EVIDENCE OF COMPACTION IN GRANITE BELOW A MAFIC SHEET IN THE VINALHAVEN PLUTON, ME

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Field relations indicate that the Vinalhaven pluton was constructed by multiple replenishments of mafic and felsic magma into an active, late Silurian magma chamber. Although the pluton is mostly granite, gabbro sheets are common. Each gabbro sheet may represent a snapshot (in time) of the chamber floor (in other words, the subhorizontal boundary between mostly liquid magma and underlying crystal mush). Therefore, deformation in granites beneath mafic sheets may yield information about the thickness of crystal mush at the floors of active magma chambers and about mechanisms by which granites acquire magmatic fabrics.

The purpose of this study is to test the hypothesis that granites below mafic sheets in the Vinalhaven pluton record compaction of granitic crystal mush beneath a mafic sheet. Here we report new data from granite beneath one mafic sheet, which is locally subvertical, striking 080-120º. Subhorizontal felsic pipes in the mafic sheet indicate that it rotated into its current orientation after crystallization. We gathered two samples of granite from beneath the mafic sheet: one at the contact, the other 2 m away. We measured two kinds of fabrics in these samples: shape-preferred orientation of sub-equant feldspar crystals 0.5-2.0 cm long (SPO) and AMS. The results from the two methods agree well. In both samples, foliation strikes 150º and dips 70º to the west; lineation is down-dip. There is no apparent variation in the intensity of the fabrics between the two samples. We interpret these fabrics as magmatic (i.e. not solid-state) in origin because there is no evidence of fracturing or crystal-plastic deformation of any grains. We infer that the fabrics are related to the emplacement of the mafic sheet because: (1) one sample is literally at the contact, and (2) the orientation of the foliation is similar to the orientation of the base of the mafic sheet (both are very steep, but the strikes diverge by at least 30º). This interpretation suggests that the zone of crystal mush at the base of the active magma chamber was at least 2 m thick and reacted to the sheet's emplacement in a rheologically and kinematically homogeneous manner. Some features of the fabric that we cannot yet explain are the magmatic lineation and the obliquity of the foliation to the base of the sheet.