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Anorthosites at Hrappsey, Iceland

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The Hrappsey islands, Breidafjördur, West Iceland, consist of anorthosite and dolerite emplaced into Neogene flood basalts. The anorthosite is coarse grained, sometimes layered and includes "igneous breccias" with up to m–sized anorthosite blocks in a coarse dolerite matrix. The anorthosite is composed of calcic plagioclase ($An_{65–83}$), it is texturally heterogeneous and comprises: *i*) coarse anorthosite with plagioclase crystals up to 6 cm, often with augite inclusions (<2 mm); *ii*) massive anorthosite with grain size <1 cm, locally grading into gabbro and pyroxenite; *iii*) mottled anorthosite with 5–20 cm thick mesocratic layers rich in pyroxene oikocrysts up to 15 cm. Outcrops of "igneous breccia" are up to several hundred metres across and the blocks are exclusively of the anorthosite types described above. The blocks vary from angular to rounded, and often make up 60–80 % of the breccia. The anorthosite bodies are cut by basaltic and coarse grained dolerite dykes with rare plagioclase pheno– or xenocrysts compositionally similar to the anorthosite. The coarse dolerite surrounding the anorthosite, postdate the anorthosite. The "igneous breccias" show that the dolerite fragmented the anorthosite..

Our working hypothesis is that the Hrappsey anorthosite was emplaced as a sill, or lopolith, more than 10 km^2 in lateral extent and more than 30 m thick, into its present position. The plagioclase crystallized from tholeiite at 0.5–1.1 GPa, then rose to 0.03-0.3 GPa where the anorthosite accumulated, and finally blocks of anorthosite were brought up to <0.03 GPa in a dolerite sill [1]. Following solidification, the anorthosite was invaded, fragmented and tilted by later intruding dolerite. We suggest that the anorthosite at Hrappsey crystallized from a tholeiitic basalt that experienced pronounced adiabatic decompression and degassing during ascent, both effects expanding the stability of plagioclase over pyroxene and olivine..

Reference

[1] Kristmannsdóttir, H. J. *Geol.* **79** (1971) 741-748.

5.4.P01

Structural and magnetic role of iron in obsidians

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The process of formation and the structure of volcanic glasses are not well known. These glasses can either result from the cooling of a visqueous magma (obsidians) or from the quench of a more fluid magma (basaltic glass). Iron has long been known to play an important role in determining the properties of natural magmatic liquids. The determination of the sites occupied by ferrous and ferric cations in volcanic glasses gives information on cooling conditions. However, the exact location of iron in the glassy matrix and the geometry of the sites are still poorly understood due to the complex structure of amorphous materials.

Optical absorption spectra are selectively sensitive to the geometry of the sites occupied by ferrous and ferric cations in the glass structure and to the diffusion mechanisms. At room temperature, silicic glasses (obsidians) show absorption spectra which are totally different from those obtained on synthetic glasses containing iron. Optical absorption spectra of Fe2+ in synthetic glasses features usually a broad high-intensity asymmetric band located around 10000 cm-1 while in obsidians, a band is found with a similar intensity but at lower wavenumber (around 8500 cm-1). The shape of this band depends on the composition and evidenced a site distribution in synthetic glasses while in silicic volcanic glasses, the gaussian shape of the band may be related to a modification of the Fe-coordination state. Isolated Fe3+ in the glassy matrix is responsible for low-intensity absorption bands laying on the front edge of a charge transfer band occuring in the UV range. It is possible to show that no scattering process exists in synthetic glasses while in silicic volcanic ones, these scattering mechanisms may be simulated by a Rayleigh function. In both types of glasses charge transfer phenomenon can be modeled by an Urbach law or by a Gaussian function depending on the glass. Low temperature spectra of obsidians revealed peculiar features, which will be discussed. These obsidians have been tested to be used as possible paleomagnetic references to complete, in a magmatic series, the study of the rapid variations of the terrestrial magnetic field. The use of such silicic glasses would also extend the paleomagnetic studies in regions where basaltic rocks or sediments that carried reliable magnetization are not available.