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Zircon $^{207}Pb/^{206}Pb$ evaporation ages of Panafrican metasedimentary rocks in the Kombé-II area (Bafia Group, Cameroon): Constraints on protolith age and provenance

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Abstract

The Kombé-II area belongs to the southern part of the Cameroonian Panafrican belt. It is made up of different gneisses, amphibolites and quartzites of the Bafia Group. This volcano-sedimentary rock sequence became polyphasely deformed and metamorphosed during the Panafrican orogeny. It was thrust in SSW-ward direction, parallel to the L2 stretching lineation, over the Congo Craton.

Zircon morphology and $^{207}Pb/^{206}Pb$ evaporation ages (2289–2351 Ma) show that the gneissic metasediments contain detritus of Paleoproterozoic plutonic rocks. In addition to existing data, our zircon ages and Nd model ages (generally in the range of 2.4–3.4 Ga) indicate that the sedimentary sequence derived from material which was added to the crust between the Archean and the Mesoproterozoic era. A garnet-amphibole paragneiss, however, has a Nd model age of 1.5 Ga demonstrating the contribution of younger mafic material in the sediment source. Our results strengthen earlier suggestions that NE Brazil and Central Africa followed the same evolution during the Proterozoic.

Keywords: Zircon evaporation age; Nd model age; Proterozoic; Panafrican orogeny; Central African fold belt; Cameroon

1. Introduction and geological setting

The Panafrican formations in Cameroon belong to a fold belt known as central African fold belt, CAFB (Penaye et al., 1993; Toteu et al., 2001) or Panafrican North-Equatorial fold belt (Nzenti et al., 1988). The CAFB is a part of the Gondwana-wide Panafrican orogenic system, which comprises the Trans-Saharan fold belt to the west (Cahen et al., 1984; Black, 1985) and the Borborema province of north-eastern Brazil, which is part of the Braziliano Belt (Almeida et al., 1981; Santos and Brito Neves, 1984).

Recent studies discribed remnants of Paleoproterozoic basement rocks within the CAFB (Penaye et al., 1989); based on the distribution of these rocks, the Neoproterozoic Braziliano-Panafrican fold belt was divided into two domains (Castaing et al., 1993; Van Schmus et al., 1995; Toteu et al., 2001): in one domain reworked Paleoproterozoic basement is present, and in the other it is absent or only present as small isolated blocks. Penaye et al. (2004) interpreted the remnants of Paleoproterozoic basement of the western CAFB as a result of Eburnean (2.1–2.0 Ga) collision between the Congo Craton and the São Francisco Craton. In the Bafia region of Cameroon, a Paleoproterozoic age could only be demonstrated for the Makenene orthogneiss (Toteu et al., 2001; Nzolang, 2005) and for

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garnet-amphibolite and biotite-amphibole gneiss in the Tonga area to the W of Makenene (Tanko Njiosseu et al., 2005a). However, in the Tonga area, Toteu and Penaye (2005) obtained different results, although they used the same data and diagrams. Therefore Tanko Njiosseu et al. (2005b) dismissed this Paleoproterozoic age and stated that the Eburnean event remains to be precisely dated in the Tonga area.

The Kombé-II area belongs to the Bafia Group in the southern part of the CAFB. The Bafia Group as defined by Noizet (1982) contains older basement, and as a tectonic unit was overthrust towards the south above the Yaoundé Group. The Yaoundé Group is made up of Pan-African metasedimentary units which in turn were thrust in SSW-ward direction onto the Congo Craton (Ball et al., 1984; Nédélec et al., 1986; Toteu et al., 1994). The existence of older basement in the Bafia Group has been proven by the presence of granulite facies assemblages retrogressed during the Pan-African nappe tectonics (Tchakounté, 1999), and a ca. 2.1-Ga zircon age recorded from the Makenene gneiss, west of Bafia (Toteu et al., 2001).

The Kombé-II region (Fig. 1) is made up of gneisses of various compositions (garnet-biotite gneiss, garnet-amphibole gneiss, biotite-muscovite gneiss), quartzites, and amphibolites. The latter form boudins or continuous bands within the gneisses (Ngnotué, 1997; Ganwa, 1998; Tchakounté, 1999; Tchakounté Numbem et al., 2007). This rock sequence is intruded by Panafrican plutonic rocks, e.g., the Ngaa Mbappé monzodiorite or the Bantoum granitoids (Nzolang et al., 2003).

U/Pb and Sm/Nd data to the west of Bafia enabled Tchakounté Numbem et al. (2007) to characterize the protoliths of the gneisses (and quartzites) as a Neoproterozoic metasedimentary sequence. The source rocks of the detrital material derived from Paleoproterozoic to Archean terrains and from 1.6 Ga old granitoids.

Three deformation phases were identified in the CAFB. The first phase, D1, is responsible for the S1 foliation, which was transposed by the second deformation phase (D2). D2 is responsible for the formation of map-scale folds, shear planes and the L2 stretching lineation, which indicates SSW-ward thrusting onto the Congo Craton (Ball et al., 1984; Nzenti et al., 1984; Ganwa, 1998). The third deformation phase was brittle.

The present paper is a contribution to a better understanding of the Kombé-II area as part of the CAFB. The studied rocks represent a volcano-sedimentary sequence. Geochemical analyses, studies of the internal structure of zircons by cathodoluminescence, and zircon evaporation ages show that the Paleoproterozoic source rocks of the

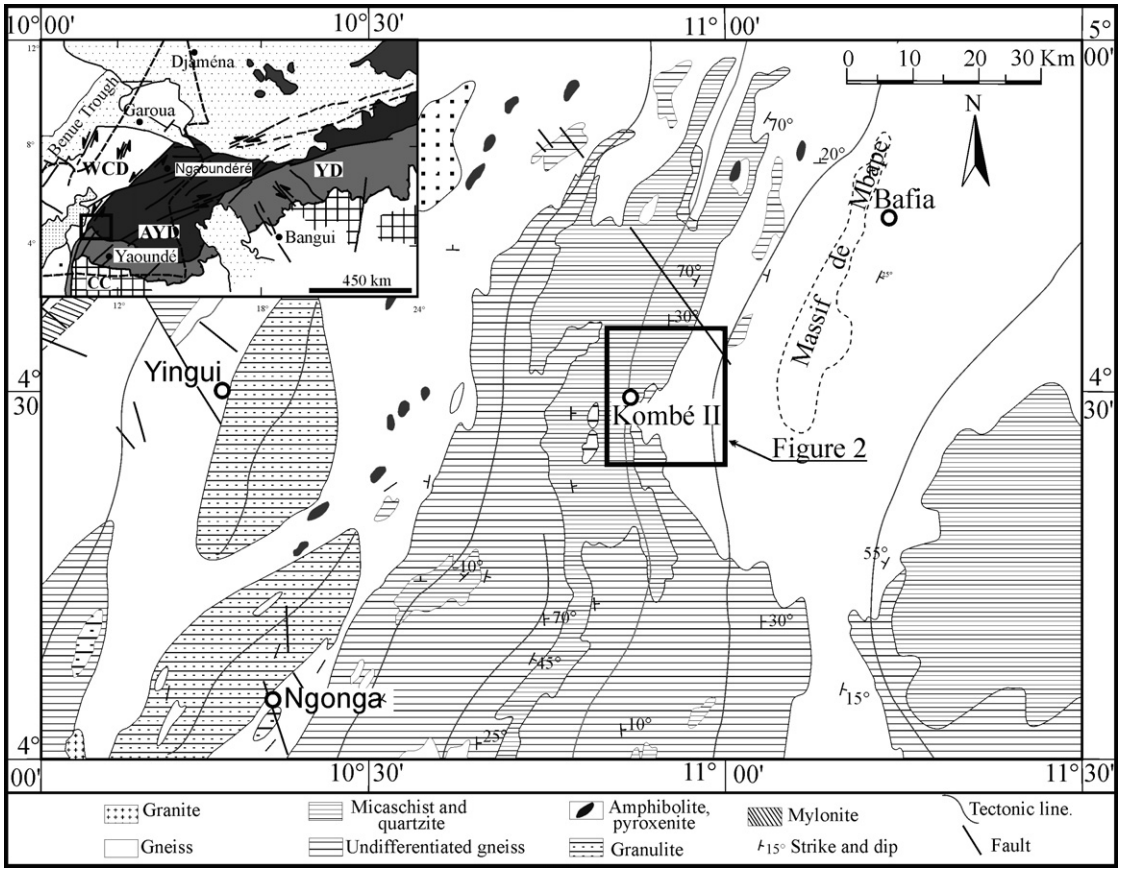

Fig. 1. Geological sketch map of Bafia area (modified after Weecksteen (1957); Dumort (1968)) showing the Kombé-II area. Inset (Toteu et al. (2004)): Patterns are as follows: grids, Congo craton (CC); dark grey; Adamawa–Yadé Domain (AYD); medium grey, Yaoundé Domain (YD); light grey, West Cameroon Domain (WCD); heavy dots, Cameroon Line; light dots, Mesozoic sediments. The square in the inset localizes the study area (large figure).