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Helium-3 and diffuse Helium-4 emissions prior the 2014-15 Fogo eruption, Cape Verde

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On November 23, 2014 a new volcanic eruption started at the southwestern flank of Pico do Fogo volcano (Fogo Island, Cape Verde) after 19 years of the last eruptive event. Helium-3 emission from fumarole discharges and diffuse helium-4 degassing studies have been carried out regularly at the summit crater of Pico do Fogo since May 2007 until March 2014. The first published data on helium isotopes and diffuse helium-4 degassing from Pico do Fogo volcano is related to the field work performed on February 2010 which shows already relatively high helium-3 emission, 8.53 $\pm$ 0.9 R/RA (being R and RA the sample and atmospheric 3He/4He isotope ratio, respectively), and diffuse helium-4 degassing rate, 4.2 $\pm$ 0.2 kg d-1 (Dionis et al., 2015).

During the eight year period 2007-2014, helium-4 emission rate was measured yearly at 50 different sampling sites selected in the surface environment of the summit crater of Pico do Fogo (0.14 km2) following the Darcy's law, and assuming that helium-4 emission is mainly governed by convection. The distribution of the sampling sites was carefully chosen to homogeneously cover the target area, allowing the computation of the total helium-4 emission by sequential Gaussian simulation (sGs). In addition, helium-3 emission was measured in the fumarole gases following the method described by Sumino et al. (2001). During the eight year period, convective helium-4 emission ranged between 1.2 and 5.7 kg d-1, and helium-3 emission between 7.73 and 8.82 R/RA. Both helium-4 and helium-3 emission showed significant increases on February 2010, suggesting a potential magma intrusion into the volcanic system of Pico do Fogo. However, the highest observed values of both parameters were observed on November, 2013 (helium-3 emission) and on March 2014 (diffuse helium-4 emission) suggesting a second magma intrusion giving rise to the volcanic eruption on November 23, 2014. As was observed in other volcanic systems (Padrón et al., 2013), helium degassing monitoring in oceanic volcanic islands could be an excellent early warning geochemical precursory signal for volcanic unrest.

Dionis et al. (2015), Bull. Volcanol., in press ; Padrón et al., (2013), Geology 41 (5) 539–542.; Sumino et al., (2001), J. Mass Spectrom. Soc. Jpn. 49, 61–68.