The effect of Na/K ratio on the viscosity of iron-silicates: application to the Yasur (Vanuatu) volcano

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Le Losq and Neuville (2013) have shown that viscosity and structure of Na/K silicate glasses and melts do not follow ideal mixing rules that suggest a decrease of viscosity with Na/K mixing as proposed by the classic alkali mixing model. Instead viscosity increases non-linearly when K^+ ions substitute Na^+ ions. This effect can have important consequences for eruptions of volcanoes like Toba, Mont Dore or Yellowstone, which compositions are close to rhyolites (e.g. 83%SiO_2-8%Al_2O_3-3.7%K_2O-3.4%Na_2O). The aim of this work is to test the mixing effect of Na/K on SiO_2-poorer compositions, such as those of Yasur or Nyiracongo lavas, that are also rich in iron and alkaline-earth elements.

The first viscosity measurements show that the viscosity variations depending on chemical composition cannot be reproduced using an ideal mixing model of the configurational entropy. Consequently, it appears that Na and K elements do not mix randomly in the studied iron-aluminosilicate melts. We plan to present and discuss new viscosity, Raman and Xanes at the Fe K-edge data and try to establish some links to better understand magmatic processes.

Keywords: aluminosilicate glasses, redox, lava, viscosity.

Reference: Losq C. and Neuville D.R. (2013) Effect of K/Na mixing on the structure and rheology of tectosilicate silica-rich melts. Chemical Geology, 346, 57-71.