Geophysical Research Abstracts
Vol. 16, EGU2014-1329, 2014
EGU General Assembly 2014

Dynamics of upper mantle rocks decompression melting above hot spots under continental plates

Yury Perepechko, Konstantin Sorokin, and Victor Sharapov

Institute of Geology and Mineralogy, Geodynamics, Novosibirsk, Russian Federation (igor.ashchepkov@igm.nsc.ru, +7 (383) 333-27-92)

Numeric 2D simulation of the decompression melting above the hot spots (HS) was accomplished under the following conditions: initial temperature within crust mantle section was postulated; thickness of the metasomatized lithospheric mantle is determined by the mantle rheology and position of upper asthenosphere boundary; upper and lower boundaries were postulated to be not permeable and the condition for adhesion and the distribution of temperature (1400-2050°C); lateral boundaries imitated infinity of layer.
Sizes and distribution of lateral points, their symmetry, and maximum temperature varied between the thermodynamic condition for existences of perovskite - majorite transition and its excess above transition temperature. Problem was solved numerically a cell-vertex finite volume method for thermo hydrodynamic problems.
For increasing convergence of iterative process the method of lower relaxation with different value of relaxation parameter for each equation was used. The method of through calculation was used for the increase in the computing rate for the two-layered upper mantle - lithosphere system. Calculated region was selected as 700 x (2100-4900) km. The time step for the study of the asthenosphere dynamics composed 0.15-0.65 Ma.
The following factors controlling the sizes and melting degree of the convective upper mantle, are shown: a) the initial temperature distribution along the section of upper mantleb) sizes and the symmetry of HS, c) temperature excess within the HS above the temperature on the upper and lower mantle border TB=1500-2000oC with 5-15% deviation but not exceed 2350oC.
It is found, that appearance of decompression melting with HS presence initiate primitive mantle melting at TB > of 1600oC. Initial upper mantle heating influence on asthenolens dimensions with a constant HS size is controlled mainly by decompression melting degree.
Thus, with lateral sizes of HS = 400 km the decompression melting appears at TB > 1600oC and HS temperature (THS) > 1900oC asthenolens size $\sim$700 km. When THS = of 2000oC the maximum melting degree of the primitive mantle is near 40%. An increase in the TB > 1900oC the maximum degree of melting could rich 100% with the same size of decompression melting zone (700 km).
We examined decompression melting above the HS having LHS = 100 km - 780 km at a TB 1850– 2100oC with the thickness of lithosphere = 100 km.It is shown that asthenolens size (Lln) does not change substantially: Lln=700 km at LHS = of 100 km; Lln= 800 km at LHS = of 780 km. In presence of asymmetry of large HS the region of advection is developed above the HS maximum with the formation of asymmetrical cell. Influence of lithospheric plate thicknesses on appearance and evolution of asthenolens above the HS were investigated for the model stepped profile for the TB $\leq$ of 1750oS with Lhs = 100km and maximum of THS =2350oC. With an increase of TB the Lln difference beneath lithospheric steps is leveled with retention of a certain difference to melting degrees and time of the melting appearance a top of the HS. RFBR grant 12-05-00625.