



The escape of melt in the crust: insight from two phase flow modelling

Alexis Plunder, Laetitia Le Pourhiet, Ludovic Raess, Charles Gumiaux,
Michel Pichavant

► To cite this version:

Alexis Plunder, Laetitia Le Pourhiet, Ludovic Raess, Charles Gumiaux, Michel Pichavant. The escape of melt in the crust: insight from two phase flow modelling. EGU General Assembly 2019, May 2019, Vienne, Austria. pp.2019 - 18610. hal-02093799

HAL Id: hal-02093799

<https://brgm.hal.science/hal-02093799>

Submitted on 9 Apr 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



The escape of melt in the crust: insight from two phase flow modelling.

Alexis Plunder (1,2), Laetitia Le Pourhiet (2), Ludovic Raess (3), Charles Gumiaux (4), and Michel Pichavant (4)

(1) BRGM, F-45060 Orléans, France, (2) ISTE, Sorbonne Université, 4 place Jussieu, 75005 Paris, France, (3) Dept. Geophysics, Stanford University, Stanford CA, USA, (4) ISTO, Univ. Orléans, 45000 Orléans, France

In the continental crust, silicate rich melts with their range of composition are one of the prime sources of ore on Earth. Understanding how such fluids propagate and interact with the lithosphere is therefore of prime interest to study (i) the long-term lithospheric dynamics with emphasis on its deformation and the weakening effects related the weakening properties of fluids or (ii) to predict how ore concentration can form, in relation with the deformation and/or the chemical evolution of the melts and simply (iii) how pegmatite are emplaced. Generally speaking, pegmatites are igneous rocks, most of the time with a granitic composition and are characterised by a crystal growth dominated texture (with graphitic intergrowth). They are often enriched in rare elements such as Li, Cs, Be, Ta, (amongst others) offering valuable ore deposit of economical interest and they produce amongst the purest minerals used in the ceramic industry (e.g. quartz, feldspar, mica...). Recent experimental constraints show that pegmatitic melt must have crystalized ca. 130°C below their solidus ($\sim 630^{\circ}\text{C}$ at 2 kbar), and thus be emplaced extremely fast. In nature we observe pegmatite as fields at different crustal levels (lower to mid, mid and upper levels). Statistical approaches show that the organisation of a pegmatite field is directly related to the host rock: clustering along brittle fault in the upper levels, scattering in the mid to lower crustal levels. Here, we use the finite difference approach to solve for this two-phase flow problem. The formulation couples a Stokes solver to predict the deformation of the porous matrix to a non-linear Darcy flow representing the pore fluid. The code run on GPU(s) (Graphic Process Unit) allowing fast and high-resolution calculation in order to bypass problems related to the dependence on the grid resolution. Here, we show that we reproduce the first order geometry of a pegmatite fields using a numerical modelling approach. We discuss our results and discuss the effects heterogeneities in the host porous media.