



## **Experimental study of eclogite partial melting under influence of H<sub>2</sub>O-CO<sub>2</sub>-KCl fluid at 5 GPa**

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Partial melting is one of spectacular features of eclogite nodules from kimberlites (Sobolev et al., 1999; Spetsius & Taylor, 2002; Misra et al., 2004; Shatskiy et al., 2005 (in Russian)). It was described in eclogite nodules from kimberlite pipes of South Africa (Taylor & Neal, 1985), while the most detailed study of the partial melting was performed for eclogite nodules from Yakutian kimberlite pipes (Bulanova et al., 1980 (in Russian); Bulanova et al., 1993 (in Russian); Novgorodov et al., 1990 (in Russian)). There are two major hypotheses on the origin of eclogite partial melting. The first hypothesis considers a kimberlite magma as an agent of partial melting of nodules (Spetsius, 1999), while the second hypothesis states that the partial melting of eclogite nodules related to the deep-seated fluids penetrating eclogites before the capture of the nodules by kimberlite (Taylor & Neal, 1985; Sobolev et al., 1999; Spetsius & Taylor, 2002; Misra et al., 2004; Shatskiy et al., 2005 (in Russian); Spetsius & Taylor, 2003). In addition, there are petrological and geochemical evidences for relation of the eclogite partial melting with crystallization of microdiamonds or their overgrowth with the formation of «fibrous coats» (Spetsius & Taylor, 2002; Shatskiy et al., 2005 (in Russian)). Thus, the eclogite partial melting could proceed within stability field of diamond, i.e. at pressure above 4.5 GPa.

There are many experimental studies on the partial melting of eclogites (Dasgupta et al., 2006; Hirschmann et al., 2003; Kessel et al., 2005; Kogiso et al., 2003; Pertermann & Hirschmann, 2003; Yaxley & Brey, 2004). But these works were performed at pressures 3-4 GPa, that corresponding to thermodynamical conditions of crust or crust-mantle boundary. Thus, according to studying literal material, the purpose is

creation of experimental model of partial melting of eclogites at high pressures and temperatures, that characterized the thermodynamical stability of diamond conditions.

The present study at 5 GPa and 1200-1300<sup>0</sup>Ñ with participation of the H<sub>2</sub>O-CO<sub>2</sub>+ KCl fluid is a first step to study melting of eclogites of diverse compositions. The following compositions of eclogites were chosen: (1) model eclogite (Prp<sub>80</sub>Grs<sub>20</sub>)<sub>50</sub>(Di<sub>60</sub>Jd<sub>40</sub>)<sub>50</sub>; (2) natural bimineral eclogite from the «Udachnaya» kimberlite pipe, Yakutia. An oxalic acid was taken as a source of the H<sub>2</sub>O-CO<sub>2</sub> fluid.

The following regularities were found in the experiments with the model eclogite Prp<sub>80</sub>Grs<sub>20</sub>)<sub>50</sub>(Di<sub>60</sub>Jd<sub>40</sub>)<sub>50</sub>-(H<sub>2</sub>O)<sub>50</sub>(CO<sub>2</sub>)<sub>50</sub>. Firstly, quantity of the melt regularly increases with the increase of the fluid quantity in the system. At 6 % of the fluid, this melt coexists with pyroxene and garnet. At 8% of the fluid, the melt coexists with garnet only. At near complete melting, corundum and coesite occur. And at 18% of the fluid, no solid phases were observed. The same regularity, i.e. the increase of quantity of the melt with the increase of the H<sub>2</sub>O-CO<sub>2</sub>fluid amount in the system, was established for the melting of the “Udachnaya” eclogite. At 8% of the fluid, the intergranular melt occurs, while at 15% of fluid, large pods of the quenched melt appear in addition to the melt films.

Following to the phase assemblages in the run products, the composition of the melt regularly changes. These regularities can be explained with the following scheme. The eclogite begins to melt with a formation of the melt, enriched in SiO<sub>2</sub> and Na<sub>2</sub>O, reflecting the pyroxene-dominant composition of this melt. With increasing of the degree of melting and quantity of the “garnet component” in the melt, they accumulate Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, but become less alkiline. Composition of the melts is shown on the ternary diagram (SiO<sub>2</sub>+Al<sub>2</sub>O<sub>3</sub>+TiO<sub>2</sub>) – (K<sub>2</sub>O+Na<sub>2</sub>O) – (MgO+FeO+CaO). They form regular trend. According to this trend, composition of the melts from products of eclogite melting (much SiO<sub>2</sub>-components) can form at much lower degree of melting, which correspond to low content of the fluid in the system. Nevertheless, the eclogite melting under influence of the H<sub>2</sub>O-CO<sub>2</sub>fluid only can not explain all unique characteristics of melt composition, for example, their high alkali content with domination of K over Na.

The next stage of the experiments included the eclogite melting under influence of H<sub>2</sub>O-CO<sub>2</sub>+ KCl fluid. Even in the experiments at 1200 and 1300<sup>0</sup>Ñ, the products of complete melting were observe: silicate melt, coexisting with immiscible chloride liquid. These melts are highly alkaline, K predominates over Na, while the Cl content in these melts reaches 3 mas.%. Predomination K over Na is explained by an intensive K-Na exchange between chloride and silicate liquids, the chloride liquid is being enriched in Na. This exchanges and high Cl concentration in the melts cause the abrupt

increase of the melting temperature. These liquids correspond to some compositions of natural melts. Support RFBR: 07-05-0049 and the Program RAS NP9.