic accretion and eventual collision of cratonic blocks in the late Mesoproterozoic (Kokonyangi et al., 2006, 2007; Johnson and Oliver, 2000). However, numerous recent studies emphasise similarities of sedimentary basins on adjacent cratons and the evidently limited displacement between them (De Waele et al., 2008; Tack et al., 2010; Fernandez-Alonso et al., 2012). These models suggest rather intracratonic processes and basin formation is envisaged to have occurred during episodic crustal extension of pre-existing Paleoproterozoic crust, driven by and associated with voluminous mafic under- and intraplating and spatially and temporally related granite plutonism between ca. 1.8 and 1.3 Ga (Tack et al., 2010; Fernandez-Alonso et al., 2012). The deformation of these basins is attributed to later orogenic episodes and far-field stresses unrelated to earlier basin formation. Most of these tectonic models rely mainly on geochronological and geochemical data. In contrast, detailed structural data that could constrain actual kinematics for individual belts are limited and our understanding of spatial and kinematic relationships relies, in many parts, on regional reconnaissance mapping or remote sensing data (e.g. Fernandez-Alonso and Theunissen, 1998).

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http://dx.doi.org/10.1016/j.jafrearsci.2014.04.018
1464-343X/