Geophysical Research Abstracts
Vol. 16, EGU2014-5977, 2014
EGU General Assembly 2014

Disequilbrium plagioclase in Icelandic magma chambers

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The Austurhorn intrusive complex of southeast Iceland represents the exhumed roots of a ∼6 Ma central volcano. A modally layered gabbro occupies the central part of the complex. The outer part is dominated by granophyre which frequently carries pillow- or sheet-like enclaves of basalt, interpreted to reflect mafic magma intruded into a molten rhyolitic magma chamber. Some of the basaltic pillows are highly plagioclase-phyric (20–30%) and carry macrocrysts with cores that are more primitive (An85–75) than overgrowth rims and groundmass grains (An67–43), indicating disequilibrium with the host melt.

The layered gabbro comprises more than 800 m of cpx + plag ± ol ± Fe-Ti oxide cumulates and can be divided into at least 8 macrorhythmic units formed by repeated injections of mafic magma. Two distinct populations of high- and low-An plagioclase crystals have also been identified in the gabbro. The high-An grains are typically 2–4 mm, prismatic to tabular in shape and have bytownite cores (An87–69) abruptly zoned to labradorite rims (An65–55). The low-An grains (An69–55) are smaller (1–2 mm), typically lath-shaped and weakly zoned (ΔAn $\leq$ 7 mol.%). Microdrilling followed by TIMS Sr isotope analyses of high- and low-An plagioclase grains indicate that the rims of the high-An grains ($^{87}Sr/^{86}Sr$ = 0.70337-0.70340) are in isotopic equilibrium with the low-An grains (0.70338). The cores of the high-An grains, however, are generally more radiogenic (0.70342-0.70344) than coexisting rims, indicating a xenocrystic origin.

We suggest that the high-An plagioclase macrocrysts of the basalt enclaves and the layered gabbro are two of kind and grew in a deeper, more primitive magma chamber. The macrocrysts were entrained by genetically unrelated magmas and were carried into the Austurhorn plumbing system during magma recharge events. The low-An grains, on the other hand, are interpreted to record in situ growth.