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# Petrogenesis of a silicic magma system: Geochemical evidence from Bamenda Mountains, NW Cameroon, Cameroon Volcanic Line

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ABSTRACT

The concentrations of major and trace elements and the isotopic compositions were measured in felsic lavas of the Bamenda Mountains, an extinct volcanic center of the West Cameroon Highlands (WCH), in order to assess the relative roles of mantle versus crustal magma sources in the evolution of silicic magmatic systems. These silicic volcanics are composed of benmoreites, trachytes and rhyolites associated with alkaline basaltic lavas and have characteristics of A-type magmas. Chemical diagrams show two magmatic lineages based on the ratios of HFSE/LILE (e.g. Hf/Rb: 0.19–0.34 and 0.11–0.23), the degree of fractionation (La/Sm: 5.2–6.4 and 6.5–7.5) and the contents of REE; they are respectively referred to as less-differentiated felsic lavas (LDFL) and high-differentiated felsic lavas (HDFL). Their evolution is mainly governed by alkali feldspar-dominated fractional crystallization. The K/Ar ages on trachytes range from 27.40 ± 0.50 to 12.74 ± 0.25 Ma with the HDFL being mostly younger. Their $\varepsilon_{Nd}$ range mostly between −0.88 and + 2.43 with one value at −3.43 precluding their derivation from melting of a continental crust. Besides the most negative value (−3, 43) obtained in trachyte BA63 remains high compared to −20.28 calculated for a Bamemda Pan-African granitoid suggesting very low crustal contamination. However, the fact that this lower $\varepsilon_{Nd}$ in BA63 is not followed by the corresponding low Ce/Pb and high La/Nb rather indicates a selective role of crustal contamination. This feature seems characteristic of the felsic lavas of the whole Cameroon Volcanic Line. The isotopic and trace element variations observed for the Bamenda felsic lavas are most consistent with a source in the continental lithospheric mantle.

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## 1. Introduction

The Cameroon Volcanic Line (CVL) is made up of oceanic and continental sectors, which have been active from 52 Ma to Present (Moundi et al., 2007; Yokoyama et al., 2007). The oceanic sector includes four volcanic islands (Déruelle et al., 1991 and references therein; Lee et al., 1994) and two large seamounts (Burke, 2001) which erupted undersaturated lavas. The continental sector is marked by a trend of large massifs including the still active Cameroon Mountain (last eruption in 2000; Suh et al., 2003) and the Manengouba, Bambouto and Bamenda Mountains (Fig. 1). The latter mostly erupted bimodal lavas, with a gap between silicic and mafic lavas with minor intermediate lavas (Nono et al., 1994; Marzoli et al., 1999; Ngounouno et al., 2000, 2003) whereas the Cameroon Mountain is mainly basaltic. The above studies support the evolution of silicic lavas by fractional crystallization of the mafic melts, accompanied by crustal contamination. Such a direct link between mafic mantle-derived melts and felsic rocks has also been described by Davidson and Wilson (1989) in Sudan, Gasparon et al. (1993) in Central Ethiopia, and Mungall and Martin (1995) in the Azores archipelago. These findings contrast with studies favouring partial melting of the continental crust for the generation of felsic rocks in bimodal volcanic massifs (Davies and Macdonald, 1987; Jarrar et al., 1992). In fact, crystal fractionation and crustal melting need not be mutually exclusive processes in any given volcanic system. For example, in the 1875 Askja eruption, some silicic xenoliths appear to represent crustal contaminated melts, whereas others are consistent with a fractionation origin (Macdonald et al., 1987).

The Bamenda Mountains are characterized by the predominance of felsic lavas over basaltic ones (Kamgang, 2003; Kamgang et al., 2007). This study presents major and trace element geochemistry and whole rock Nd isotopic compositions of the felsic lavas. Our aim is to constrain their petrogenesis and test possible link with the associated basaltic lavas. A comparison with other more studied felsic lavas of the CVL is also given.

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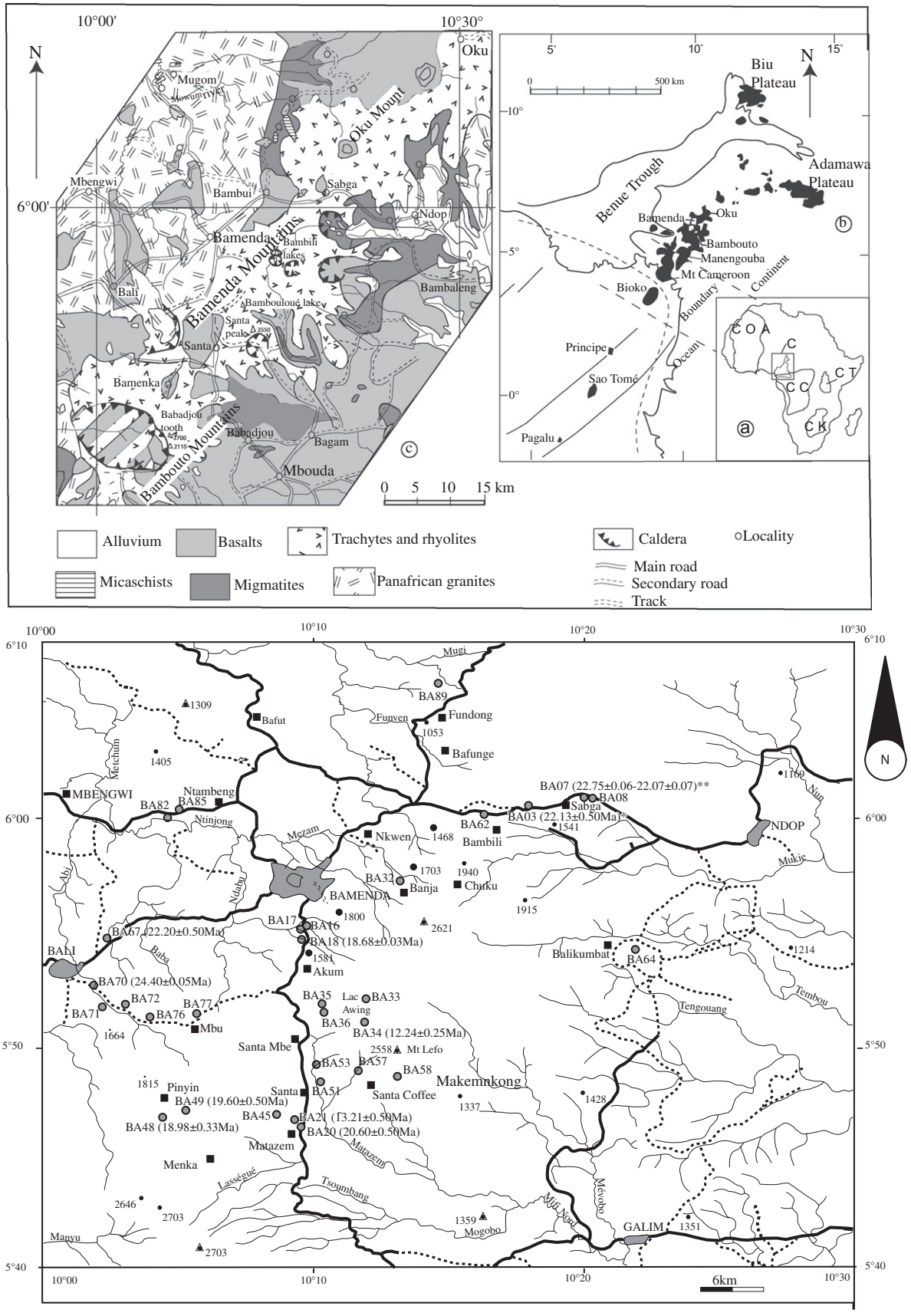


**Fig. 1.** (a) Location of Cameroon in Africa; (b) location of the Bamenda Mountains along the Cameroon line showing the outcrop of the Cameroon line volcanic rocks (black) [adapted after Halliday et al. (1988)]; the boundary between continental and oceanic crust is taken from Emery and Uchupi (1984) and oceanic transform faults are from Sibuet and Mascle (1978) and (c) in the western Highlands; (d) location map of the felsic lavas samples for Bamenda Mountains. C = Cameroon; COA = West African craton; CC = Congo craton; CT = Tanzanian craton; CK = Kalahari craton. African cratons are after Kampunzu and Popoff (1991).