ABSTRACT (Dissertation Schattel)

Iceland is mainly made up of basaltic rocks, but up to 10% are of silicic origin. These silicic magmas often have widespread ash dispersals and are therefore a threat to our modern live. However, factors controlling the origin of silicic magmas on Iceland are still poorly constrained. This is a comprehensive study of the major geochemical parameters of silicic magma as recorded in Holocene tephra, namely temperature (T), pressure (P), water pressure (**p**H2O), oxygen fugacity (**f**O2) and oxygen isotopes (**δ**18O). The volcanic centers used in this study represent all the major tectonic settings (rift zone, propagating-rift zone, seismic zone and off-rift zone), to determine the relationship between the geochemical parameters and the region of origin of the magma. Rift-zone silicic magmas (Askja and Krafla) from the active spreading center originate at the highest temperatures (> 900 °C), in shallow, oxidized magma chambers (**Δ**QFM = 1.4; < 1.8 km) with low magma water content (2.1 - 2.5 wt%) and low **δ**18O (1.3 - 3.1‰). Rhyolites from the southwards propagating rift (Torfajökull and Katla) originate at high temperatures (~900 °C) and shallow depths, they show lower oxygen fugacity (**Δ**QFM = -0.2), showing intermediate water contents and **δ**18O values (H2O up to 4.8 wt%; 2.5 - 2.8 ‰). Silicic magmas from the seismic zone (Hekla), connecting the segments of the active spreading center and from the off-rift systems originate at the lowest temperatures (850 - 900°C), from the deepest depths (off-rift 4 - 6 km, seismic zone 6 - 10 km), at the lowest oxygen fugacity (**Δ**QFM = -0.9 - -0.1) and mantle-like **δ**18O values (**δ**18O = 5.0 - 6.0). While offrift systems originate with intermediate to high water contents (up to 5.4 wt%), seismic zone magmas show water contents as high as in the most H2O rich subduction zone magmas (> 7.8 wt%). The oxidized nature and low oxygen isotopic composition of silicic magmas on Iceland that formed in mature rifts indicate that assimilation of hydrothermally-altered crustal rocks by hot mantle melts after hydrothermal preconditioning that reduced **δ**18O is an important process affecting these magmas. Since data on oxygen fugacity on Iceland and elsewhere is rather rare, a new method to estimate oxidation state of silicic magmas relative to the Quartz-Fayalite-Magnetite buffer (**Δ**QFM) was established. This has conventionally required compositional analysis of co-existing magnetite and ilmenite in the volcanic rock. We used a set of 30 natural compositions of silicic glasses coexisting with magnetite and ilmenite to calibrate an empirical equation relating **Δ**QFM with SiO2 and Fe# in glass. It has been shown that SiO2 and Fe# are closely linked to the oxidation state of the magma. Redox conditions of the magma at depth can be preserved in silicic glasses / obsidians and is not affected H2O degassing, enabling us to use glass for oxybarometer calibrations. The equation predicts **Δ**QFM with a precision of ±0.3 log units (2**σ**) for the range of SiO2 in glass from 60 to 78 wt% and **Δ**QFM from -1 to + 2.5, covering the prevailing redox conditions in the Earth crust. Testing our equation using experimental data on the composition of 108 silicic melts saturated with magnetite ± ilmenite under controlled oxygen fugacity reproduces the experimental **Δ**QFM with a precision of ±1.0 log units (2**σ**) from 0 to + 3.5 **Δ**QFM. This new oxybarometer can be applied to estimate equilibrium **Δ**QFM for a wide range of natural silicic glasses, aphyric rocks or melt inclusions that may not preserve magnetite and ilmenite.