KELYPHITES ON GARNETS IN MANTLE XENOLITHS AND KIMBERLITES: COMPOSITION, GENESIS, PETROLOGICAL IMPLICATION.

Vishnevsky Alexei A.

USSR, 252142, Kiev, Palladina av. 34, Institute of Geochemistry and Physics of Minerals Ukr. Acad. of Sci.

COMPOSITION.

Today in kelyphites identified more than fifteen minerals, the most common of wich are phlogopite, clinopyroxene, orthopyroxene, amphibole, chlorite, serpentine, carbonates, minerals of spinel group. On garnets in mantle xenoliths mainly developed two pyroxene - spinel rims, while in kimberlites, in most cases, kelyphites have phlogopite-spinel composition.

Chemical composition of minerals from kelyphites highly specific and variable:
orthopyroxene - Mg/Mg+Fe=0.76-0.97, Al_2O_3=5-13 wt.%, CaO - up to 2.5wt.%
clinopyroxene - Ca/Ca+Mg=0.31-0.57, Mg/Mg+Fe=0.72-0.91, Al_2O_3=4-14 wt.%;
phlogopite - Mg/Mg+Fe=0.78-0.94, Cr_2O_3 - up to 8.9 wt.%;
spinel - Mg/Mg+Fe=0.09-0.86, Cr/Cr+Al=0.01-0.90, etc.
Established positive correlation between content of Cr, Ti, Fe in minerals from rims and its content in replacing garnets.

GENESIS.

I. PT-conditions of formation. Process of formation of kelyphitic mineral aggregates, realized in several stages, in general outline could be conceived in a such way:
first stage - $10 < P < 40$ kbar, $800 < T < 1300^{\circ}C$ - reaction replacement of garnets by high-temperature mineral assemblages, i.e.: Phl+Spl, Phl+Cpx+Spl, Opx+Cpx+Spl, Phl+Opx+Cpx+Spl, Amf+Opx+Cpx+Spl;
second stage - $P < 5$-10 kbar, $T < 800^{\circ}C$ - amphibolization and chloritization of silicate minerals of high-temperature assemblages;
third stage - $T < 400^{\circ}C$ - serpentinization and carbonatization of earlier formed mineral aggregates.

2. Chemical regime. During the process of kelyphitization the most mobile components are Si, Ca, K, Na, H_2O, less mobile - Mg, Al, Fe and inert - Ti and Cr. In all cases take place considerable introduction of H_2O, K, Na and insignificant amounts of Fe into forming coronas. Negative balance shows Si and often Al. Other components (Ca, Mg, Mn) have both - positive and negative balance.

3. Causes, speed and possible mechanism of formation. One of the main factors, wich stipulated the process of kelyphitization, was sharp decrease of pressure at T≈const; the last is a result of rapid ascent of kimberlite magma from mantle to the surface. Other significant cause - action of rich in alkalies and H_2O kimberlitic magma (fluid) on garnets.

On the base of published experimental data we suppose that replacement of garnets by high-temperature assemblages is a transient process, that finished in the majority of cases during a few hours.

Kelyphitization of garnets in mantle xenoliths and kimberlites conceived us as a process of metasomatic replacement of them in the upper mantle. Evidence of that - morphological features of kelyphites, established regularities of migration of components and PT-conditions of process.

PETROLOGICAL IMPLICATION.

Developed notions about nature and conditions of formation of kelyphites allows to discuss a number of questions regards the genesis of kimberlitic rocks. For example, proposed two-stepped scheme of changing of PT-conditions during the ascent of kimberlitic magma to the surface, estimated speed of its ascent, suggested considerations about its chemical evolution during transportation from the mantle, etc.