



## Preliminary Geochemical Data of the 2014 Erupted Lavas and Pyroclasts at Fogo Island (Cape Verde Archipelago)

### *Geoquímica Preliminar de Materiais Lávicos e Piroclásticos Emitidos em 2014 na Ilha do Fogo (Arquipélago de Cabo Verde)*

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#### Abstract

On the 23<sup>rd</sup> of November of 2014 an eruption began in the Island of Fogo (Cape Verde). The eruption lasted for 77 days with emission of lava flows and pyroclasts during simultaneous or alternating hawaiian, strombolian and vulcanian manifestations. The volcanic products present alkaline affinity with geochemical characteristics typical of the southern Cape Verde Islands. Even though the geochemistry of major and trace elements seems to indicate a similarity with the eruptions of 1995 and 1951, their distinct isotopic signature indicates that the products of the last 3 eruptions in Fogo Island cannot be considered comagmatic and point to the existence of small-scale heterogeneities in the mantle source feeding the volcanism of Fogo Island.

Keywords: Cape Verde Archipelago, Fogo Island, 2014-2015 eruption, Alkaline lavas, Small-scale mantle heterogeneity

#### Resumo

A 23 de Novembro de 2014 teve início uma erupção na ilha do Fogo (Cabo Verde). A erupção durou 77 dias tendo sido expelidos derrames lávicos e piroclastos durante episódios de atividade de tipo havaiano, estromboliano e vulcaniano. Os materiais vulcânicos são de afinidade alcalina, com características geoquímicas idênticas às encontradas na maioria das ilhas do Sul no arquipélago de Cabo Verde. Embora a geoquímica de elementos maiores e traço pareça indicar uma semelhança com as erupções de 1995 e 1951, a assinatura isotópica claramente distinta da erupção de 2014 indica que os produtos das 3 últimas erupções no Fogo não são comagmáticos e aponta para a existência de heterogeneidades na fonte mantélica subjacente região de Chã das Caldeiras.

Palavras-chave: Arquipélago de Cabo Verde, Ilha do Fogo, Erupção de 2014-2015, Lavas alcalinas, Heterogeneidade mantélica



## Introduction

Between November 23, 2014 and February 7, 2015 an eruption took place in Fogo Island. The event presented simultaneous or alternating hawaiian, strombolian and vulcanian manifestations and was fed by a NNW-SSE trending fissure located on the SE flank of the cone from the previous 1995 eruption. Some  $4 \times 10^7 \text{ m}^3$  of lava were erupted, to which a still undetermined volume of pyroclasts, produced by strombolian and vulcanian activity, must be added.

We will present and discuss preliminary data on the geochemistry of lavas and pyroclasts erupted up to December 5, 2014.

## Geochemistry

As all other subaerial lavas in the Cape Verde Islands, the volcanic products erupted in 2014 in Fogo are alkaline. The sampled pyroclasts and lavas are similar in composition, the most significant difference being the S-enriched composition of pyroclasts (120 to 230 ppm) as compared with lavas (60 to 120 ppm). This indicates a more effective degassing of lavas as a consequence of slower cooling.

Alkaline lavas from the Cape Verde Archipelago form two groups with distinct geochemical signatures, according to their geographical location (Northern vs. Southern islands; e.g. Gerlach et al., 1988; Doucelance et al., 2003). Brava Island is the notable exception presenting signatures typical of both Northern and Southern islands (Mourão et al., 2012). The materials erupted in 2014 are chemically akin to the Southern islands in agreement with the location of Fogo.

As observed for the 1995 eruption (Munhá et al., 1997; Silva et al., 1997; Hildner et al., 2011), the initial products erupted in 2014 were more evolved ( $\text{SiO}_2$  up to 47.99 wt.% - phono-tephrites) than those emitted subsequently, for which  $\text{SiO}_2$  contents as low as 43.03 wt.% were

obtained. The similar major element compositional range, the short time interval (19 years) between these 2 eruptions and the close proximity of the volcanic vents (< 200 m) could suggest a situation of comagmatism, the same being eventually applied to the 1951 eruption, whose volcanic vents are located less than 2000 m from the 2014 fissure. However, this is clearly not the case given the significantly different isotope signatures (cf. Mata et al., 1995; unpublished data; Escrig et al., 2005; this study). Indeed, the 2014 volcanic materials are clearly more Sr-unradiogenic and Nd-radiogenic than the previous two eruptions. Such differences, observed in volcanic products erupted during a time lag of just 63 years from vents so closely located emphasize the presence of small-scale heterogeneities in the mantle sources feeding the volcanism of Fogo Island.

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