Geophysical Research Abstracts
Vol. 13, EGU2011-3713, 2011
EGU General Assembly 2011

Mössbauer Spectroscopy and Electron Microscope Imaging of Samples from the 2010 Flank Eruption at Eyjafjallajökull

Haraldur Páll Gunnlaugsson (1), Kristine Albers Olsen (2), Sigurdur Steinthorsson (3), and Per Nørnberg (2)

(1) Department of Physics and Astronomy, Aarhus University, DK-8000 Aarhus C, Denmark (hpg@phys.au.dk), (2) Department of Earth Sciences, Aarhus University, DK-8000 Aarhus C, Denmark, (3) Institute of Earth Sciences, Askja, University of Iceland, IS-101 Reykjavik, Iceland

The 2010 flank eruption at Eyjafjallajökull (Iceland) preceded the summit eruption that produced large amounts of fine ash, disturbing air traffic across the N-Atlantic and within Europe. Two samples were investigated, a tephra sample of relatively fast cooled material, and a rock sample from the lava flow.

The Mössbauer spectra of the tephra sample shows lines originating from Fe^{3+} and Fe^{2+} in glass and Fe^{2+} in olivine. Details reveal that some small fraction of the Fe^{2+} assigned to glass must originate from Fe^{2+} in pyroxenes. The $Fe^{3+}/Fe_{\mathrm{Tot}}$ ratio of the glass suggests crystallization close to the magnetite/hematite buffer 2.5 log units above the FMQ buffer.

Mössbauer spectroscopy of the rock sample is consistent with a high oxidation state as 36% of the area of the Mössbauer spectra are assigned to Fe in titanomaghemite and hematite. Detailed analysis shows that no additional olivine has formed in the crystallization process.

Due to the high oxidation state, high amounts of Fe have been incorporated into the groundmass plagioclase. Analysis of Fe in pyroxenes and plagioclases indicate oxygen fugacity 3.5-5.5 log units above the FMQ buffer, suggesting that the melt oxidized in the cooling and crystallization process. Conversely, Fe is much lower in plagioclase phenocrysts, and FeTi-oxide oxygen geobarometry indicates “normal” (FMQ) oxidation state in the mantle at depth.

Þór Kristjánsson and Ármann Höskuldsson are acknowledged for providing the samples.