The effect of the Na/K ratio on the viscosity and structure of iron-bearing aluminosilicates

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Le Losq and Neuville (2013) have shown that the viscosity and structure of silica-rich alkali tectosilicate glasses and melts do not follow ideal mixing rules, which imply a decrease followed by an increase of the melt 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 the work presented here is to test the mixing effect of Na/K on SiO_2-poorer compositions, such as those of the Yasur basaltic-trachyandesites or of the Nyiragongo nephelinitic lavas, that are also rich in iron and alkaline-Earth elements.

Our first measurements show that viscosity increases with Na/K substitution. Therefore its variations with chemical changes 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

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