S6. IGNEOUS PETROLOGY

Relationship between plagioclase shape, size and density during the cooling of a basaltic andesite under various pre-treatment conditions

Billon M.*[1], Charlier B.[1], Namur O.[2] & Vander-Auwera J.[1]

1. Department of Geology, University of Liège, Belgium

2. Department of Earth and Environmental Sciences, University of Leuven, Belgium

melvyn.billon@uliege.be

Experimental studies of dynamic crystallization are important to better understand the different parameters (cooling rates, temperature, pressure) leading to the different terrestrial or extra-terrestrial rock textures. In most studies, the starting material (synthetic or natural) is preheated over the liquidus to ensure a homogeneous melt [1]. However, some studies have shown the impact of relic crystals on the texture and density of newly formed crystals and crystal overgrowths [2-4].

In this project we conducted a series of experiments at 1 atm to determine the nucleation and growth rates of plagioclase as a function of the initial thermal treatment above the liquidus as well as the presence or absence of plagioclase seeds in the starting material. Experiments were conducted on an anhydrous natural basaltic andesite from Osorno volcano (Central Southern Volcanic Zone, Chile) under NiNiO oxygen fugacity conditions (buffered with a CO-CO_2 gaz flow). Three series of cooling-driven experiments were conducted and quenched at 1100-1165°C: (A) initial equilibration at 1190°C, ~10°C above the for 24h followed by different cooling rates (1°C/h, 3°C/h, 9°C/h); (B) Initial equilibration at 30°C to 50°C above the liquidus followed by a cooling rate of 1°C/h; (C) initial heating at 1450°C followed by a 1°C/h cooling rate. The series (A) is supposed to retain a certain number of germs from the starting material. The growth and nucleation rates of plagioclase have been determined by batch method (image analyses) and maximum size (lmax). The results show a great variability of texture ranging from few large skeletal crystals to abundant, small, tabular/bladed crystals in 2D sections. The degree of superheating and the presence or absence of an initial dwell time near the liquidus modify the presence of plagioclase seeds (>70 An mol%) as well as the size and texture of new plagioclase for which nucleation is delayed by overheating. We also observe a large variability of plagioclase shape in a single sample for each degree of undercooling that we tested.

[1] Pupier, E. et al. (2008): Contrib. Mineral. Petr., 155, 555.

[2] Lofgren, G.E. (1983): J. Petrol., 24, 229-55.

[3] Fokin, M. et al. (1999): J. Non-Cryst. Solids, 258, 180-186.

[4] Auxerre, M. et al. (2022): Meteorit. Planet. Sci., 57, 1474-1495.

plagioclase, nucleation, superheating

Poster