

USING OF THE MONOMINERAL THERMOBAROMETERS

FOR THE RECONSTRUCTION OF THE MANTLE LITHOSPHERE STRUCTURE

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System of the original monomineral thermobarometers [1] in modified variant [2] allow to reconstruct the structure of the mantle lithosphere beneath the Siberian craton (60 pipes) using original data, and Africa (30 pipes), North America (20 pipes) using data from literature and public domains.

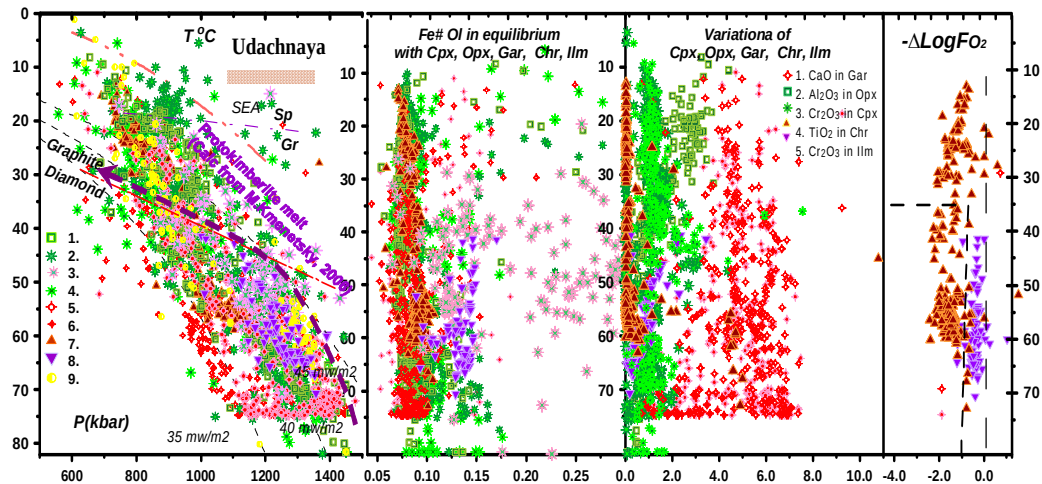


Fig.1. TPF diagrams for the mantle lithosphere beneath the Udachnaya pipe obtained with data for xenoliths [3] and from the PHD thesis of Kuligin, Malygina, Pokhilenko, Alymova and for concentrate. Signs: 1. Opx T°C [4]- P(kbar) [5], 2. T°C [6]- P(kbar) [1], 3. Cpx – the same for eclogites; 4. Cpx TP [6], 5. [7] (mono)- P(kbar) [1], 6. T°C Gar [8] (mono)- P(kbar) [1], 7. Chromite T°C [9]- P(kbar) [1]; 8. Ilmenite [10]- P(kbar) [1], 9. Opx-Gar [4].

For the reconstruction of the equilibrium of the peridotite minerals and details of the structure of mantle columns the calculated with the regressions the Fe#Ol coexisting with each minerals and series of the TPF diagrams was used. The layered structure of the mantle [1] is proved by the geophysical models. The influence of the plume melts is shown by the rising of the Fe# of the minerals and temperatures which are coinciding on TP diagrams with the position of the HT eclogites and HT diamond inclusions [11] and TP trajectories of the ilmenite trends leaved by the protokimberlite melts [12]

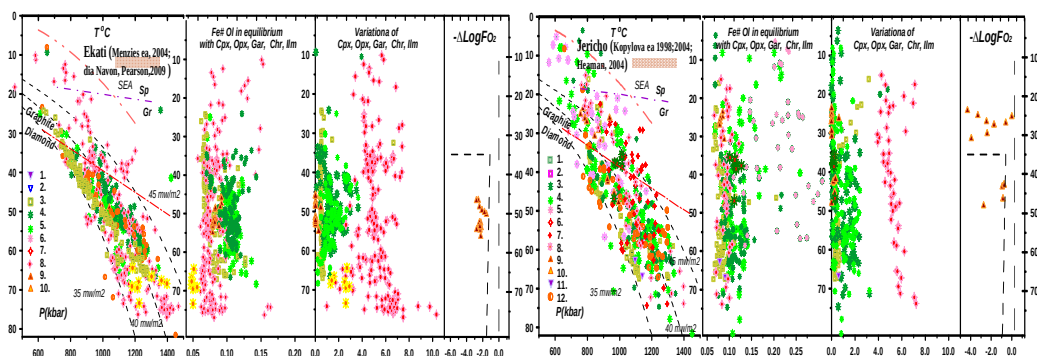


Fig.2. TPF diagrams for the mantle beneath the kimberlite pipes from Canada, Ekati field [13] and Jericho pipes [14]

As a rule it possible to determine several geotherms starting from the subduction (<35 mwtm-2) to conductive (35-40 mvtm-2) and HT ones (>45 mwtm-2). According to the thermobarometer [4] for the deeper part of the mantle column beneath the Udachnaya show the presence of the subadiabatic HT

branch traced by HT pyroxenites and deformed peridotites 65 to 40 kbar, which coinciding with the TP trajectories of the ilmenites and deformed peridotites. High scattering of the temperatures was followed by the melting of peridotites and eclogites due to the polybaric interaction with the plum melts, melt percolation and mantle diapirism. Presence of the several branches of the geotherms evidences about the several stages of the melt percolation.

Similar regularities were determined for the mantle columns beneath the Mesozoic pipes of Canada. Due to the difference in the diffusion rates for the minerals they are tracing different stages of the thermal history of the peridotites rocks. Garnet gives the more deep seated conditions and clinopyroxenes marks all the stages including most low temperature. Eclogites TP also mark quit different thermal conditions. Eclogite inclusions in iamonds refelet as a rule more HT conditions.

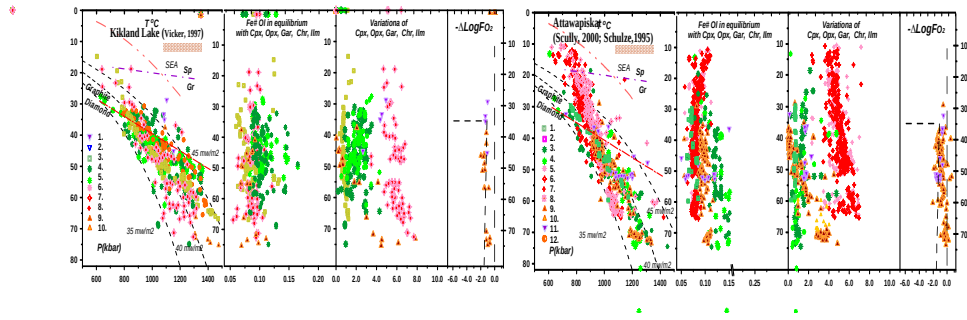


Fig.3. TPF diagrams for the mantle beneath the kimberlite pipes from Canada, Kirland Lake [15] and At-tawapiskat [16]

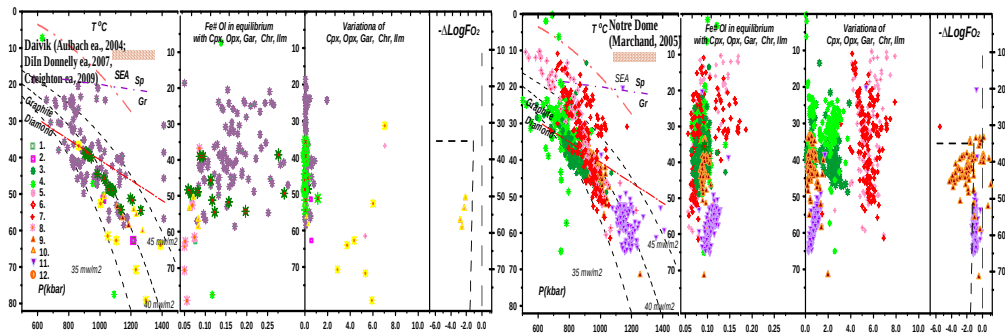


Fig.4. TPF diagrams for the mantle beneath the kimberlite pipes from Canada, Davic mine [17] and Notr Dam de Nord (Torngat mountains) [18]

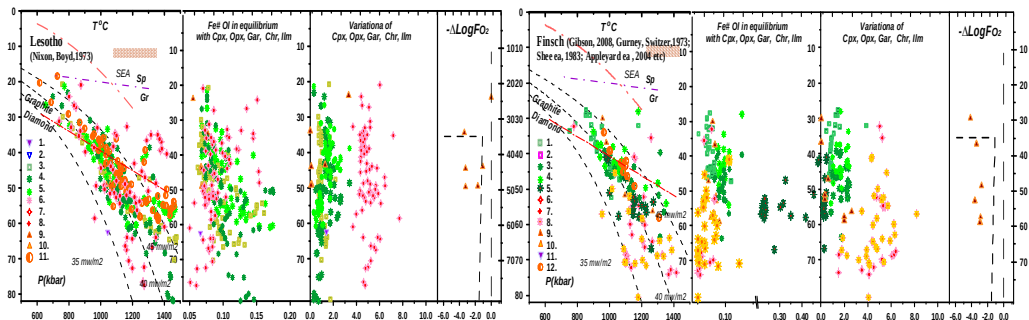


Fig.5. TPF diagrams for the mantlebeneath the kimberlite pipes from South Africa, the pipes from Lesotho [19] and Finsch pipe individually [20]

Clalssic geotherm for South Africa [18] also reveal the HT subadiabatic geotherms when increasing the number of analyses.

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