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Effect of sonic and ultrasonic frequencies on the crystallization of basalt

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ABSTRACT

Experiments were conducted to determine whether vibrations with frequencies in the sonic to ultrasonic range have any effect on the crystallization of basalt. One-atmosphere melting experiments were done at the QFM buffer on a sample of alkali basalt. A piezoelectric quartz crystal and a function generator were used to generate waves of 1.5 MHz and 150 kHz, and waves were propagated along the platinum quench wire to which the experimental charge was attached. Experiments were conducted at 1182 °C; at this temperature the sample was about 25% crystalline and contained olivine and plagioclase. Compared to the static control experiments, vibrated experiments produced plagioclase crystals that were less euhedral and had lower aspect ratios. Crystal size distributions for plagioclase were steeper for the vibrated experiments, with a higher population density of smaller crystals. The effect on olivine crystal size distributions was less. If the effect on plagioclase extends to lower vibrational frequencies, it is possible that this phenomenon may occur in magmas prior to eruption. The experimental technique developed to produce vibrations is potentially useful for improving homogeneity of melt and increasing likelihood of achieving mineral-melt equilibrium in partitioning experiments.