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Mafic dikes at Kahel Tabelbala (Daoura, Ougarta Range, south-western Algeria): New insights into the petrology, geochemistry and mantle source characteristics

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ABSTRACT

New petrological, geochemical and Sr–Nd isotopic data of the Late Triassic and Early Jurassic Kahel Tabelbala (KT) mafic dikes (south-western Algeria) offer a unique opportunity to examine the nature of their mantle sources and their geodynamic significance. An alkaline potassic Group 1 of basaltic dikes displaying relatively high MgO, TiO_2, Cr and Ni, $La/Yb_N \sim 15$, coupled with low $^{87}Sr/^{86}Sr_i \sim 0.7037$ and relatively high $\varepsilon_{Nd}(t) \sim +3$, indicates minor olivine and clinopyroxene fractionation and the existence of a depleted mantle OIB source. Their parental magma was generated from partial melting in the garnet–lherzolite stability field. A tholeiitic Group 2 of doleritic dikes displaying low MgO, Cr and Ni contents, $La/Yb_N \sim 5$, positive Ba, Sr and Pb anomalies, the absence of a negative Nb anomaly coupled with moderate $^{87}Sr/^{86}Sri \sim 0.7044$ and low $\varepsilon_{Nd}(t) \sim 0$ (BSE-like), indicates a contamination of a mantle-derived magma that experienced crystal fractionation of plagioclase and clinopyroxene. This second group, similar to the low-Ti tholeiitic basalts of the Central Atlantic Magmatic Province (CAMP), was derived from partial melting in the peridotite source within the spinel stability field. Lower Mesozoic continental rifting could have been initiated by a heterogeneous mantle plume that supplied source components beneath Daoura, in the Ougarta Range.

1. Introduction

Mafic dike swarms are a common expression of mantle-derived magma generation in continental setting characterized by extensional tectonic regimes in post-collisional or intraplate extensional settings (Rock, 1991). They resulted from a considerable extension of the continental lithosphere (Halls, 1982; Tarney and Weaver, 1987). They can thus provide important information for understanding not only the mantle source of the magmas, but also the tectonic evolution of the orogenic belt (Gorring and Kay, 2001; Yang et al., 2007).

Mafic dikes, distributed in southwestern Algeria, outcrop in the Ougarta Range, the Tindouf basin, the Eglab, the Reggane and Abadla regions. These occurrences have been widely investigated, especially in Morocco (Bensalah et al., 2011; Bertrand and Westphal, 1977, Choubert and Faure-Muret, 1974; El Aouli et al., 2001; El Maidani et al., 2013; Hafid et al., 1998; Hollard, 1973; Leblanc, 1973; Mahmoudi and Bertrand, 2007; Verati et al.,

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2007). In contrast with Morocco, a few studies have been carried out in southern and southwestern Algeria (Boissière, 1971; Chabou et al., 2007; Chabou et al., 2010; Conrad, 1972; Djellit et al., 2006; Fabre, 1976; Mekkaoui, 2015; Mekkaoui and Remaci-Bénaouda, 2014; Menchikoff, 1930; Sebai et al., 1991).

This paper presents a new study of the petrology and geochemistry of these Mesozoic mafic dikes in the Ougarta Range, southwestern Algeria. New major and trace elements analyses as well as Sr–Nd isotopic data of mafic-dike rocks were collected from representative sections in Kahel Tabelbala (KT). These data allow us to identify the magma types, investigate their mantle sources and petrogenesis, and understand the evolution of the Mesozoic lithospheric mantle beneath KT, Ougarta Range.

2. Geological setting

The Ougarta Range corresponds to an imposing series of reliefs arising within the Saharan platform (Fig. 1a). These reliefs are confined to the Saoura and Daoura basins (Menchikoff, 1930). The KT, which is a major orogenic entity within the Daoura, is aligned along a Ougartian direction from N130° to N140°. It is bounded to the north by the "Hamada of Mande", to the east by Erg er Raoui, and to the south by the Erg Chech, and to the west, by the Iguidi and El Aâtchane ergs (Fig. 1a and b). The Ougarta Range belonging to the northern boundary of the West African Craton (Fig. 1c) is involved in the Late Pan-African history (Ennih and Liégeois, 2001; Kurek and Preidl, 1987). The continental collision between Gondwana and Laurasia in the Late Carboniferous was originally a major uprising and

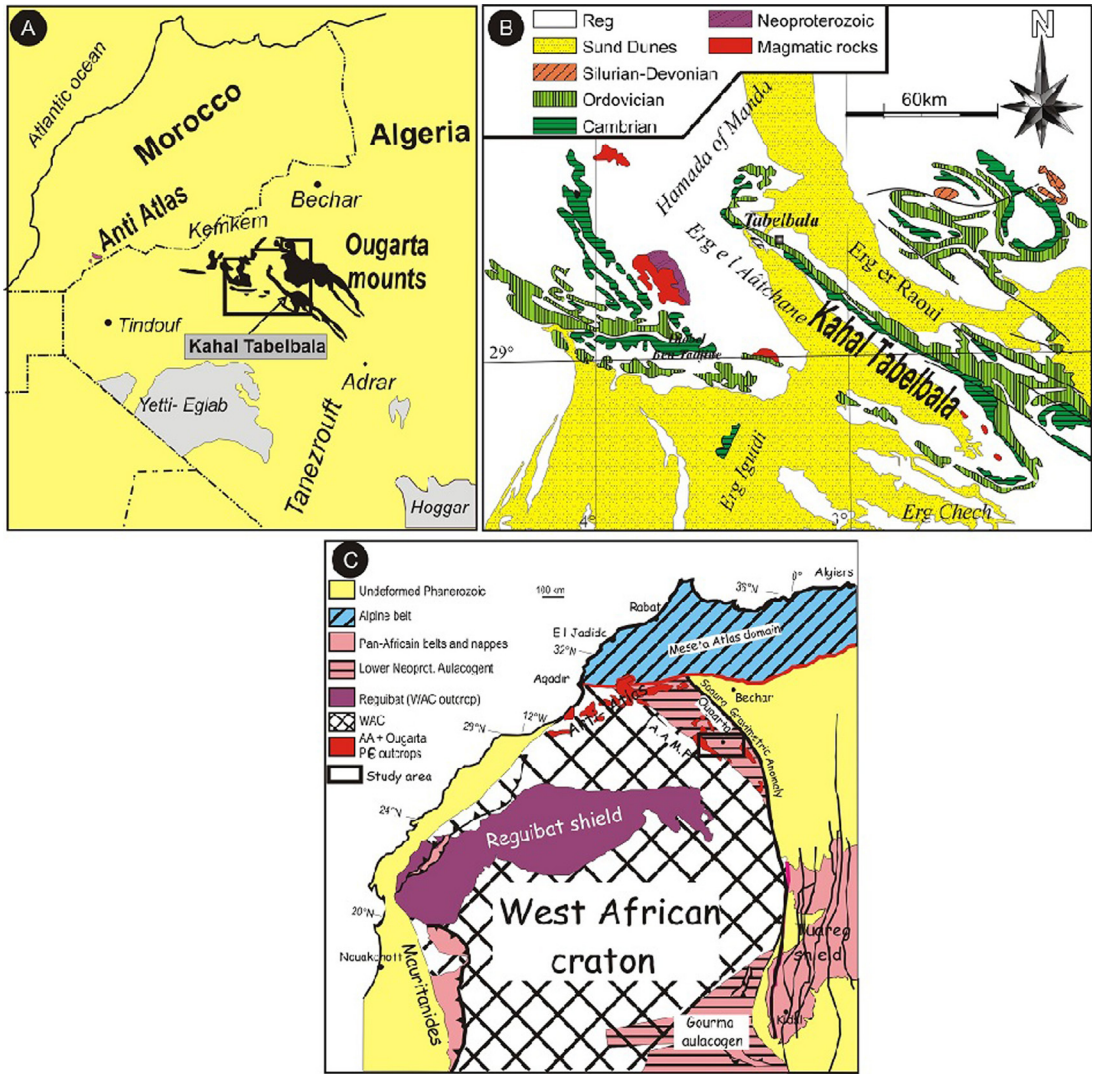

Fig. 1. Map of the studied area, showing (A) the location of Ougarta Range (Michard, 1976), a simplified geological map of the studied area, Kahel Tabelbala (B), a WAC sketch map placing the Ougarta range into its regional context (C) (modified after Fabre, 1976; Ennih and Liégeois, 2001).

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