The thermodynamic modeling of downwelling limb of a hydrothermal cell at slow-spreading ridges with the solid solution data using

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The main goal of this investigation is determination of differences in thermodynamic modeling of descending path of hydrothermal cell with the use of “simple” mineral and solid solution data. Calculations were implemented on a basis of complex GEOCHEQ including program of equilibrium calculation and thermodynamic data base [Mironenko et al, 2001].

Two series of calculations with one algorithm were realized. I used “simple” mineral data in the first case (control calculation). There are 7 solid solutions in the second case: aragonite-strontianite, Ca-Mg-Na saponite, Mg-Fe chlorite, chrysotile-greenalite, Mg-Fe olivine, Mg-Fe talc, Mg-Fe tremolite. The modeling is carried out on base of thermodynamic calculations of the interaction between percolated sea water and peridotite substratum. Calculation follows by flowing reactor method. This reactor is consists of 22 consecutive blocks at T = 19° – 482°C, P = 0.48 – 3.92 kbar and W/R = 1438 – 2.

Received data for the system with solid solutions were normalized to the control calculation’s result. To estimate this value has been carried next inferences:

Chemistry of fluid -

Take place the difference in the trend of carbon compounds after the derivation of aragonite. Carbon compounds have an increase of 65% in the case with solid solutions. Sulphates have an increase of 15% during high temperature (last 3 blocks). Iron anomaly is down 70% (last 3 blocks). It’s related with a character of mineralogy. Sr concentrates more intensive in the rock.

Bulk chemistry of rock -

Some differences take place only in first two blocks. There are Na (-20%), Sr (+80%) and Ca (-10%). It’s related with the derivation of solid solutions of saponites and aragonite-strontianite.

Mineral phases -

Most important differences are related with the formation of saponites and aragonite-strontianite during low temperature and olivine during high temperature. The carbonatization of rock is more intensive in the case with solid solutions. The carbon phase has an increase of Sr (+ 75%). Saponites are charactered by another composition: $Ca_{0,02}Mg_{0,22}Na_{1,53}Mg_{18}Al_2Si_{22}O_{60}(OH)_{12}$. Olivine has more magnesium (the control case - $Fo_{0,89}$, the case with solid solutions – $Fo_{0,98}$).

This investigation has shown that using of solid solutions data don’t change result of calculations greatly. However, some minerals and compounds depend from this method. There are aragonite-strontianite, saponites and olivine.

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