Journal of African Earth Sciences 56 (2010) 83–94

Contents lists available at ScienceDirect

Journal of African Earth Sciences

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

Succession of structural events in the Goren greenstone belt (Burkina Faso): Implications for West African tectonics

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ARTICLE INFO

Article history:
Received 27 December 2008
Received in revised form 15 May 2009
Accepted 9 June 2009
Available online 14 June 2009

Keywords:
West African craton
Birimian
Tectonics
Structure
Burkina Faso

ABSTRACT

Ten years after field investigations in the SE Goren greenstone belt (GGB) of Burkina Faso by the Sanmatenga J.V., sponsored field studies conducted in 2007 have significantly enhanced structural datasets. The studies in 2007 were conducted across an expanded area of the GGB that included both southwestern and northeastern domains, and portions of the Pissila batholith to the west of the GGB. A revision of tectonic models proposed by Hein et al. [Hein, K.A.A., Morel, V., Kagoné, O., Kiemde, F., Mayes, K., 2004. Birimian lithological succession and structural evolution in the Goren Segment of the Boromo-Goren Greenstone Belt, Burkina Faso. Journal of African Earth Sciences 39, 1–23] is now possible.

Three deformation events characterise the Goren greenstone belt. The deformation, D1 (previously D3) resulted in the formation of NW to NNW-trending steeply-dipping dextral-reverse shear zones folds and a penetrative S1-C schistosity that formed during a period of NE–SW shortening. The event is termed the Tangaean Event because it can be correlated across NE Burkina Faso in the Boromo, Bouroum, Yalago and Oudalan-Gorouol greenstone belts.

The deformation, D2 (previously D2) resulted in the progressive development of NNE to NE-trending macroscopic to mesoscopic folds and a penetrative axial planar cleavage (S2), which was followed by the formation of dextral- and sinistral-reverse shears and a pervasive schistosity (S2-C). The first-order crustal-scale Sabce Shear Zone, which traverses the northern portion of the study area, is associated with macroscopic anticlockwise drag rotation of NW to NNW-trending D1 shears and folds: (the macroscopic fold was previously classified as D1). D2 in the GGB corresponds with the Eburnean Orogeny at 2130–1980 Ma, as described by [Feybesse, J.-L., Billa, M., Guerrot, C., Duguey, E., Lescuyer, J.-L, Milesi, J.-P., Bouchot, V., 2006, The paleoproterozoic Ghanian province: geodynamic model and ore controls, including regional stress modelling. Precambrian Research, 149–196].

The deformation D3 (previously D4) is recognised throughout the GGB. It is characterised by the formation of kinks and chevron folds (F3), or crenulation cleavage (S3) that are hosted by narrow WNW-trending shear zones. These formed during a period of north–south shortening termed the Wabo-Tampelse Event that post-dates the Eburnean Orogeny.

1. Introduction

The NW-trending Goren Greenstone Belt (GGB) of Burkina Faso (Fig. 1) can be divided into two domains when the overall trend of stratigraphic units and major structures is considered (Hein et al., 2004): a southwestern domain where the dominant trend is northeast and an northeastern domain where the dominant trend is northwest to north–northwest. The boundary between the domains coincides with a NW-trending geophysical lineament that is interpreted to be a steeply dipping shear zone, termed the Sanmatenga Shear Zone (Fig. 2).

During July–November 1997, field studies in the GGB by Hein et al. (2004) for the Sanmatenga Joint Venture characterised the stratigraphic succession, intrusive rocks and relative chronology of structural events for (principally) the southwestern domain of the greenstone belt. The study concluded that the Sanmatenga district comprises a conformable succession of meta-sedimentary rocks that are interbedded with volcanic deposits (pillowed basalt-andesite, dacite, volcanic breccias and tuffs). These supracrustal rocks were intruded by gabbro-diorite-pyroxenite bodies, and granodiorite–tonalite and granite plutons. They were deformed during (tentatively) four phases of deformation including: D1 – formation of a gently NW-plunging macroscopic anticline (F1); D2 – development of NE-trending shear zones (sinistral-reverse) and folds (F2), and NW-trending (dextral) strike-slip faults; D3 – formation of a series of NW to NNW-trending thrusts and northerly-plunging mesoscopic folds (F3); D4 – formation of the Wabo-Tampelse Shear Zone (corrected spelling from Wabi-Tampelse Shear Zone). D2 deformation was interpreted as concomitant

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1464-343X/$ - see front matter © 2009 Published by Elsevier Ltd.
doi:10.1016/j.jafrearsci.2009.06.002

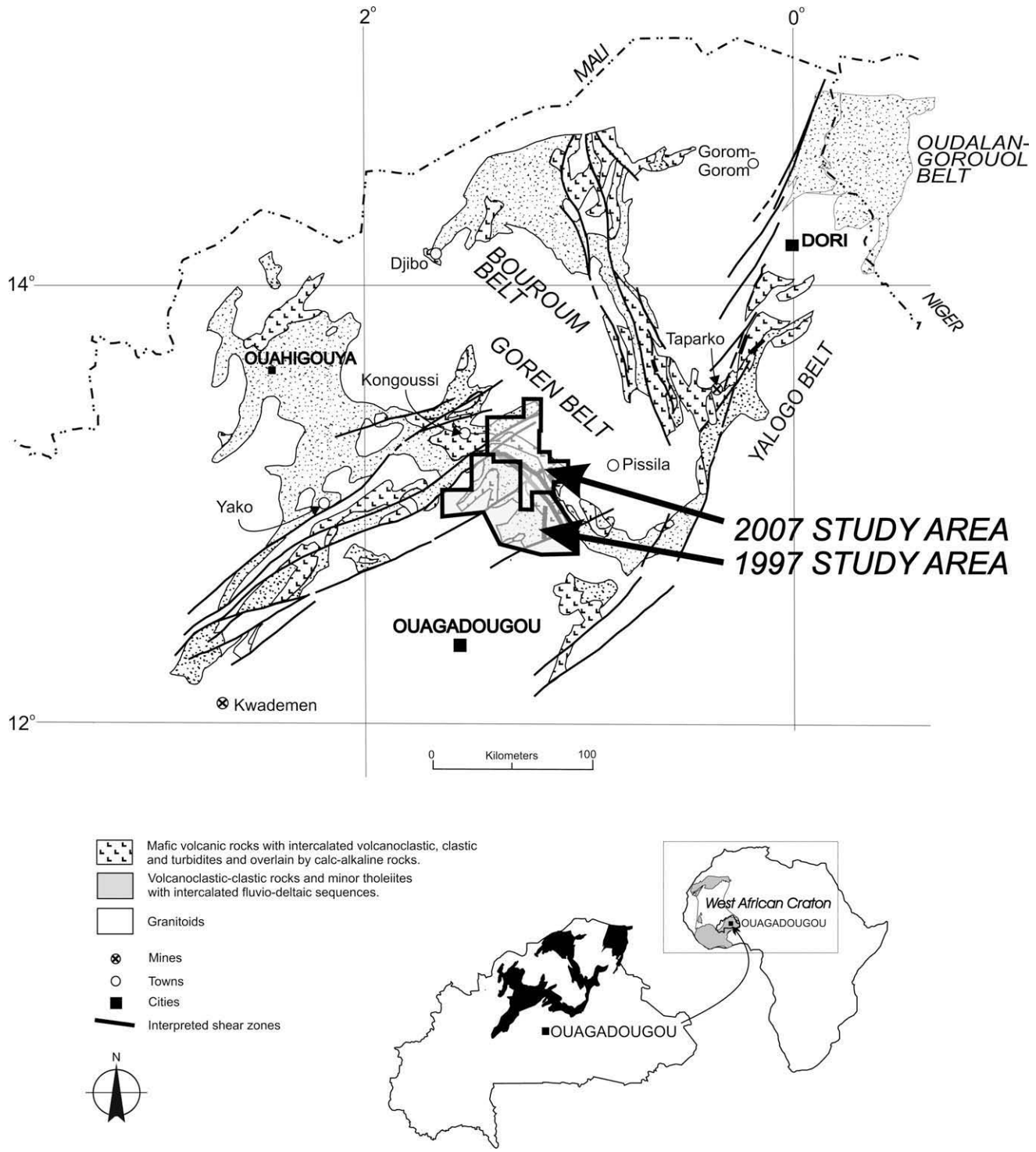

Fig. 1. Schematic location map of the Boromo, Goren, Bouroum, Yalogo and Oudalan-Gorouol greenstone belts in Burkina Faso and Niger. The Sanmatenga JV permit boundary of 1997 and Riverstone Resources Inc. permit in 2007 are situated approximately 75 km NE of the city of Ouagadougou. Modified after Feybesse et al. (1990).

to emplacement of granodiorite–tonalite and granite plutons and was correlated with the Eburnean Orogeny at 2100–2000 Ma (Milési et al., 1991, 1992; Ledru et al., 1991).

In 2007, 10 years after initial mapping by the Sanmatenga Joint Venture, the supracrustal rocks of the GGB once again became the focus of research which was conducted between the town of Korsimoro in the southeast and Tangapella Hill in the north (Fig. 2a). The result was a marked improvement in regional datasets and tectonic interpretations for the GGB. A new tectonic model is consequently proposed in revision of Hein et al. (2004) which better correlates structural data from the GGB with studies by Ouedraogo and Prost (1986), Ama Salah et al. (1996), Bourges et al. (1998), Feybesse et al. (1990), Lompo et al. (1991), Cheilletz et al. (1994), Pons et al. (1995), and Tshibubudze et al. (2009) from the Boromo, Yalago, Bouroum and Oudalan-Gorouol greenstone belts. These are summarised in Tables 1 and 2.