Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04827, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04827
EGU General Assembly 2008

Melt migration in partially molten upwelling mantle

I. J. Hewitt (1) and A. C. Fowler (2,1)

(1) Mathematical Institute, University of Oxford, (2) Department of Mathematics and Statistics, University of Limerick (hewitt@maths.ox.ac.uk/Phone: +44 1865 270517)

Upwelling mantle rock beneath mid ocean ridges and in mantle plumes undergoes partial melting, resulting in a porous matrix through which the produced magma rises buoyantly. There is evidence to suggest however that the magma flow does not always remain distributed evenly but must evolve into high porosity melt channels which allow for more efficient transport.

We present a mathematical model for such upwelling regions which accounts for both the production and migration of magma, along with the convection and compaction of the mantle rock. Melting is principally driven by the advection of heat from below, and by explicitly accounting for the heat transport we are able to predict where and how much partial melting occurs.

Moreover we find that the flow is subject to a melting instability in which regions of increased porosity undergo enhanced melting which leads to a positive feedback and melt channel formation. The process is similar to that of the 'Reactive Infiltration Instability', except that it results from the melting itself, and is therefore a fundamental feature of magma production and migration.