Tectonic setting and Pan-African structural evolution of the western Saldania Belt, South Africa

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Abstract

The western Saldania Belt records the closure of the Adamastor Ocean and amalgamation of southwest Gondwana in the latest Neoproterozoic and early Phanerozoic, but the geodynamic setting and evolution of the belt remains controversial. Regional mapping and the integration of structural data presented in this paper document the juxtaposition of domains with distinct fabric development and kinematics. Structures record Pan-African strains and a strike-slip dominated sinistral transpression during southeast-directed subduction and convergence at low angles to the continental margin. Two main, structurally overlying domains – an upper and a lower domain – can be distinguished. Rocks of the upper domain record the partitioning of the transpressional strain into (1) broad regions of more or less upright, north to northwesterly-trending folds (F_2) that record horizontal, mainly coaxial, east-northeast to west-southwest directed shortening at high angles to the continental margin, and (2) the northwesterly-trending, sinistral strike-slip Colenso Fault Zone that accommodates the margin-parallel, non-coaxial component of deformation between *ca*. 555 and 520 Ma. The strike-slip partitioning was promoted by strain localisation into synkinematic plutons of the Cape Granite Suite. In contrast, rocks in the pervasively transposed, mélange-like lower domain in the central Swartland region record episodes of vertical, coaxial shortening alternating with non-coaxial top-to-the-west and -northwest thrusting. The coaxial shortening strains relate to the thickening and gravitational loading of the succession in response to thrusting and tectonic underplating. Non-coaxial strains denote episodes of seismic slip during underthrusting.

The different fabric domains are interpreted to represent a section through a fore-arc region, from the deeper level accretionary prism (lower domain) to the overlying, folded fore-arc basin succession (upper domain). Regional-scale klippen structures indicate the transfer of lower-domain phyllites into the overlying fore-arc sequence. The proposed fore-arc setting of the Saldania Belt suggests the subduction of the Adamastor Ocean below the leading edge of the Kalahari Craton. This challenges stratigraphic and structural correlations between the Saldania Belt and the Gariep Belt to the immediate north.

Introduction

The western branch of the Saldania Belt in South Africa forms the southernmost extension of the system of Pan-African and Brasiliano belts in southern Africa and South America that accommodated the amalgamation of southwest Gondwana in the latest Neoproterozoic and early Phanerozoic (Almeida et al., 1973; Porada, 1979, 1989; Torquato and Cordani, 1981; Hartnady et al., 1985; Basei et al., 2000, 2018; Caby 2003; Cordani et al., 2013; D'Agrela-Filho and Cordani, 2017; Konopásek et al., 2020). On the African side, the chronology and kinematic evolution of Pan-African events are well documented in the northern Kaoko and Gariep belts (Hartnady et al, 1985; Gresse, 1994; Gresse et al., 2006; Frimmel, 1995, 2000, 2018; Frimmel et al., 1996, 2002, 2011; Goscombe et al., 2003, 2005a, 2005b; Goscombe and Gray, 2007, 2008; Frimmel and Fölling, 2004; Konopásek et al., 2005, 2014). The belts record the southeast-directed accretion of terranes onto the cratonic margins along major thrusts and/or steep transpressional shear zones (Von Veh, 1993; Gresse, 1994; Hälbich and Alchin, 1995; Goscombe et al., 2005a; Konopásek