

Experimental investigation of peridotite-basalt-(K, Na)₂CO₃-H₂O system: Effect of T on phase composition and solubility of accessory minerals in silicate melt

KOSTYUK A. V. AND GORBACHEV N. S.

Institute of Experimental Mineralogy RAS, Academica
Osipyana 4, Chernogolovka, Russia. nastya@iem.ac.ru

Experimental study of peridotite-basalt-(K, Na)₂CO₃-H₂O system with accessory minerals (ilmenite, apatite, zircon and pyrrhotite) were carried out at P = 0.5 GPa and T = 1100-1250°C. Experiments were carried out on a high gas pressure apparatus in IEM RAS, using Pt-Pt ampoules with peridotite container method. Prt container with starting mixture of tholeiitic basalt (60%) + (Na, K)₂CO₃ (~10%) + Ilm (5%) + Apt (5%) + Zrn (5%) + Po (5%) + H₂O (10%) placed in to the Pt ampoule and hermetically sealed. Duration of experiment was 48 hours. Products of experiments were studied by scanning electron microscope CamScan MV2300.

We're determining compositions of silicate melts (L_{Sil}), liquidus association and solubility of accessory minerals (AM) in melts. Concentrations of typomorphic elements (C_X) for every AM in L_{Sil} are the indicator of solubility AM under saturation conditions. Thus, for Ilm – it's C_{TiO₂}, Apt – C_{P₂O₅}, Zrn – C_{ZrO₂}, Po – C_{SO₃}.

T = 1250°C. Quenching samples are presented by Ol + Cpx + K-Amf + Phlog association, which cemented by L_{Sil} with inclusions of sulfate (L_{Sif}) and carbonate (Cb) phases. Chr, Ti-Mgt and Zrn are present as an AM. Features of texture (sulfate globules in L_{Sil} matrix) indicate the existence of immiscible L_{Sil} and L_{Sif}. L_{Sil} presented as sub-alkalic andesites (Na₂O + K₂O > 5 wt.%, SiO₂ - 59 wt.%); sulfate globules has anhydrite composition (CaO - 35.7, SO₃ - 36.6) with a high content of P₂O₅ (up to 6 wt.%); carbonate phase has calcite composition.

T = 1100°C. Quenching samples are represented by L_{Sil} coexisting with Ol + Cpx + Amf + Phlog association with AM - Chr, Ti-Mgt, Zrn. The main differences are: the composition of the melt - is basalts normal alkalinity (SiO₂ - 50 wt.%, Na₂O + K₂O ~ 4 wt.%); Cb and L_{Sif} are absent.

As a result, our research found that phase composition and solubility of AM depended on T. C_{ZrO₂} in the L_{Sil} (in equilibrium with Zrn) was much higher at T=1250°C, than at T=1100°C, 1.44 wt.% and 0.66 wt.%, respectively. C_{P₂O₅} and C_{SO₃} conversely decrease with increasing T and equal: C_{P₂O₅} are 0.63 and 0.29 wt.%; C_{SO₃} are 1.0 and 0.65 wt.% at T=1100 and T=1250°C respectively. Ilmenite is completely dissolved and independent on T (C_{TiO₂} in equilibrium with Ti-Mgt ~ 0.4 wt.%).

Supported by grant RFBR № 14-05-00752