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Symplectites in garnet megacrysts captured by alkali mafic magma

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Megacrysts are widespread in Cenozoic alkali-basalts of many volcanic provinces of the world. Garnet megacrysts containing symplectites are the most interesting, as can be used for reconstruction of physical and chemical conditions in liquid basalt at the moment of garnet crystal capture.
The collection of garnet megacrysts and garnet-pyroxene aggregates from Shavaryn-Tsaram (Hangaj plateau, Mongolia) and Bartoj (Dzhida basaltic field, Russia) paleovolcanoes has studied. Cenozoic alkali basaltic volcanism of these two spatially separated areas is considered to be related to a uniform process of lithosphere spreading in Baikal and related Central Asian rift systems.
The studying of garnet-pyroxene aggregate and fragments of garnet megacrysts from these two paleovolcanoes revealed two mineral associations: primary and secondary. The former includes garnet and clinopyroxene, the letter (symplectite) is presented by products of garnet disintegration (clinopyroxene remain unaltered). At least two paragenesis can be allocated: 1) shpinel - plagioclase–olivine sometimes with gedrite and orthopyroxene; 2) olivine (with glass).
Experimental modeling of decomposition process in garnet megacryst has been carried out with the help of ‘Selector’ softwear at various P-T parameters.
Physical and chemical conditions of this paragenesis occurrence have also been estimated by up-to-date geothermometers and geobarometers (T 950-1000 C, P 4-4.5 kbar.
Conclusions: 1. Garnet megacrysts are apparently in non-equilibrium with alkali-basalts. They were formed in conditions corresponding to zones of mantle plums at the bottom of crust, in magmatic chambers at constant infiltration of fluid. Subsequently megacrysts were captured by alkali-basalt magma and taken out to the surface.
2. Kelyphitic rims on garnet megacrysts is a result of partial melting of megacrysts on interaction with the hosting alkali basaltic rock. During melting garnet transforms with the formation of Na-K glass and Mg olivine. Presence of alkaline volcanic glass in the kelyphitic rim testifies that Na and K migrate from alkali-basalt melt.
3. Subisothermal decompression inside garnet crystal yields solid-phase decomposition to form symplectite. Paragenesis of the formed minerals depends on garnet composition, P-T conditions and water presence/absence: 1) at pressure over 10 kbar and temperature more than 1300 C, garnet steadily co-exists with clinopyroxene; 2) at pressure and temperatures decreasing (4-8 kbar, 900-1300 C),garnet decomposes as follows: Sp+Pl+Ol sometimes with Opx, in the presence of water - Sp+Pl+Ol with Opx and Amph; 3) at temperature 950-1000 C and pressure 4-4.5 kbar, the following association is formed Sp+Opx+Pl; 4) if temperatures makes up 700-800 C, at the same pressure P=4 kbar, Sp+Opx+Cpx paragenesis is formed.