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Diachronous evolution of volcano-sedimentary basins north of the Congo craton: Insights from U–Pb ion microprobe dating of zircons from the Poli, Lom and Yaoundé Groups (Cameroon)

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Abstract

Ion microprobe U–Pb dating of zircons from Neoproterozoic volcano-sedimentary sequences in Cameroon north of the Congo craton is presented. For the Poli basin, the depositional age is constrained between 700–665 Ma; detrital sources comprise ca. 920, 830, 780 and 736 Ma magmatic zircons. In the Lom basin, the depositional age is constrained between 613 and 600 Ma, and detrital sources include Archaean to Palaeoproterozoic, late Mesoproterozoic to early Neoproterozoic (1100–950 Ma), and Neoproterozoic (735, 644 and 613 Ma) zircons. The Yaoundé Group is probably younger than 625 Ma, and detrital sources include Palaeoproterozoic and Neoproterozoic zircons. The depositional age of the Mahan metavolcano-sedimentary sequence is post-820 Ma, and detrital sources include late Mesoproterozoic (1070 Ma) and early Neoproterozoic volcanic rocks (824 Ma). The following conclusions can be made from these data. (1) The three basins evolved during the Pan-African event but are significantly different in age and tectonic setting; the Poli is a pre- to syn-collisional basin developed upon, or in the vicinity of young magmatic arcs; the Lom basin is post-collisional and intracontinental and developed on old crust; the tectono-metamorphic evolution of the Yaoundé Group resulted from rapid tectonic burial and subsequent collision between the Congo craton and the Adamawa–Yade block. (2) Late Mesoproterozoic to early Neoproterozoic inheritance reflects the presence of magmatic event(s) of this age in west–central Africa.

Keywords: Cameroon; Volcano-sedimentary basins; Pan-African; Mesoproterozoic; Zircon; Ion microprobe dating

1. Introduction

The study of plutonic rocks is an important tool to understand the evolution of orogenic belts. This has been particularly useful in the refinement of the orogenic evolution of the western Hoggar shield which is one of the better-known Neoproterozoic belts reflecting evidence for subduction, collision, crustal delamination and which is a tectonic collage of terranes (see recent reviews by Acef et al., 2003; Caby, 2003; Caby and Monié, 2003; Liégeois et al., 2003). In the central African fold belt (CAFB) of northern Cameroon and southeastern Nigeria, U–Pb zircon ages on plutonic rocks permit constraint of collisional and post-collisional events within the age range 640–570 Ma (Toteu et al., 1986, 1987, 1990, 2001, 2004; Soba et al., 1991; Penaye et al., 1993). However, collisional events may not have been coeval in the CAFB north of the Congo craton as shown by Penaye et al. (this volume). Despite these data, we only have a partial view of the orogenic evolution since very few data are available on the period preceding collision and, more generally, on the

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Neoproterozoic sedimentary and volcano-sedimentary rocks that constitute important rock units of the belt. Some of these rocks crop out in well-defined basins such as the Poli Group and its assumed extension in Chad (Zalbi Group), the Lom Group, and the Yaoundé Group (ca. 600 Ma tectonic nappe including Pan-African granulite facies metasediments, thrust southwards on the Congo craton), and the Bouzoum and Kouki Groups in the Central African Republic (Fig. 1). Other supracrustal sequences occur within the high-grade "basement complex" which also includes Archaean to Palaeoproterozoic rocks (Bessoles and Trompette, 1980; Toteu et al., 2001). Unfortunately, most of these Neoproterozoic supracrustal units lack geochronological data, or when available, they are not informative enough. The Neoproterozoic age of the Poli and Lom Groups has been demonstrated on the basis of mean U–Pb zircon ages from conventional multigrain dating methods (Toteu et al., 1987; Soba et al., 1991). However, it was neither possible to develop a clear picture of the depositional history, nor to establish the source provenance of the individual detrital zircons. In an attempt to reconstruct the orogenic evolution of the CAFB north of the Congo craton, we dated detrital zircons from some of the above rock units, using the CAMECA 1270 high-resolution ion microprobe. The results enable us to develop a model for diachronic evolution of Neoproterozoic orogenic basins in Cameroon north of the Congo craton.

2. Geological framework

The Neoproterozoic metasedimentary and metavolcanic rocks in Cameroon were initially recognized in the Poli, Lom and Mbalmayo regions (Figs. 1–3) by their low-grade metamorphism. Subsequent studies have revealed, however, that they also include medium- to high-grade rocks that were previously attributed to an Archaean to Palaeoproterozoic basement complex (Bessoles and Trompette, 1980). Such cases are documented in the western Poli region (Toteu et al., 1987) and in the Yaoundé Group whose Neoproterozoic age was shown by young Nd mean crustal residence ages (Penaye et al., 1993; Toteu et al., 1994). Consequently, detailed mapping is still necessary to define the extension of Neoproterozoic metasediments and associated metavolcanic rocks.

The Poli Group (Fig. 2) is dominated by tectonically interleaved metavolcanic and metasedimentary rocks (Njel,

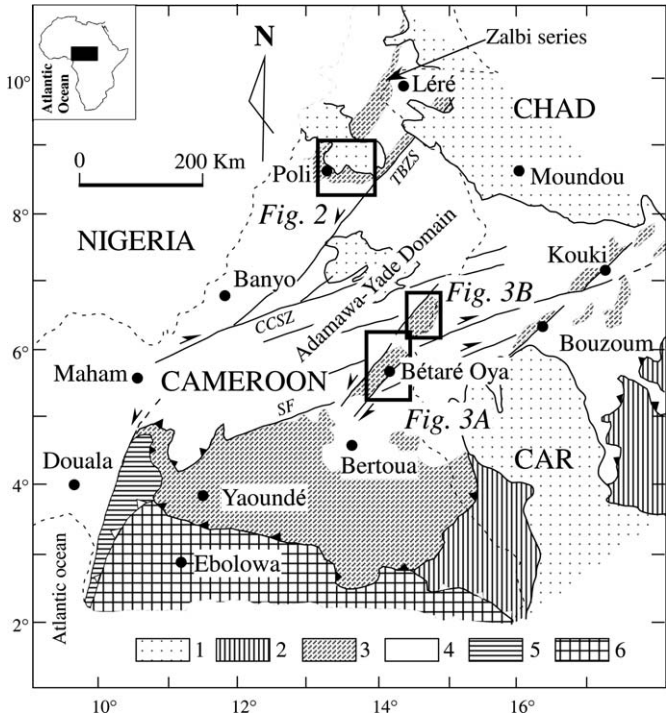

Fig. 1. Geological sketch map of the Central African Fold Belt (CAFB) showing location of Neoproterozoic supracrustal sequences: (1) Post-Pan-African cover, (2) Platform cover on the Congo craton, (3) Neoproterozoic units, (4) Granitoids, gneisses and migmatites of various ages of the basement complex, (5) Palaeoproterozoic Nyong Group, (6) Congo craton. Dot line represents political boundaries. TBSZ, Tcholliré–Banyo Shear Zone; CCSZ, Central Cameroonian Shear Zone; SF, Sanaga Fault. The Adamawa–Yade crustal domain extends between the TBSZ and the Yaoundé Group. Modified from Moloto (2002), Nickles and Hourcq (1952), Pinna et al. (1994), Rolin (1995) and Toteu et al. (2004).

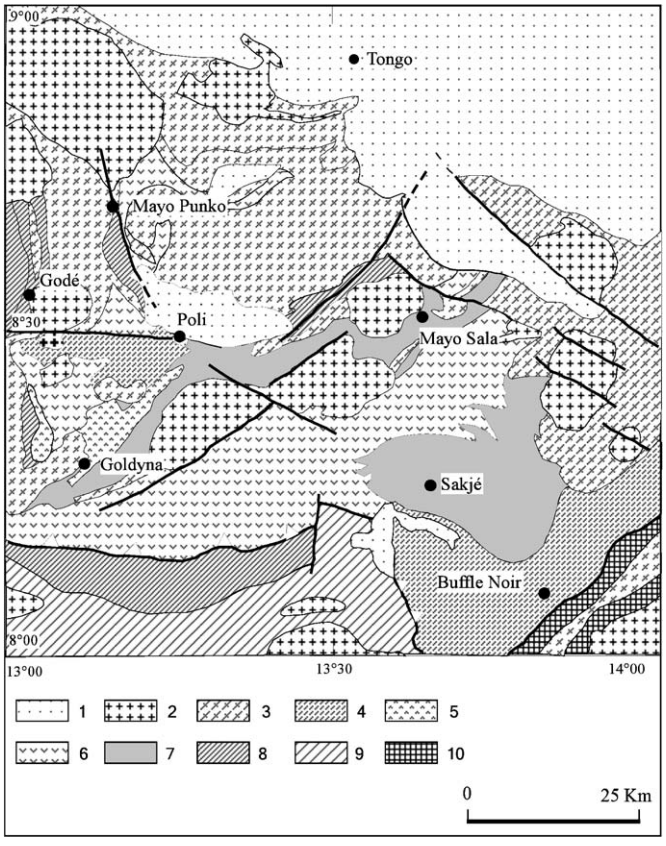

Fig. 2. Geological sketch map of the Poli basin. (1) Post-Pan-African cover, (2) Pan-African granitoids, (3) Pan-African orthogneisses, (4) low-grade schists, (5) Goldyna metarhyolites, (6) mafic metavolcanics, (7) medium-grade schists, (8) biotite- and biotite–hornblende gneisses, (9) heterogenous high-grade gneisses, (10) Palaeoproterozoic basement. Modified from unpublished map of the Centre for Geological and Mining Research, Garoua, Cameroon.