



## **Oxygen conditions in mantle column beneath Siberian kimberlites and its application to structure of feeding systems and layering.**

**I.V.Ashchepkov (1)**, N.P.Pokhilenko (1), N.V.Sobolev (1), N.V.Vladykin (2), A.Ya.Rotman (3), A.M.Logvinova (1), V.P.Afanasiaev (1), V.P.Kostrovitsky (2), M.A.Karpenko (3), L.N.Pokhilenko(1), S.S.Kuligin(1), L.V.Malygina(1), Yu.B.Stegnitsky (3), E.V.Vishnyakova (4), O.S.Khemelnikova (1).

(1) United Institute of Geology Geophysics and Mineralogy SD RAS, Novosibirsk, Russian Federation (Igor.Ashchepkov@uiggm.nsc.ru), (2) Institute of Geochemistry SD RAS, Irkutsk, Russian Federation (vlad@igc.irk.ru), (3) Central Science and Research Geology And Prospecting Institute Of The Stock Company "ALROSA", Mirny, Russian Federation (rotman@cnigri.alrosa-mir.ru), (4) Novokuznetsk metallurgical enterprise, Russian Federation (vishnyakova\_ev@nkmk.ru)

$\delta^{18}O$ -  $F_{O_2}$  were determined with the monomineral thermobar- and oxybarometry for ilmenites and Cr-spinels (Ashchepkov, Vishnykova, 2005), The Ilmenite method give the conditions for the megacrystalline veins served as the feeding systems for the protokimberlite melts for metasomatites and pyroxenites. Chromite shows the conditions for peridotites. Every studied region or kimberlite field or even kimberlite pipe reveal distinct features of the construction magmatic systems and mantle column layering.

Principal types in configurations of T-  $F_{O_2}$  and P-  $F_{O_2}$  diagrams allow to decode construction of magmatic systems including megacrystalline bodies, pyroxenites, veined peridotites and metasomatites surrounding magmatic bodies considering the ilmenite variation trends. Long compositional trends with TP values tracing interval from 20 to 65 kbar is common type determined for Mir and Dachnaya pipes representing the magmatic fractionation without the essential interaction with the wall rocks in the long vertical fracture. It is common also for many African kimberlite pipes. The case with the rapid rise of the oxygen fugacity refer to the crystallization without exchange with the peridotites with olivine as the major fractionation product the addition of the oxide phase decreases the inclination of the T-  $F_{O_2}$  and P -  $F_{O_2}$  trends as well

as the phlogopite. The intensive exchange with the wall rocks show the and the high variation of the  $F_{O_2}$  and the Cr-Ni-V components.

For Daldynsky region (Udachnaya, Dolgozhdannaya, Aeromagnitnaya show relatively short P(kbar) intervals (65- 50 kbar) while for Zarnitza , Leningradskaya, Osenyaya and Ukrainskaya the main ilmenite fractionation interval is within 65-40 kbar. The  $\tilde{N}_r$  content for later pipes is rising together with the decreasing of the pressure and means the step by step contamination when melt intrude the next upper level. For the first three pipes the Cr is rising only at the end of the trend during the final melt solidification. Layered structure with the high variations of  $F_{O_2}$  is determined for every mantle columns in Daldyn region.

In Alakite field ilmenite from most of the pipes display the long compositional ranges with stepwise rising Cr content and melt upwelling. Three major levels of fractionation are determined for Sytykanskaya, Aylhal and Komsomolskaya and more for Yubileynaya. The amount of the steps 3-4 is close the number of peridotite layers detected in Alakite mantle columns. But P-  $F_{O_2}$  trends found for Cr spinels show the two branches in each of the horizons. One with continuous  $F_{O_2}$  growth joining with the ilmenite seems to be created due to the influence of the feeding system while the other one is referring the conditions of the pervasive preceding metasomatism.

For the MaloBotuobinsky region long compositional trend without the rising of Cr content means tracing by crystallizing protokimberlites in rising fracture The other including Internationalnaya, Tazhnaya, Anmkinskaya mantle columns shows the stop in developing of feeding system at 40 kbar with further creation of metasomatites in veils. Peridotitic chromites also show the sharp divide at the 40kbar with wide  $F_{O_2}$  ranges. While rising of  $F_{O_2}$  below this pyroxenites lens suggests high degree interaction and homogenization with small relic trend.

Long continuous ilmenite trends are not characteristic for the Verhne –Munsky region – only discrete relics of the trend are found in concentrated from Poiskovaya, Debyut , Malaya, InterKosmos. Only Deimos and Komsomolskaya- Magnitnaya pipes reveal long compositional ranges with three separate PT levels and two stages of contamination similar to the Alakite pipe. But chromite highly enriched in the ulvospinel show the straight rising of  $F_{O_2}$  wit the decreasing pressure 2-3 such lines what possibly means the direct migration of the prprotokimberlite melts through the peridotite column

In Nakyn field only Nyurbinskaya pipe show the crystallization of protokimberlite melt withing 60-50 kbar and rising of  $F_{O_2}$  conditions for peridotites at the same interval while upper their values sharply decrees.

In Priyanabarie cold branch at the basement of the mantle columns reflect the developing of the metasomatites with clinopyroxene 70-60 kbar. The main level of the magma fractionation close to 45-60 kbar seems to be continuous. Synchronous trend  $F_{O_2}$  rise from spinel seems to be the result of the high degree interaction also.

The general tendency is that the multistage pipes have the more steps of the melt protokimberlite melt rising in the mantle. Long compositional and TP trends are more common for lithospheric mantle with continental signature and highly metasomatic mantle columns. Oxygen fugacity for ilmenite trends are partly within or close to the diamond stability field and at least some diamonds may grow up in megacrystalline bodies or directly in the contacts.

In Naryn field only Nyurbinskaya pipe show the crystallization of protokimberlite melt withing 60-50 kbar and rising of  $F_{O_2}$  conditions for peridotites at the same interval while upper their values sharply decreases.

In Priyanabarie cold branch at the basement of the mantle columns reflect the developing of the metasomatites with clinopyroxene 70-60 kbar. The main level of the magma fractionation close to 45-60 kbar seems to be continuous. Synchronous trend  $F_{O_2}$  rise from spinel seems to be the result of the high degree interaction also.

The general tendency is that the multistage pipes have the more steps of the melt protokimberlite melt rising in the mantle. Long compositional and TP trends are more common for lithospheric mantle with continental signature and highly metasomatic mantle columns. Oxygen fugacity for ilmenite trends are partly within or close to the diamond stability field and at least some diamonds may grow up in megacrystalline bodies or directly in the contacts.

RFBR grants 99-05-65688, 03-05-64146, 05-05-64718 and projects 2-05; 65-03; 77-02 of joint projects UIGGIM SD RAS and ALROSA Company.