



# Diachronism in the late Neoproterozoic–Cambrian arc-rift transition of North Gondwana: A comparison of Morocco and the Iberian Ossa-Morena Zone



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## ABSTRACT

In the northwestern border of the West African craton (North Gondwana), a transition from late Neoproterozoic subduction/collision to Cambrian rift processes was recorded in the Anti-Atlas (Morocco) and in the Ossa-Morena Zone (Iberia). Cambrian rifting affected both Pan-African and Cadomian basements in a stepwise and diachronous way. Subsequently, both areas evolved into a syn-rift margin episodically punctuated by uplift and tilting that precluded Furongian sedimentation. A comparison of sedimentary, volcanic and geodynamic evolution is made in the late Neoproterozoic (Pan-African and Cadomian) belts and Cambrian rifts trying to solve the apparent diachronous (SW–NE-trending) propagation of an early Palaeozoic rifting regime that finally led to the opening of the Rheic Ocean.

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## 1. Introduction

The geodynamic evolution of southern Europe (North Gondwana) during Ediacaran–Cambrian times is a subject that has received much attention in the last decade (Sánchez-García et al., 2003, 2008a; Linnemann et al., 2004, 2008; Pereira et al., 2006, 2008, 2011, 2012a; Nance et al., 2008; Abati et al., 2010; Díez-Fernández et al., 2010; Droste et al., 2011; Avigad et al., 2012; Meinhold et al., 2012). As the Ediacaran–Cambrian rocks are spread out over different regions of North Africa and Europe, it is essential to develop stratigraphic correlation studies to improve the knowledge of the whole evolution of North Gondwana.

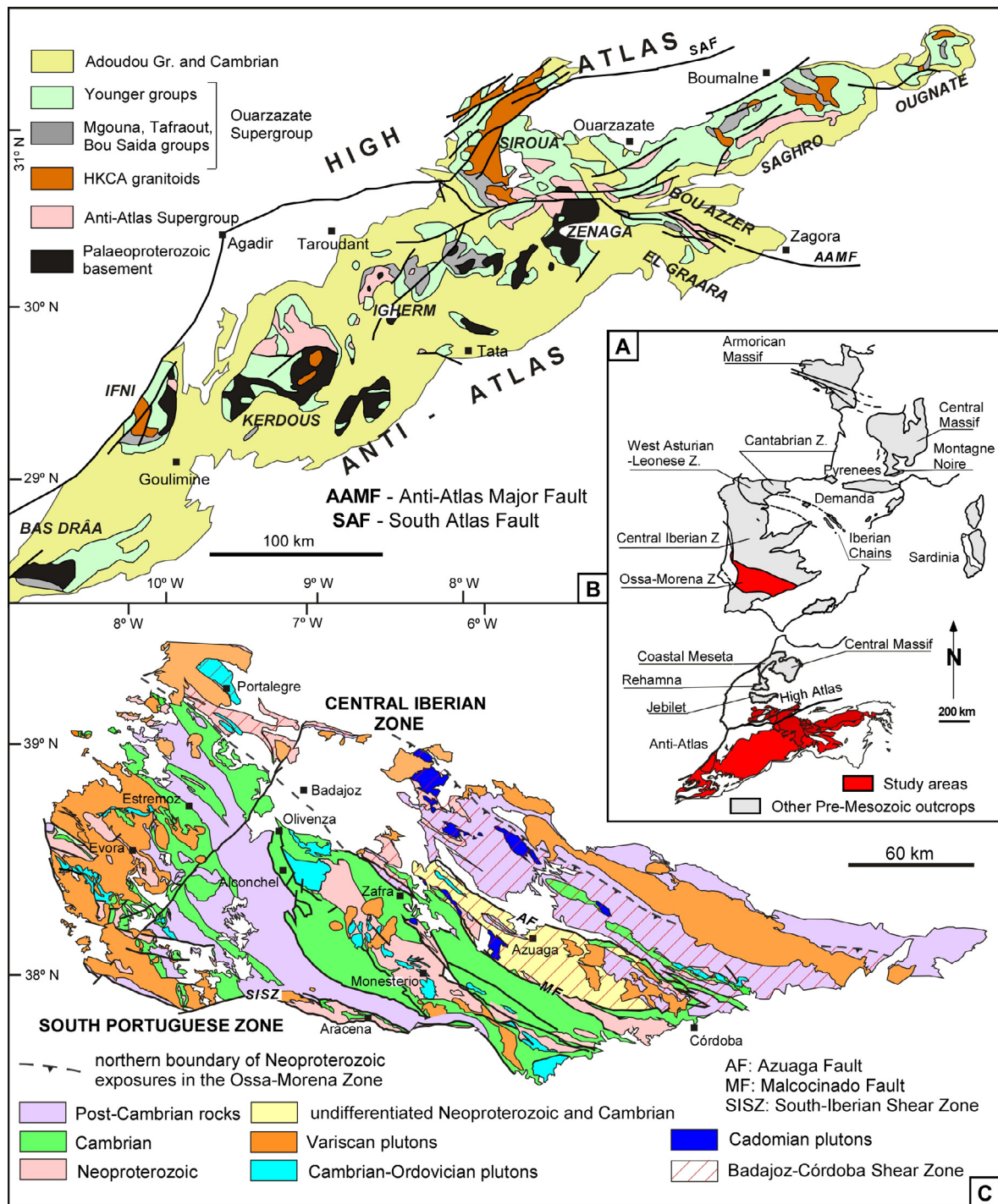
During the late Neoproterozoic, North Gondwana included distinct tectonically active regions (Kröner and Stern, 2005): a more peripheral region, facing the ocean (Cadomian belt), and inner regions fringing the cratons (Trans-Saharan belt and East African orogen). In North Africa, the Trans-Saharan belt would have been

an important mountain belt (Transgondwanan Supermountain; Squire et al., 2006) that resulted from the collision of the West African craton with the Saharan Metacraton evolving the Anti-Atlas (Pan-African belt; Kröner and Stern, 2005). The Trans-Saharan belt consists of a pre-Neoproterozoic basement and Neoproterozoic ophiolites tectonically reworked during the Cryogenian and Ediacaran (Liégeois et al., 2003; Kröner and Stern, 2005). In Morocco, the Anti-Atlas has a stratigraphy characterized by a Palaeoproterozoic basement representative of the northern domains of the West African craton (WAC) (c. 2.2–2 Ga; Reguibat shield; Thomas et al., 2002), subsequently covered by Neoproterozoic volcanosedimentary strata (Thomas et al., 2004; Gasquet et al., 2008; Abati et al., 2010) (Fig. 1). Their involved Cadomian and Pan-African zircon-forming events are sometimes difficult to distinguish because they overlap in time and locally in space (Murphy and Nance, 1991; Nance and Murphy, 1994).

In Europe, the Cadomian belt (Iberia, Cadomia and Bohemia) resulted from the amalgamation process of magmatic arcs and synorogenic basins (peri-Gondwanan terranes; Murphy and Nance, 1991; Nance and Murphy, 1994; Linnemann et al., 2004, 2008; Nance et al., 2008). The Cadomian belt includes a pre-Neoproterozoic basement (Icartian gneiss, 2.1 Ga; Samson and D'Lemos, 1999; Inglis et al., 2004), Cryogenian magmatism (c. 755–745 Ma; orthogneisses from the Penthièvre Complex; Nagy et al., 2002)

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**Fig. 1.** (A) Geological sketch map of the main Pan-African and Variscan tectonostratigraphic units of the western Mediterranean region. (B) Moroccan High Atlas and Anti-Atlas; modified from Gasquet et al. (2008). (C) Ossa-Morena Zone; adapted from Gonçalves and Fernandes (1973), Gonçalves et al. (1975, 1978), Oliveira (1984, 1992), Pereira and Silva (2002) and the Geological map compilation of the Ossa-Morena Zone in Spain (Quesada and Sánchez-García, 2002); setting of Badajoz-Córdoba Shear Zone after Quesada and Dallmeyer (1994).

and Ediacaran sedimentary basins and coeval magmatism reworked by later deformation and metamorphism (Chantraine et al., 2001; Linnemann et al., 2007, 2014; Nance et al., 2008). In Iberia, the oldest rocks of the Ossa-Morena, Central Iberian, West Asturian-Leonese and Cantabrian zones are Ediacaran in age (Fig. 1).

This review work tries to provide an updated overview following up previous comparisons of Ediacaran–Cambrian stratigraphic records between the Anti-Atlas and the Ossa-Morena Zone (Tahiri

et al., 2005; Pereira et al., 2006; Álvaro et al., 2013a). It is intended to better understand the temporal and spatial relations between: (1) the Cadomian and Pan-African belts formed in North Gondwana as a result of peripheral and internal processes of subduction/collision; and (2) the various rifted segments that controlled the Cambrian North Gondwanan breakup. Because there is uncertainty regarding the meaning of some units of the Ediacaran–Cambrian record observed in these two regions, it is of interest to discuss the following points: (1) the significance of the

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