Geophysical Research Abstracts
Vol. 16, EGU2014-7987, 2014
EGU General Assembly 2014

Duration of gas accumulation before the 2010 Eyjafjallajökull eruption constrained by 210Po-210Pb-226Ra disequilibria

Olgeir Sigmarsson (1,2), Pierre-Jean Gauthier (1), and Michel Condomines (3)

(1) LMV, CNRS - Université Blaise Pascal, Clermont-Ferrand, France, (2) IES, University of Iceland, Reykjavik, Iceland (olgeir@hi.is), (3) Géosciences Montpellier, Université Montpellier 2 - CNRS Montpellier, France

Excess gas phase in magmas erupting explosively is well known world-wide. However, the origin of this gas phase, in excess of what can be dissolved in the erupting magma at depth, and the duration of gas accumulation, is less well defined. The 2010 mildly explosive eruption at Eyjafjallajökull, Iceland, produced mingled tephra of benmoreiitic and trachytic composition whereas alkali basalt (MgO > 8 %) was emitted during the preceding flank eruption. The silicic tephra of the first explosive phase is composed of three glass types, alkaline rhyolite, mixed benmoreiite, and evolved basalt (MgO < 5 %). The rhyolitic glass is indistinguishable from tephra glass composition emitted during the penultimate eruption of Eyjafjallajökull in 1821-23 AD (Sigmarsson et al., 2011).

Tephra from the first explosive phase, emitted on 15 and 17 April, had large 210Po in excess of 210Pb ((210Po/210Pb)0 as high as 2!) and a small, but significant, 210Pb excess over its parent 226Ra ((210Pb/226Ra)0= 1.05 and 1.04, respectively). These excesses suggest rapid accumulation of Po and Rn together with the major gas species in the residual rhyolitic magma from the 1821-23 eruption. The gas most likely originates from the basalt recharge that eventually provoked the eruption. Basalts emitted a month earlier during the flank eruption at Fimmvörðuháls lost all their Po upon eruption and had (210Po/210Pb)0 equal to 0). From a simple model of radon and polonium degassing and accumulation, the mass of basalt magma degassing over the mass of silicic magma accumulating the excess gas can be calculated. Moreover, the duration of gas accumulation can be shown to be close to 300 days. This duration suggests that gas was liberated from the basaltic magma since June 2009, a month that corresponds to the initial seismic swarm beneath Eyjafjallajökull preceding the explosive eruption of 14 April 2010.