Geophysical Research Abstracts
Vol. 16, EGU2014-13554-1, 2014
EGU General Assembly 2014

Melt segregation in a gabbroic intrusion studied by means of AMS

David Floess (1), Luca Caricchi (1), and Simon Wallis (2)
(1) University of Geneva, Switzerland (david.floess@unige.ch), (2) Nagoya University, Japan

The Miocene Muroto Gabbroic Intrusion (MGI) at Cape Muroto, Japan is a layered sill and displays spectacular evidence of melt segregation (Yoshizawa, 1953). Felsic melts separated from the mafic mush to form individual, anorthositic melt lenses in the central portions of the 230m thick sill. We sampled across the entire sill at intervals of 10m, with a special focus on the zone displaying melt lenses (5m sample interval). Oriented hand specimens were cored in the lab for measurement of the Anisotropy of Magnetic Susceptibility (AMS).
Bulk susceptibilities range between 2.7x10-3 and 37.7x10-3 SI with a mean value of 16.3x10-3 ± 7.2x10-3 SI. The degree of anisotropy (Pj) is predominantly low (<1.12) and the highest values can be found in the center of the MGI. The shape parameter (T) ranges from oblate (0.95) to prolate (-0.9) but its distribution is not random throughout the sill. T switches from predominantly prolate to oblate at around 75m from the bottom of the sill. From 150m above the bottom to the top of the sill, T is more variable. The orientation of the major axis of the AMS ellipsoid (K1) is relatively variable throughout the sill but steadily converges to a sub-horizontal orientation between 50m and 110m from the bottom. The minor axis (K3) is mainly subvertical, when K1 is horizontal.
Field and thin section observations suggest that the sill did not record intense deformation after solidification. Bulk susceptibilities and thermomagnetic curves suggest that the AMS signal is dominated by titaniferous magnetite.
MELTS (Gualda et al. 2012) modeling indicates the crystallization of Fe-Ti oxide at 1075°C upon cooling of the sill, a temperature corresponding to a crystal fraction of ~0.55. Hence, crystallization of the AMS signal carrier occurs once the silicates formed a rigid framework. Crystallization of the AMS signal carrier in the residual, melt-filled pore space may record valuable information about the separation of melt from a partially crystallized mush. In the MGI, this is supported by the conspicuous AMS parameters and orientations towards the central portion of the sill, where melt segregation is evident from field observations.

Gualda et al., 2012, J.Pet, v. 53, p. 875-890.
Yoshizawa, 1953, Mem.Col.Sci.Univ.Kyoto, v. 20, p. 271-284.