COMPARATIVE CHARACTERISTIC OF CARBONATITES, KIMBERLITIC CARBONATITES AND CALCIPHYRES AS INDICATORS OF THEIR ORIGIN IN THE LOWER CRUST.

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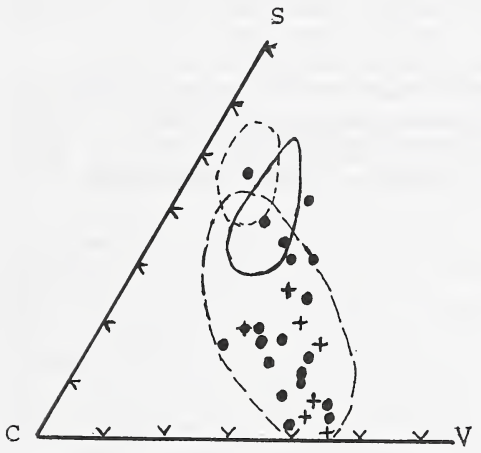
The genetic relationship of carbonatites and kimberlites is shown in many works. Few data have been reported on the carbonatite occurence in the early Precambrian whereas a sufficient number of silicate-carbonate rocks (calciphyres) are known to be embedded in the metamorphic complexes. Traditionally their origin is considered to be sedimentary. However the comparison of mode of occurrence, textures, mineralogical, petrochemical and geochemical composition of calciphyres and carbonatites has shown their total identity. Calciphyres as well as carbonatites form embedded bodies stocks and veins (Shakhov, 1983), have similar interrelations with the wall-rocks, such as grading into pyroxenites and crosscutting relations followed with breccia zones. Among the calciphyres as in the carbonatites there occur varieties filled with the xenoliths of rounded, angular and bandlike forms. Their petrographic composition is identical with that of kimberlites and represented by pyroxenites, hornblendites, crystalline schists and other varieties of metamorphic rocks. All kinds of carbonatite textures occur in calciphyres. Within the basin of the Sutam river (South Yakutia) in the zone of grading from pyroxenite into calciphyre xenomorphic aggregates of carbonate can be observed to fill interstitial openings in the middle of silicates, that is carbonate looks like intercumulate material (Shakhov, 1995). Depending upon the silicate-carbonate ratio along the strike of the grading zone the rock can be observed to change from pyroxenite/verlite through calcite pyroxenite similar to calcite kimberlite of group II (Mitchell, 1986) and finally to calciphyres. A comparison of all the mineral types of calciphyres and carbonatites shows that for every mineral kind of "barren" carbonatite the mineralogically similar variety of calciphyres is found, including diamondiferous types. Only according to data available the melilite and perovskite group is not yet discovered in calciphires. The petrochemical similarity of the latter and carbonatites is represented on J.B. Dawson' triangular diagram (Fig. 1) where the compositional fields and some points coinside. Geochemical similarity of calciphyres and "barren" carbonatites is revealed on Sr-Ba and Ce-La diagrams where the points of ratio values share the common area (Fig. 2a, b). Isotope ratio $^{87}Sr/^{86}Sr$ 0.70462, 0.70470 for the calciphyres of Anabarsky shield (Rozen et al., 1988) and 0.701-0.706 for Grenvill province (Heinrich, 1966) are in the range of values common to the carbonatites.

Discussion: Once a given similarity has been identified, calciphyres could be considered as primitive "barren" carbonatites when by convention the amount of silicates is less than, say, 50% and may correspond to calcite kimberlite when it exceeds 50%. Allowing for differentiation phenomenon in Benfontein kimberlite sills three stages of calciphire formation are traced

in the outcrops: 1) incipience of carbonate liquid in pyroxenite/verlite as the result of fractional crystallization; 2) formation of layers with apophysis; 3) intrusion of crosscutting veins and stocks. On their geochemical particularities the calciphires more similar to kimberlitic carbonatites, having poorer contain of such characteristic elements of carbonatites as Nb, Zr, TR and Sr. Of particular interest is an area at the intersection of compositional fields of carbonatite and kimberlite. Precisely within this area the points of diamondiferous carbonatites of Kazakhstan are situated. It enables us make proposal that calciphyres of the same petrochemical composition may be also diamondiferous. Such type of carbonate rock is known to be described in the Kokchetavsky massive. According to data available the depth of formation of minerals-indicators of granulite facies amounts up to 60 km. So formation of calciphires has accurred under condition of magmatic layering in the lower crust.



S: $SiO_2+Al_2O_3+Na_2O+K_2O$

C: $CaO+MgO+Fe_2O_3+FeO+TiO_2$

V: Volatiles

Fig. 1. Position of the calciphyres (solid circles) and kimberlitic carbonatites (unencircled marks) on the part of the diagram (Dawson, 1967). The group of compositional points of carbonatites is changed for the field (thin solid line). The fields of alnöit (short line) and kimberlite (thick solid line) are not changed.

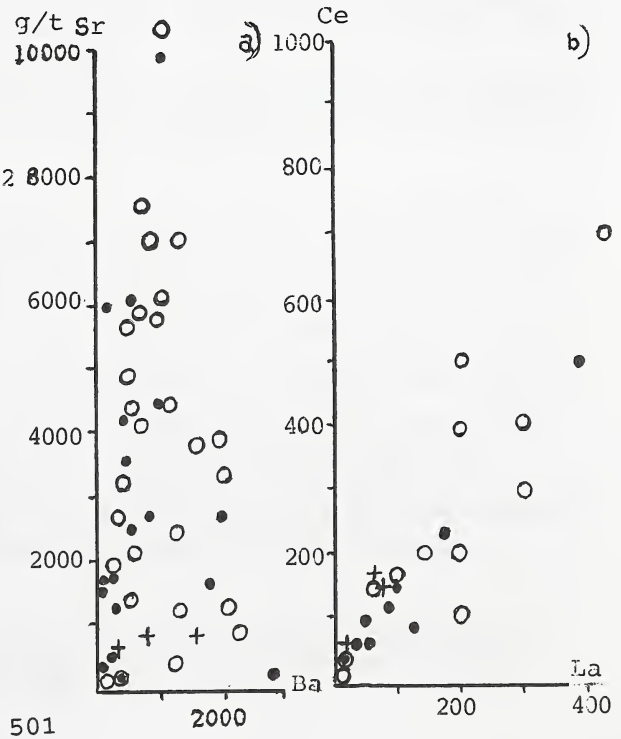


Fig. 2. Diagrams of Sr/Ba(a) and Ce/La (b) ratio for carbonatites (open circles), calciphyres (solid circles), and kimberlitic carbonatites (unencircled mark). Data on the latters are taken from the work by A.B.Lapin and V.K.Marshintsev (1984)

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