



Structure and petrology of Pan-African nepheline syenites from the South West Cameroon; Implications for their emplacement mode, petrogenesis and geodynamic significance



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ABSTRACT

Three late-Neoproterozoic nepheline syenite intrusions crop out close to the late-Pan-African SW Cameroon shear zone, namely the Mont des Eléphants, Eboundja and Rocher du Loup intrusions. They are characterized by magmatic to solid-state deformation structures and microstructures. Their magmas were mainly derived from partial melting of the subcontinental lithospheric mantle. Magmatic differentiation may have occurred through fractionation of clinopyroxene, amphibole, plagioclase and accessory minerals (apatite, sphene, magnetite and zircon). Bulk magnetic susceptibilities are variable in intensity depending of the magnetite content. Their magnetic anisotropies are unusually high, especially in the Rocher du Loup intrusion. The trajectories of magnetic foliations and lineations display an arcuate shape from an E–W direction in the easternmost Mont des Eléphants to a N–S direction in the Rocher du Loup intrusion. These features are consistent with a synkinematic emplacement in relation with the sinistral motion along the SW Cameroon shear zone, whose age is therefore dated by the age of the syenites, i.e. 590 Ma. Magma genesis and ascent was likely favored by a large gradient in lithospheric thickness along the western margin of the Congo craton.

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1. Introduction

Nepheline syenites are rather unusual peralkaline rocks. In some cases they content a variable and aesthetic mineralogy and high concentration of many rare elements such as the high field strength elements (Ti, Zr, Nb, Ta), Li, Be, Sn or the rare earths. They are also characterized by complex magma sources and crystallization paths, which may explain their mineralogical diversity (e.g., Kogarko, 1980; Drysdall et al., 1984; Bowden, 1985; Sørensen, 1992, 1997). Sometimes they are associated with carbonatite complexes such as Mont Saint Hilaire complex, Canada (Currie et al., 1986), Badakhshan Province, Afghanistan (Cook, 2004), Cerro Sapo, Bolivia (Schultz et al., 2004), Swartbooisdrif, Namibia (Drüppel et al., 2005) and South Bahia, Brazil (Oliveira, 2003; Menezes, 2005). These silica-undersaturated alkaline magmas are generally formed within continental plates where they are common in rift systems, or as products of mantle plumes associated to continental

or oceanic hot spots. The genesis of these magmas is usually attributed to small degrees of mantle melting.

In Cameroon, intrusions of Neoproterozoic nepheline syenites are restricted to the margin of the Congo craton near the Atlantic coast south of Kribi (Fig. 1a). Few studies (Edimo, 1985; Nsifa, 2005) have been carried out on these alkaline intrusions considered as important geodynamic markers, useful in reconstructing the evolution of Precambrian terrains in southern Cameroon. In this paper we present new AMS (anisotropy of magnetic susceptibility) data combined with field observations, mineral and whole-rock geochemical data to discuss the significance of these rocks for the Pan-African orogeny at the margin of the Congo craton.

2. Geological setting and geochronology

2.1. The nepheline syenite plutons

The nepheline syenites crop out as a discontinuous rock band along the Atlantic coast in south-west Cameroon where they form three small plutons which are from north to south, the Mont des

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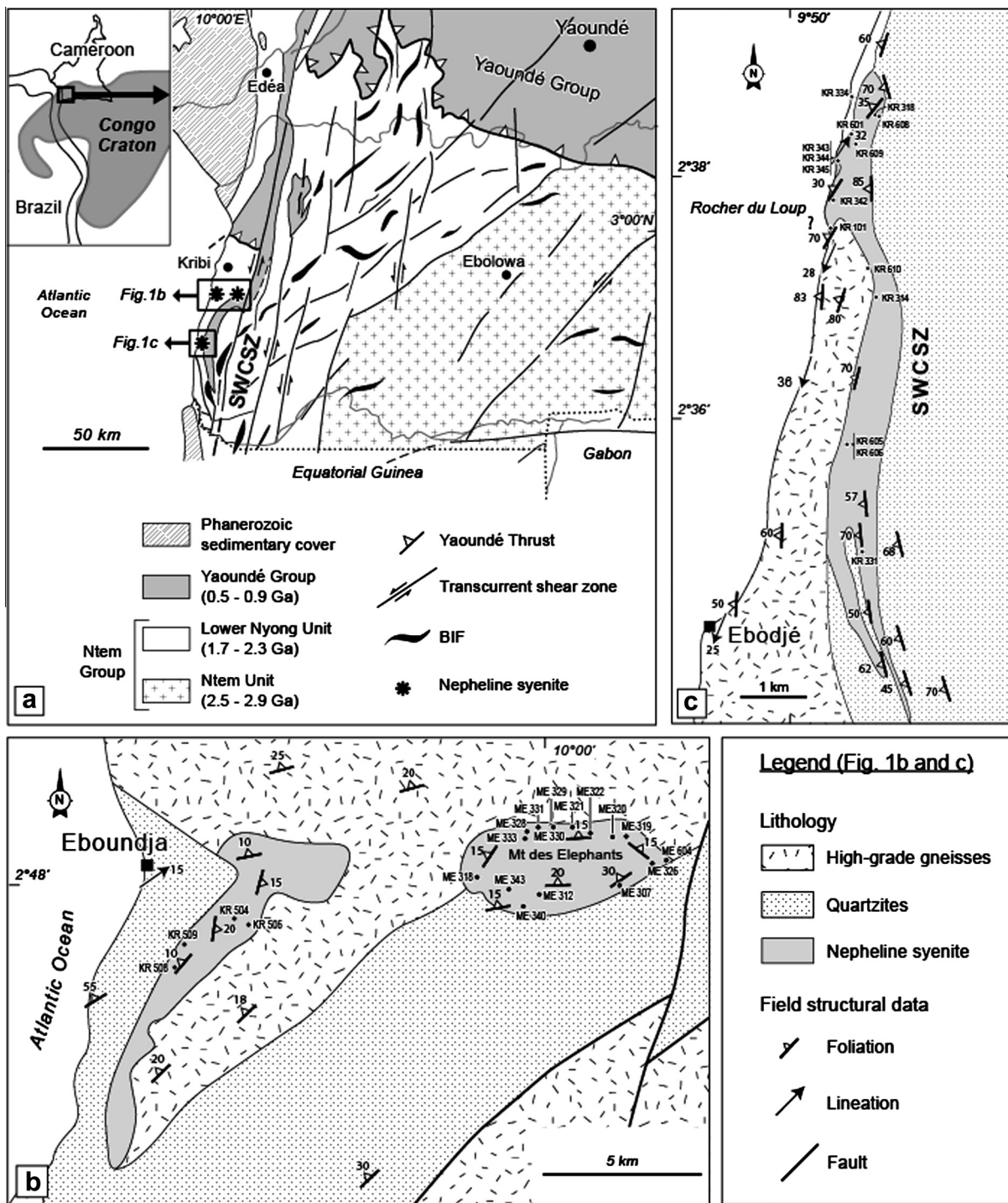


Fig. 1. (a) Geological sketch map of SW Cameroon with location of the studied nepheline syenites; (b) Map of the Eboudja and Mont des Eléphants intrusions; (c) Map of the Rocher du Loup intrusion; (b) and (c) show the location of samples for geochemistry (open circles), AMS sampling sites (filled circles) and field structural data.

Eléphants (ME), the Eboudja massif (EB) and the Rocher du Loup (RL) (Fig. 1b,c). The ellipsoidal Mont des Eléphants pluton, covering an area of ~7 km × 4 km, is dipping to the north (Fig. 1b). The Eboudja massif intrusion strikes E–W at its northern part and NNE–SSW at its southwestern end (Fig. 1b). It measures ~10 km in its longest axis. The Rocher du Loup is a small rocky island located at ~40 km south of Kribi and ~200 m from the beach. It is part of a N–S striking elongate intrusion measuring ~10 × 0.5 km and dipping 30° to 70° to the west. This so-called Rocher du Loup intrusion displays a sigmoidal shape and contains a NNW–SSE

trending roof pendant of quartzites measuring ~2 km in length (Fig. 1c) at its southern end.

Using the K–Ar dating method on amphibole, Kornprobst et al. (1976) provided an age of 529 ± 20 Ma from a Rocher du Loup sample. Recently, SHRIMP U–Pb analyses of zircons from Rocher du Loup pluton yielded an age of 591 ± 19 Ma (Lerouge et al., 2006) which is very similar to an age reported earlier using multigrain TIMS analyses (590 ± 20 Ma; Toteu et al., 1994). Therefore, the nepheline syenites of SW Cameroon are confidently regarded as emplaced at ca 590 Ma.

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