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Phase equilibria and fractionation of 2010 Eyjafjallajökull flank basaltic eruption

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Geophysical studies have shown the important role played by magma intrusion in triggering the 2010 Eyjafjallajökull volcanic eruption (Sigmudson et al., 2010, Nature 468, 426-430). How these processes have been recorded in the magmatic phase equilibria is of large interest in order to get textural and compositional interpretations to volcanic products. Scoria sampled from the flank basaltic eruption have been studied with the purpose of identifying changing mineral-melt relations in response to physical changes in the pre-eruptive magma chamber. Particular attention is paid in this preliminary study to the major element composition of glass inclusions in plagioclase and pyroxene as well as glass compositions of the groundmass. A fractionating compositional trend is obtained that is compared with model liquid lines of descent calculated with MELTS code. An anomalous fractionation pattern is characterized by a continuous increase in Ti with ongoing fractionation. The continuous Ti enrichment is contrary to the typical tholeiitic trend in which Ti displays a maximum at about MgO=5 wt% and decreases to fractionated terms. The analyzed melt inclusions follow a continuous increasing trend reaching values of about TiO2=5 wt% for MgO=2.5 wt% and TiO2=10 wt% for the most evolved melts of the matrix with MgO<2 wt% This behavior of Ti as an incompatible element for low MgO contents may indicate very low pressure of fractionation of about 300 bars or less in a system buffered around QFM conditions. The combined study of mineral assemblage, mineral composition and liquid trend evolution may help to constrain pre-eruptive conditions and to identify possible effects of magma replenishment previous to eruption.