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NON PLUME VS. PLUME ORIGINS OF THE CENTRAL ATLANTIC MAGMATIC PROVINCE (CAMP)

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Abstract

The Central Atlantic Magmatic Province (CAMP, Marzoli et al., 1999) is the largest igneous event on Earth (~7x10^6 km^2). Its emplacement is linked to the onset of the fragmentation of Pangaea and to the opening of the central Atlantic Ocean around the Triassic-Jurassic boundary (~ 201 Ma). Remnants of the CAMP are represented by dykes, sills and lava flows cropping out on four continents: North and South America, West Africa and Europe. The geochemical signature of the CAMP magmatism is dominated by low-Titanium (L-Ti) tholeiites, with minor high-Titanium tholeiites (H-Ti) restricted to limited areas in Liberia, Guyana and Brazil.

The geodynamic mechanism responsible for the Central Atlantic magmatic province is still widely debated. In the last two decades, several models on the origin of the CAMP have been proposed. These models can be grouped into two major hypotheses :

- A Mantle plume hypotheses (active models), which invoke an active role of mantle plume in the genesis of the CAMP (Morgan, 1983 ; White et McKenzie, 1989 ; Greenough et Hodych, 1990 ; Oliveira et al., 1990 ; Hill, 1991 ; Ernst et al., 1995, 2001 ; Ernst et Buchan, 1997, 2001, 2002 ; Wilson, 1997 ; Oyarzun et al., 1997 ; Leitch et al., 1998 ; Thompson, 1998 ; Courtillot et al., 1999 ; Janney et Castillo, 2001 ; Nomade et al., 2002 ; Cebria et al., 2003).

-Non plume hypotheses (passive models), involving the partial melting of the lithosphere (and/or asthenosphere) in response to heat accumulation under Pangea and/or to the disrupting of Pangaea and opening of central Atlantic ocean, without mantle plume intervention (Bédard, 1985 ; Pegram, 1990 ; Bertrand, 1991 ; Hames et al., 2000 ; McHone, 2000 ; Puffer, 2001, 2003 ; DeMin et al., 2003 ; Iacumin et al., 2003 ; Jourdan et al., 2003 ; Deckart et al., 2005 ; Verati et al., 2005 ; Coltice et al., 2007).

The different models that have been proposed for the origin of the CAMP must be able to explain : (i) The large surface area of this province, and its elongated geometry shape ; (ii) the brevity of peak magmatism of the CAMP ; (iii) the homogeneous geochemical composition of the CAMP tholeiites (LTi CAMP) in the entire province, and the existence of a HTi group in a restricted area of the CAMP.

Here, I present a brief review of the different hypotheses on the origin of the CAMP, and then I will focus on our geochemical results on the CAMP magmatism in South-western Algeria with the objective to bring new elements that can help to constraint the origin of this huge province.