Crystal Growth in Shallow Magmatic Chambers and Capture of Melt Inclusions in Phenocrystals (Examplified by Basalts of Juan-de-Fuka, East Pacific)

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The crystal growth experiments show that a capture of fluid is a result of crystal interface instability. Supersaturation gradients at interface are shown to be of great importance in formation of fluid inclusions in synthetic crystals. Causes of fluid inclusions formation in nature are much complicated. To investigate melt inclusion entrapment mechanisms we studied plagioclase, olivine and pyroxene phenocrystals from Juan-de-Fuka gialobasalts. Previous studies have shown that crystallization of gialobasalts began in shallow magmatic chamber.

Our study revealed that the crystallization begins with the plagioclase (An72-86) at temperatures higher than 1200C. Olivine (Fo82-83) and clynopyroxene (Mg#=0.83-0.86) join the plagioclase at 1160-1190C. The crystallization occur at low undercooling which results in euhedral plagioclase and olivine crystals with scarce single melt inclusions. Nevertheless, the pyroxene interface appears to be unstable and leads to capture of abundant inclusions.

Eruption and melt transportation lead to tearing off and partial dissolution of olivine and pyroxene of crystallized crust of chamber. Outpooring of lava to ocean floor is accompanied with growth of platelet and rarely skeletal plagioclase, and skeletal olivine phenocrystals. These phenocrystals are similar in composition to the earlier ones, but contain abundant melt and fluid inclusions. The glasses of melt inclusions reveal the same compositions as the glroundmass glass. It is suggested that capture of melt inclusion occur at abrupt increase of undercoolling. The concervation of inclusions occur at skeletal growth or regeneration of resorbed surfaces of phenocrystals.

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