

Energy conservation law in an open magma system: application to a 1-D steady state melting model

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An energy conservation equation appropriate for extracting information on open magmatic processes from chemical compositions of natural rocks is formulated and applied to 1-D steady-state equilibrium melting. This model allows to investigate open-system decompression melting beneath mid-ocean ridges. We adapted melting experiments of Walter and Presnall (1994) in the Ca-Mg-Al-Si-Na system for required thermodynamic relations. Because most of melting beneath ridges takes place in five phase assemblage, all the phase compositions are uniquely determined for a given pressure and temperature. By virtue of this, melt-solid reaction stoichiometry can be specified for a given bulk composition, which is dependent on open processes as well as the initial peridotite composition.