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Mössbauer Spectroscopy of Samples from the 2010 Eyjafjallajökull Summit Eruption

Haraldur Páll Gunnlaugsson (1), Sigurdur Steinthorsson (2), Niels Oskarsson (2), Morten Bo Madsen (3), Per Nørnberg (4), and Jon Merrison (1)

(1) Department of Physics and Astronomy, Aarhus University, DK-8000 Aarhus C, Denmark (hpg@phys.au.dk), (2) Institute of Earth Sciences, Askja, University of Iceland, IS-101 Reykjavik, Iceland, (3) Niels Bohr Institute, University of Copenhagen, DK-2100 Copenhagen Ø, Denmark, (4) Department of Earth Sciences, Aarhus University, DK-8000 Aarhus C, Denmark

The 2010 Eyjafjallajökull summit eruption (Iceland) [1] produced large amounts of fine ash, disturbing air traffic across the N-Atlantic and within Europe. Mössbauer spectroscopy of ash-samples has been performed to study the material properties and to gain insight into why the volcano produced so vast amounts of fine grained material.

Two samples were investigated; an ash sample collected at Sólheimasandur 5 km South of the summit, originating from a fallout on 17/4 2010 and a lava bomb collected 8/5 by P. Allard close to the summit (PAA8510).

The ash sample was separated into six size bins using sieves. Only the smallest size (< 38 μm) showed significantly different Fe^{3+}/Fe_{Tot} ratio while other samples consistently show an Fe^{3+}/Fe_{Tot} ratio of 0.26. The smallest fraction was further separated by settling (Stokes law) in a tube, and the fraction with average diameter of 4 μm showed Fe^{3+}/Fe_{Tot} ratio of 0.43. All Mössbauer spectra could be analyzed in terms of paramagnetic Fe^{2+} and Fe^{3+} together with $\sim$21% fraction of Fe in titanomagnetite ($Fe_{3-x}Ti_xO_3$) with $x \sim 0.60(5)$. The Mössbauer parameters of the Fe^{2+} and Fe^{3+} fractions deviate from idealized glass parameters suggesting $\sim$ 12% of the Fe being present in pyroxenes.

Absence of any chemical trend for different grain-sizes and the Mössbauer results suggests homogeneous source material. This furthermore suggests that the smallest fraction may have formed in oxidizing phreatomagmatic steam explosions, raising the ferric level of the smallest particles above the average. Such trends are not seen in mechanically crushed samples of basalts.

The lava-bomb sample shows lower Fe^{3+}/Fe_{Tot} ratio of 0.16, and contains $\sim$ 34% of titanomagnetite with $x \sim 0.70(5)$ and $\sim$ 17% of Fe in olivine. The presence of olivine can results from basaltic melt similar to that of the 2010-Flank eruption at Fimmvörduhals [2] mechanically mixed into silicic material from the 1821-1823 eruption in Eyjafjallajökull [3].

[1] Freysteinn Sigmundsson, *et al.*, Intrusion triggering of the 2010 Eyjafjallajökull explosive eruption, *Nature* **468** (2010) 426.

[2] H. P. Gunnlaugsson *et al.*, Mössbauer spectroscopy of samples from the Flank eruption at Fimmvörðuháls 2010, this conference.

[3] G. Larsen *et al.*, Geochemistry of historical-age silicic tephras in Iceland, *The Holocene* **9** (1999) 463.