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$^{40}Ar/^{39}Ar$ dating of basaltic dykes swarm in Western Cameroon: Evidence of Late Paleozoic and Mesozoic magmatism in the corridor of the Cameroon Line

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ABSTRACT

$^{40}Ar/^{39}Ar$ ages of three basalt dykes that intrude the Precambrian basement in the southern continental part of the Cretaceous Cameroon Line are presented. Specimen were sampled at Dschang, Maham and Kendem (Cameroon). The ages obtained are 421.3 ± 3.5 Ma (Dschang), 404.22 ± 3.51 Ma (Maham), and 192.10 ± 7.45 Ma (Kendem). The Dschang and Maham samples yield a relatively undisturbed spectrum while the Kendem sample shows an excess of argon but with plateau ages in the frame of the Mesozoic. Plateau ages at Dschang, Maham and Kendem represent more than 80% of the total ^{39}Ar released and are interpreted as emplacement ages. $^{40}Ar/^{39}Ar$ dating results confirm Devonian and Jurassic K/Ar ages obtained from similar dykes of the same region. Geochemically, the basalt dykes are subalkaline in composition with 45–50 wt.% SiO_2. Incompatible trace elements and rare earth elements are lower than that of the Cameroon Line basalts. Overall geochemical characteristics of the basalt dykes much more closely resemble those of tholeiites of the Benue Through in Nigeria that are interpreted as related to the opening of the Atlantic Ocean. The combination of $^{40}Ar/^{39}Ar$ ages, major, trace and rare earth elements geochemistry data demonstrate a magmatic phase that is significantly older and different of that of the Cretaceous Cameroon Line and younger than the dominantly granitic Neoproterozoic to early Paleozoic magmatism in the region. These findings offer new clues for a better understanding of the tectonic history of the region, particularly the origin of the Cameroon Line and Africa–South America pre-drift reconstitutions.

1. Introduction

The timing of magmatism in a region can be a good indicator for assessment of regional geodynamic processes through time as well as clues to the understanding of major tectonic events such as lithospheric rifting and changes in plates motion. In Cameroon, the magmatic corridor of the Cameroon Line displays a temporal gap between the end of Neoproterozoic granitic magmatism and the Tertiary dominantly basaltic magmatism. Intense Pan-African magmatic activity in Cameroon was followed by post-tectonic Paleozoic granitoids of which the youngest age of 491 ± 4 Ma was recorded in the Nyibi massif near the boundary between Cameroon and the Central African Republic (Lasserre and Soba, 1976). Magmatic activity was reported to start again only during the Cretaceous along the CL where the oldest magmatic rocks are recorded in the Mayo Darle anorogenic complex dated at 73 ± 6 Ma (Nguene, 1982) and 69.4 ± 0.4 Ma for extrusive rocks (pantellerites) farther north in the Lake Chad area (Mbowou et al., 2012). Between the early Paleozoic and the late Mesozoic, no geochronological information was documented for magmatic activity within the corridor of the Cameroon Line. Nevertheless, Tchouankoue et al. (2004) and Tchouankoue (2005) proposed the existence of Paleozoic and Mesozoic ages within the magmatic gap based on three K/Ar ages on basaltic dykes from the southern continental part of the Cameroon Line. The basaltic dykes discussed in this paper are intrusive in the Precambrian basement units of the West Cameroon with elevations up to 1600 m (mean altitude 1400 m) and capped by volcanic rocks of the Cameroon Line (Burke, 2001). Detailed petrographic and geochemical characteristics of these basalt dykes are available in Tchouankoue et al. (2012). In support of these intra-gap events, we here present $^{40}Ar/^{39}Ar$ ages as well as new major and trace elements

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geochemical data for these dykes and discuss their implications on regional geodynamics.

2. Geological setting

Two main Precambrian units form the Cameroonian territory: The Ntem complex representing the northernmost part of the Congo Craton and the dominant Neoproterozoic Pan–African domain (Fig. 1). The Neoproterozoic domain is part of a polycyclic WSW–ENE trending belt extending in pre-drift reconstitutions from NE Brazil to Sudan; the northern and western domains of this belt in North and West Cameroon corresponding to the basement of the Cameroon Line. There, syn- to late-tectonic granitoid and orthogneissic rocks which represent more than 60% of rock types, are oriented aggregately to the NE–SW. Oldest Phanerzoic ages for the granitoid rocks obtained by whole-rock Rb/Sr are around 490 Ma in Cameroon (Lasserre and Soba, 1976; Lasserre et al., 1981), while the oldest age for Cameroon Line formations has been determined in the plutonovolcanic anorogenic complex of Mayo Darle in the central part of the Cameroon Line dated at 73 ± 6 Ma (Nguene, 1982). Volcanic activity in the Tertiary is basalt-dominant and started in the lake Chad area (Mbowou et al., 2012), then followed by a flood basalts period (Moundi et al., 1996; Marzoli et al., 2000; Fosso et al., 2005) at ca. 51 Ma. The activity of volcanoes found in oceanic and continental domains may have started only 15 Ma ago and last volcanic eruptions of Mount Cameroon were in 1999 and 2000 (Gaudru and Tchouankoue, 2002; Suh et al., 2003).

3. Field relations and petrography

The dykes were sampled for dating in the Maham, Dschang and Kendem (Fig. 1), three localities roughly aligned along a NW–SE direction in West Cameroon. Intense weathering of rocks characterize the region, but relatively fresh samples were collected in outcrops along highway road-cuts. Dykes at Maham and Dschang are oriented N70°E while the dyke in Kendem shows an orientation of N25°E. Because of thick soils covering either the basement or the Tertiary basalts, basalt dykes could only be seen on road-cuts in Precambrian basement rocks (Fig. 2), and the stratigraphic relations with volcanic rocks of the Cameroon Line are not directly observed.

Detailed geological, petrographic and geochemical informations are available in Tchouankoue et al. (2012) and only relevant

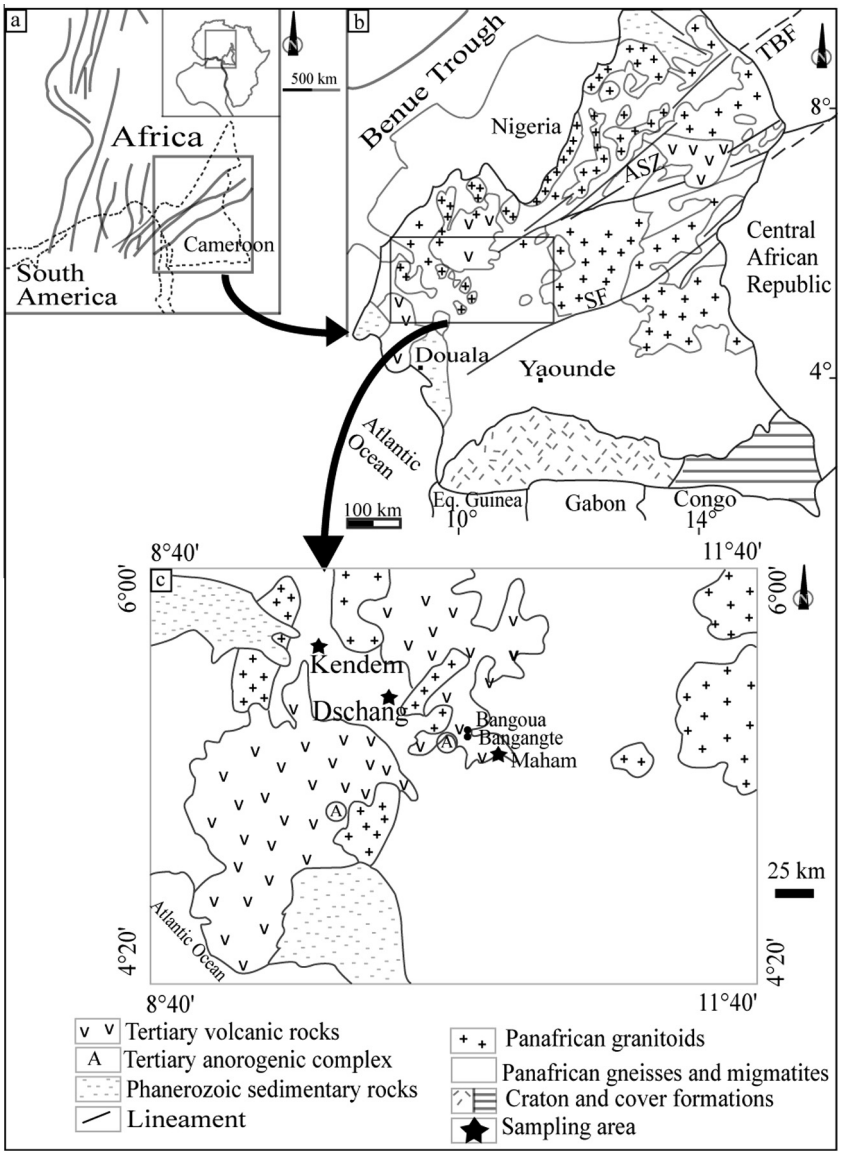

Fig. 1. (a) Position of Cameroon in the West Gondwana assembly. (b) Geological sketch map of Cameroon (simplified from Njiekak et al., 2008). (c) Geological map of the studied area and samples location. ASZ, Adamawa Shear Zone. TBF, Tchollire Banyo Fault. SF, Sanaga Fault.