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Pan-African deformation markers in the migmatitic complexes of Parakou–Nikki (Northeast Benin)

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ABSTRACT

The analysis of structural markers collected from the petrostrutural units of Parakou-Nikki, in Northeast Benin, indicates that the Pan-African remobilization or rejuvenation (600 ± 50 Ma) of the Benino-Nigerian Metacraton consits of a wide migmatization accompanied by five tectogenetic phases (Dn –Dn+4). The Dn phase is penecontemporaneous with the collision between the Benino-Nigerian shield and the oriental margin of the West-African Craton. This phase is associated with the granulitization or migmatization episode, and materialized by the Sn foliation on which the Dn+1 deformation markers (major Pan-African structuring phase in the Dahomeyide orogenic belt) are superimposed. Thus, the Sn+1 plane and the Ln+1 lineations indicate a perfect transposition of the Sn plane and a syn-Dn paragenesis remobilization in the syn-Dn+1 amphibolite facies retromorphosis. The strong resumption of the main foliation (Sn+1) corresponds to the Dn+2 deformation phase. The latter, associated with a second retromorphosis, is materialized by Pn+2 folds, with submeridian to NE–SW axes, and by a Sn+2 foliation or strain-slip cleavage. It is also the phase of emplacement of the Kandi mega-shear zone associated with the development of Cn+2 dextral shear plane very generalized over all the petrostructural units of Parakou–Nikki. At a large scale, the Dn+3 phase is expressed as Pn+3 kilometric synform and antiform structures with NE–SW to ENE–WSW trending axes. This Dn+3 phase can be considered as a transpression responsible for the development of the Cn+3 sinistral shear plane and flat shear structures displaying a westward overlapping. It ends with a fracturing episode materialized by strike-slip fault systems defining a main stress σ1 trending ESE–WNW to SE–NW. The late Dn+4 phase only corresponds to conjugated strike-slip faults which resulted from a major SE–NW to SSE–NNW compression.

1. Introduction

The present paper synthesizes the data analysis of the Pan-African tectogenesis markers in the petrostructural complexes of the Parakou–Nikki region, Northeast Benin (Fig. 1). This synthesis takes place within the framework of the research on the remobilization or rejuvenation tracers in the Benino-Nigerian shield (2000 ± 200 Ma) during the edification of the Dahomeyide Orogen (600 ± 50 Ma).

The Parakou–Nikki region belongs to the internal zone of the Pan-African Dahomeyide Orogenic Belt (Affaton et al., 1978, 1991). It is made up of various migmatitic and granitic complexes that form the Benino-Nigerian Metacraton. This is almost unknown petrologically, geochronologically and structurally, and its mining or hydrogeologic potentials are not yet evaluated. The metacratonic portion of Parakou–Nikki region is characterized by NNE-SSW structural trends on the western side and NE–SW to ENE–WSW trends on the major eastern part (Fig. 2). These NE–SW to

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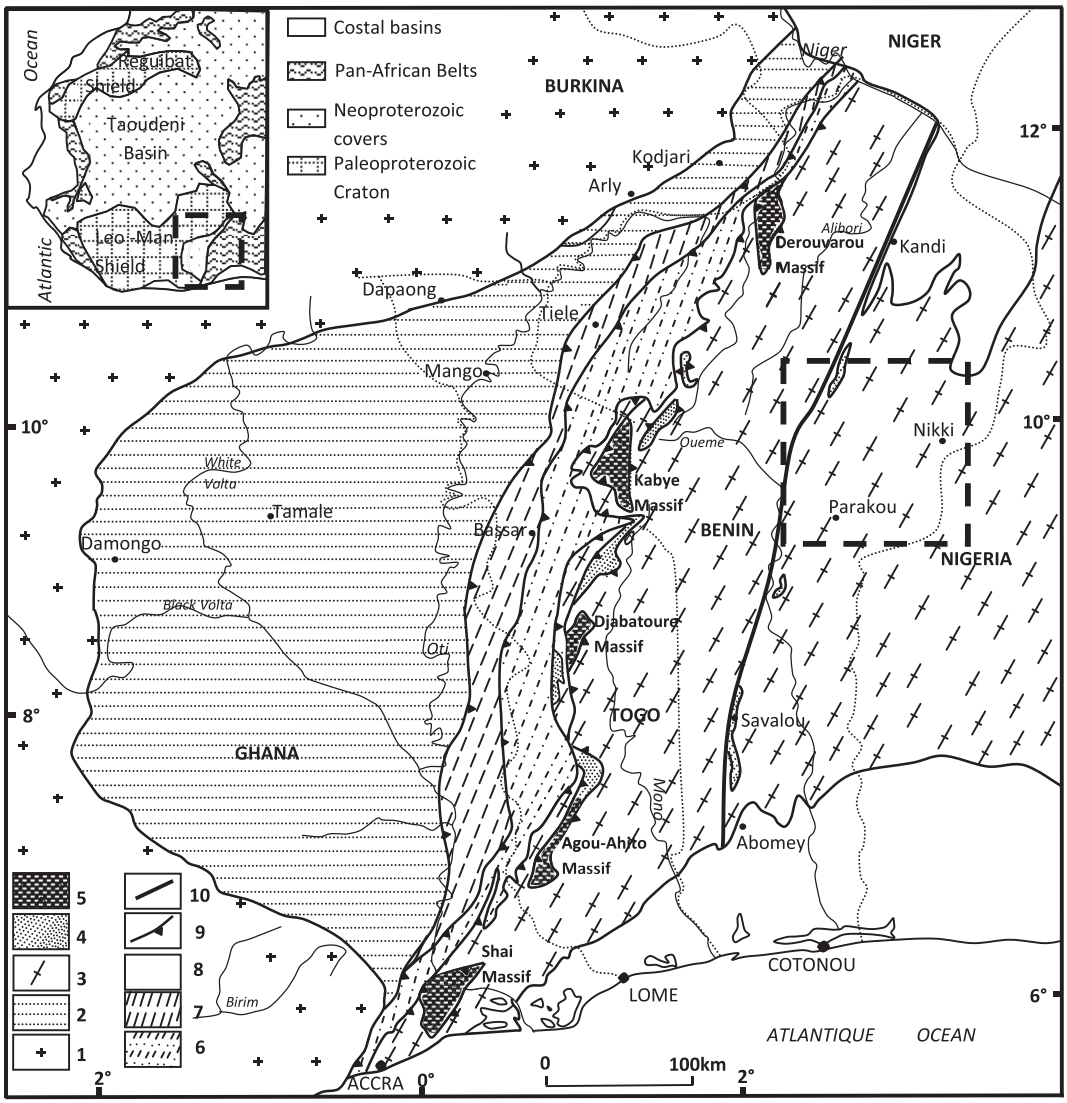

Fig. 1. Geological context including the Parakou-Nikki region. 1 = Eburnean basement of the Leo-Man shield; 2 = Neoproterozoic cover of the Volta Basin; 3 = Internal and external gneisso-migmatitic units; 4 = Kyanite-bearing micaceous quartzites; 5 = Basic and ultrabasic massifs of the suture zone; 6 = Atacora structural unit; 7 = Buem structural unit = Paleozoic to Cenozoic cover of the Kandi and Guinea Gulf basins; 9 = Thrusting contact; 10 = Kandi Shear Zone.

ENE–WSW structural trends are not in conformity with the submeridian trends of the western units of the Dahomeyide orogen or the entire Pan-African orogen in Benin and Nigeria. Such an observation led Affaton et al. (1978) to consider the whole eastern migmatitic domain as a possible Archean (Liberian) core (>2700 Ma). For Kalsbeek et al. (2012), the oldest rocks in the Parakou-Nikki region only date back to the Paleoproterozoic: they would have undergone the Eburnean orogenesis (2000 ± 200 Ma) before being rejuvenated/remobilized and intruded by several generations of granitoids during the Pan-African events.

Our recent investigations in the Parakou-Nikki region enabled us to notice numerous structural elements whose analysis led to understand the evolution of the Pan-African tectogenesis recorded by the studied petrostructural suites. This structural characterization defines markers of different phases of the petrostructural evolution during the edification of the Pan-African Dahomeyide Orogen.

2. Geological setting

The Pan-African Dahomeyide Belt corresponds to the southern segment of the transaharan orogen (Fig. 1). It represents the outcome of a long process of convergence resulting in the collision between the Benino-Nigerian plate or shield and the south-oriental margin of the West-African Craton, at the end of the Neoproterozoic (Caby, 1989; Affaton, 1990; Affaton et al., 1991). This Dahomeyide Belt is thrusted toward the West, on the Volta Basin and even directly on the West-African Craton in Accra sector, Ghana. It is composed of three lithostructural zones: a suture zone materialized by the submeridian basic and ultrabasic massifs tectonically overlying a western external zone and underlying an eastern internal zone (Fig. 1).

The external zone units of the Dahomeyide orogen are structured in nappe or slice piles overthrusted westward on the Volta Basin (Simpara et al., 1985; Affaton et al., 1991; Tairou et al., 2012a).