Amphibole bearing mantle beneath Leningrad kimberlite pipe, West Ukukit kimberlite field, NE Yakutia

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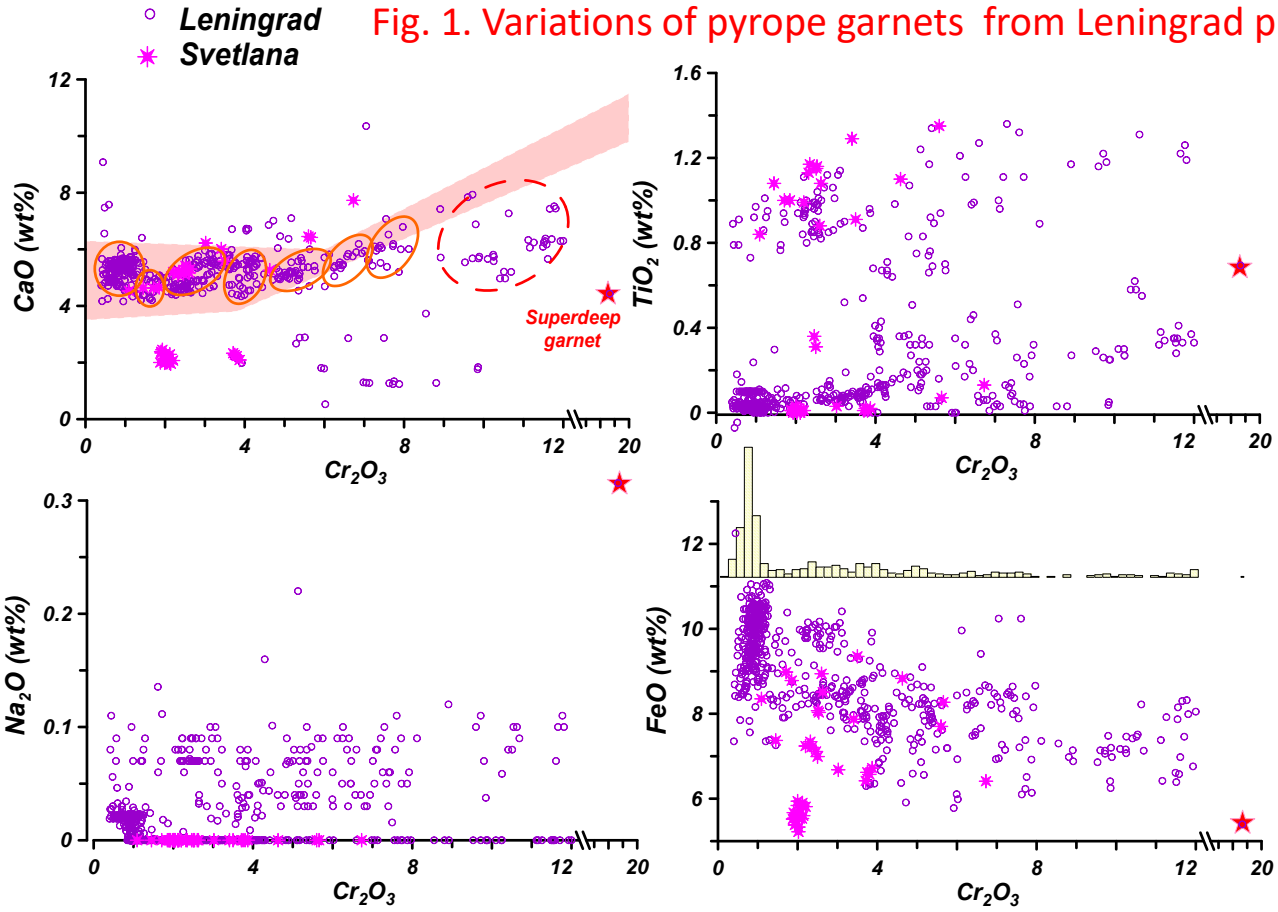
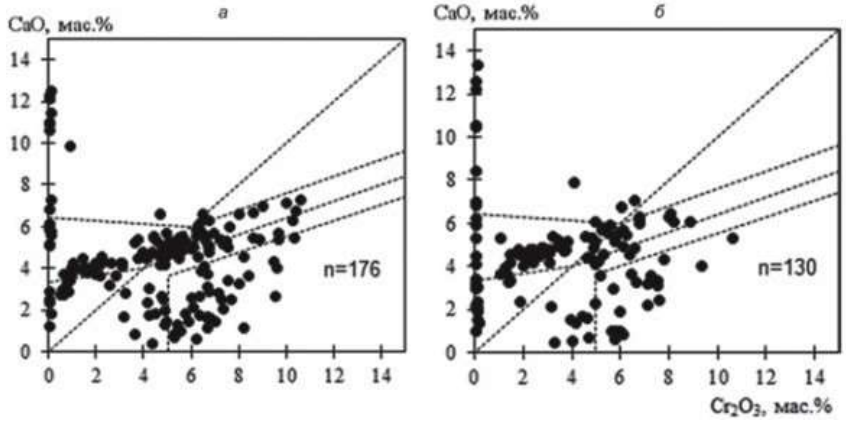
In the mantle column beneath the Leningrad pipe W Ukukit, the Cr-bearing amphiboles prevail on the clinopyroxenes. The amphiboles are varying from the Cr hornblendes near the Moho to Cr pargasites (to more Cr- bearing in the middle part of mantle columns and to K-Na near the lithosphere base. All amphiboles from hornblendes to richterites form nearly continuous range. With the in ection (Peak in Cr in pargasited and growth of K. Fe at the lithosphere base.. The single grain thermobarometry for the garnets suggest the division to at least 7 horizons which from paleo subduction slabs. The ilmenite trend from 7.5 Gpa suggest the vast range of metasomatism in the lower part and continuous trend to 3 GPA. Amphiboles compiles the HT branch from 3.5 GPA typical for basaltic melts and with the most Cr rich beginning and decreasing of Cr to the MOHO. Cr pargasites refer to 40mw/m2 geotherm together with the prevailing eclogites. An opposite the trendfor the richterites also is dividing in to LT and HT branches. The eclogites compile dense MT branch in the middle part of mantle column with the highly inclined P-Fe# trend. The richterites in the LAB show the highly inclined and enriched TRE patterns with high LILE, SRSR and troughs in Nb Pb. The Na- rich have Rb, Ba, variable Th peaks and essentially lower REEE with the MREE depressions (created in harzburgites). The pargasites and Hornblendes show contrasting Eu peaks (for enriched) and troughs (fordepleted varieties in REE). They real subduction related Ba, U, Sr peaks and troughs in HFSE. CPX are variable mostly showing TH, U Sr peaks related to plume carbonatitic meltsAbundance of unremelted subduction material s suggests that in Khapchan zone the growth of the continents was accompanied by subduction uids and possibly withnearly sub vertical subductions. Khapchan terrane as a collision terrane and contain anomalous amount of eclogitic material which was not hybridized with peridotites like in in common granite-green-stone protocontinents. RFBR grant 19-05-00788

Leningrad kimberlite pipe is the very first kimberlite body discovered in our country, which was discovered earlier than Zarnitsa. It was found by K. S. Zaburdin (NIIGA) in 1952 in the riverbed. Omonos, however, the rock was described as"agglomerate tuffs". The diamonds of the Leningrad pipe have the highest quality among the kimberlite bodies of the Siberian platform. This field W. Ukukit field also include the pipe Lorik and Svetlata wit the good diamonds (Khmelkov,2008; Kornilova et al., 2016).

Leningrad pipe contain the interesting population of pyrope garnets with the rather high amount of sub- Ca varieties essential part of which belong to high Cr varieties reaching 18 wt % **Cr2O3**. They reveal division to at least 7 groups according to Cr and calculated pressures. They are divided to the high and low TiO2 varieties.

Fig. 1. Variations of pyrope garnets from Leningrad pipe





Pyropes from Svetlana and Lorik pipes (Kornilova et al., 2016)

Fig. 1. Variations of Cr diopsides from Leningrad pipe

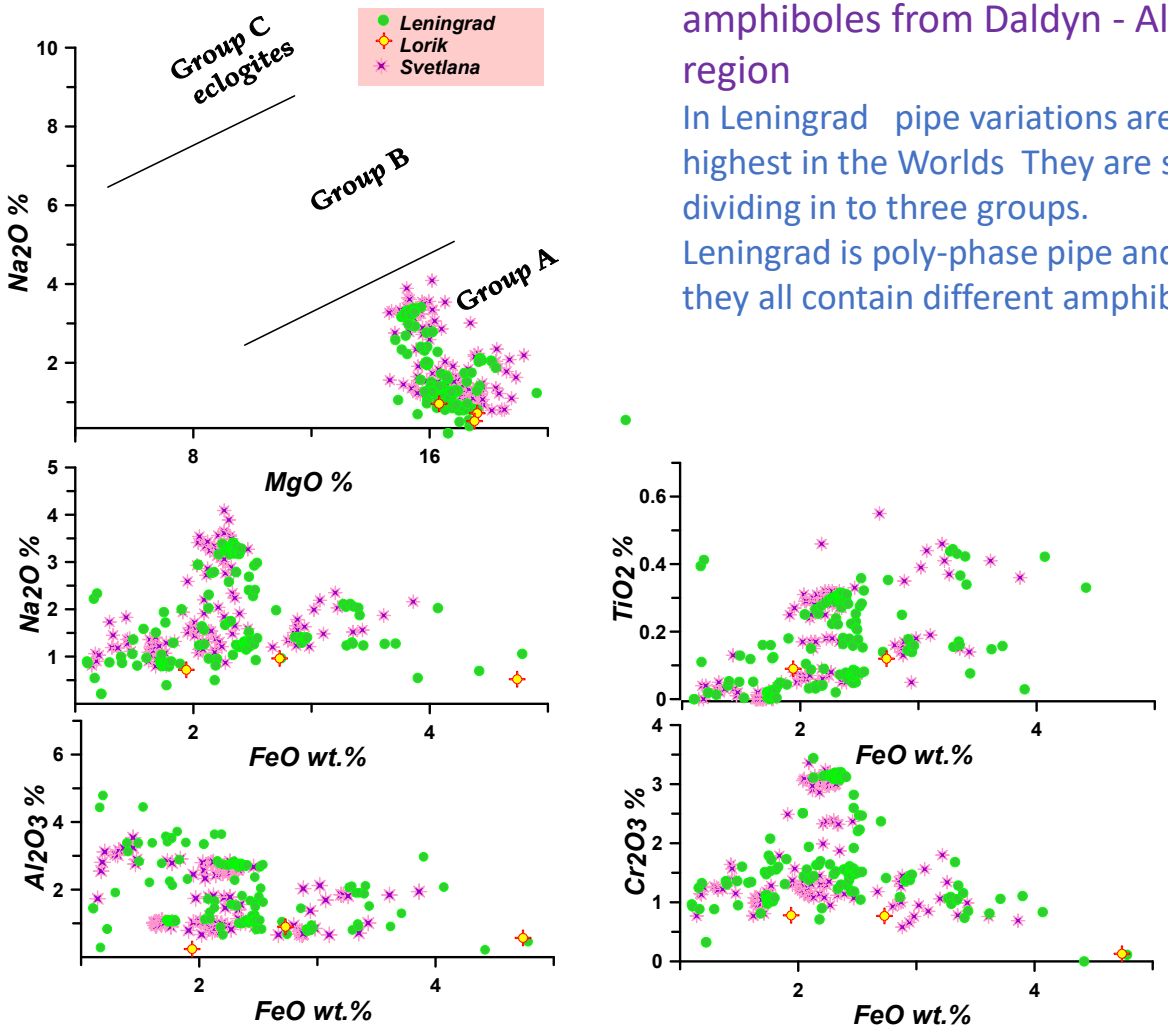


Fig. 3. Variations of Cr amphiboles from Leningrad pipe Widest in the World in comparison with amphiboles from Daldyn - Alakit region

In Leningrad pipe variations are the highest in the Worlds They are sharply dividing in to three groups.

Leningrad is poly-phase pipe and the they all contain different amphiboles

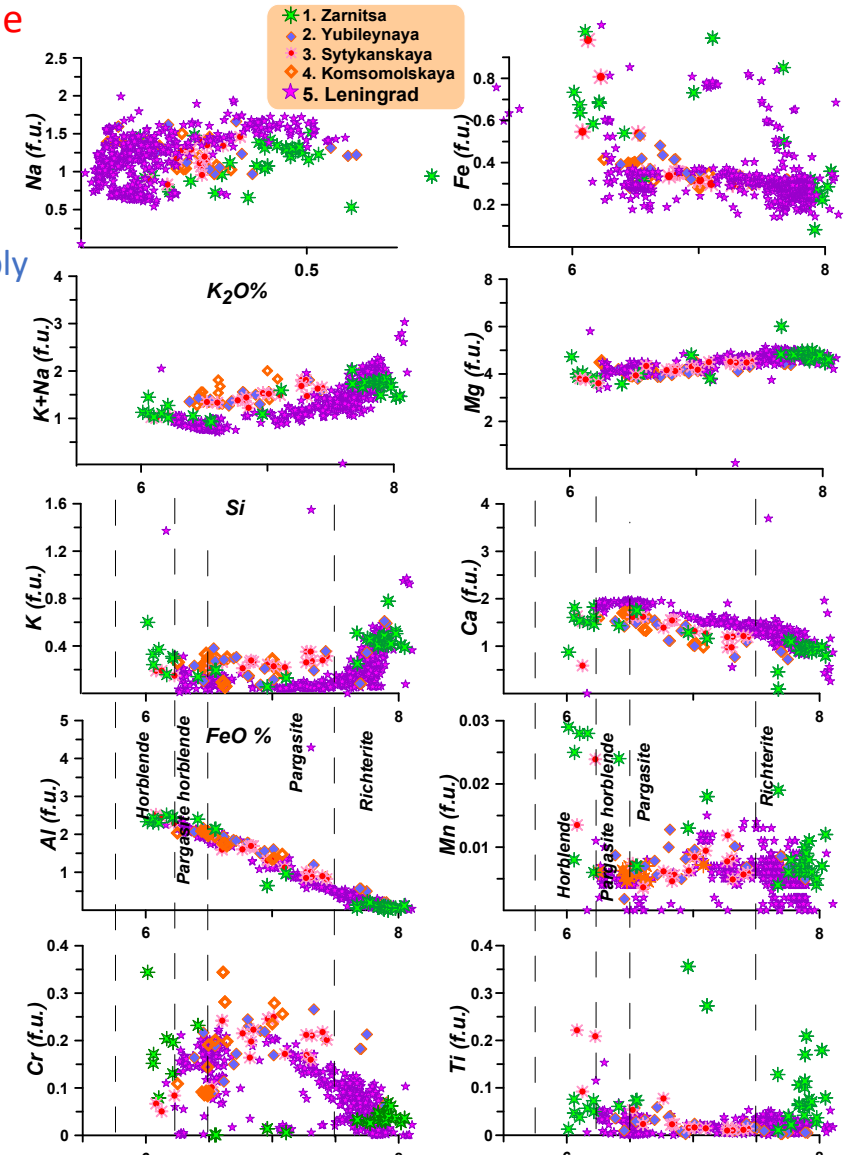
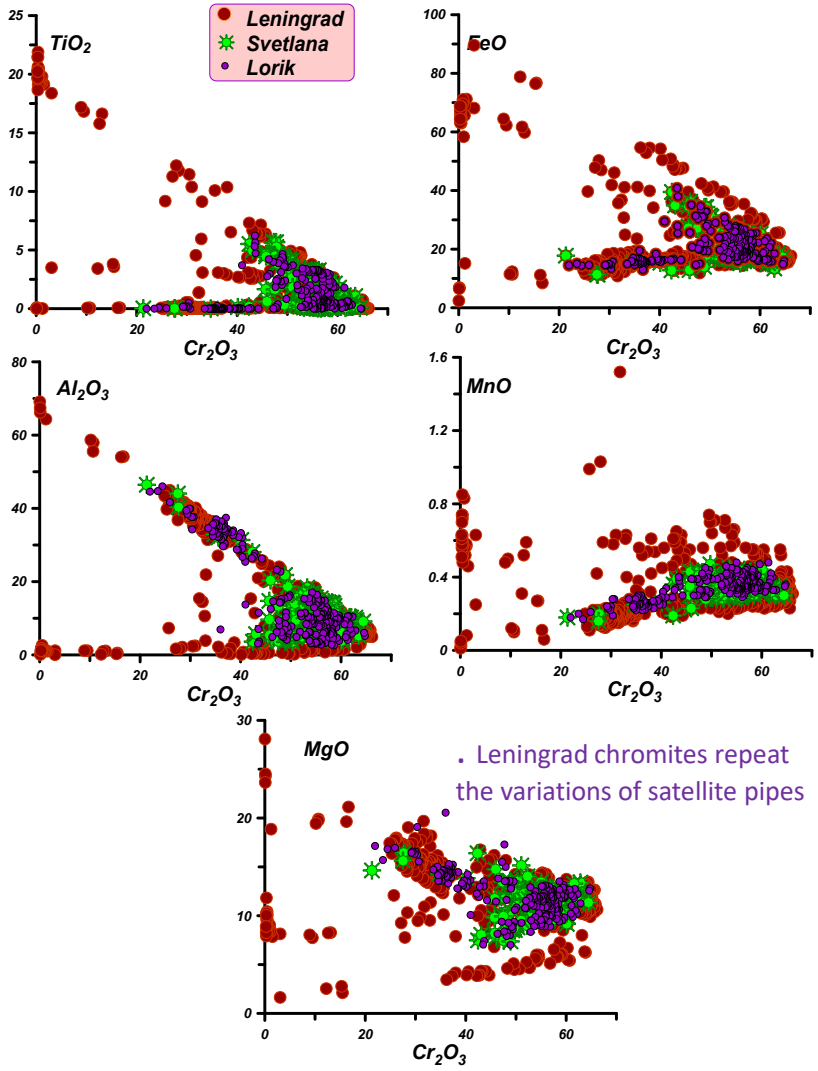


Fig. 4. Variations of Cr spinelides from Leningrad pipe

in comparison with those from Lorik and Svetlana pipes



. Leningrad chromites repeat the variations of satellite pipes

Chromites from Svetlana and Lorik pipes (Kornilova et al., 2016)

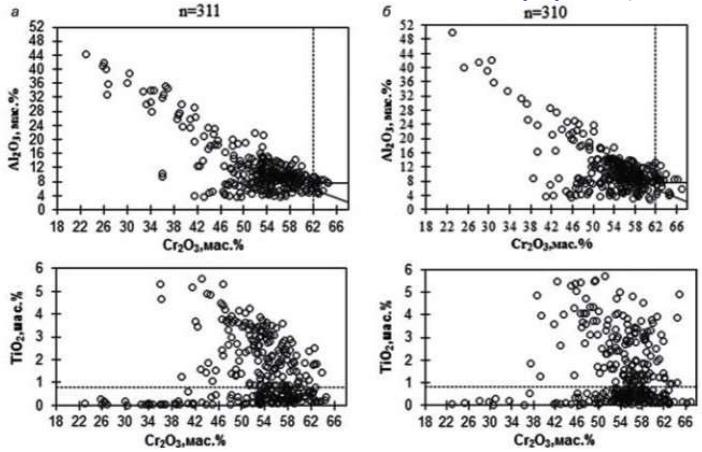
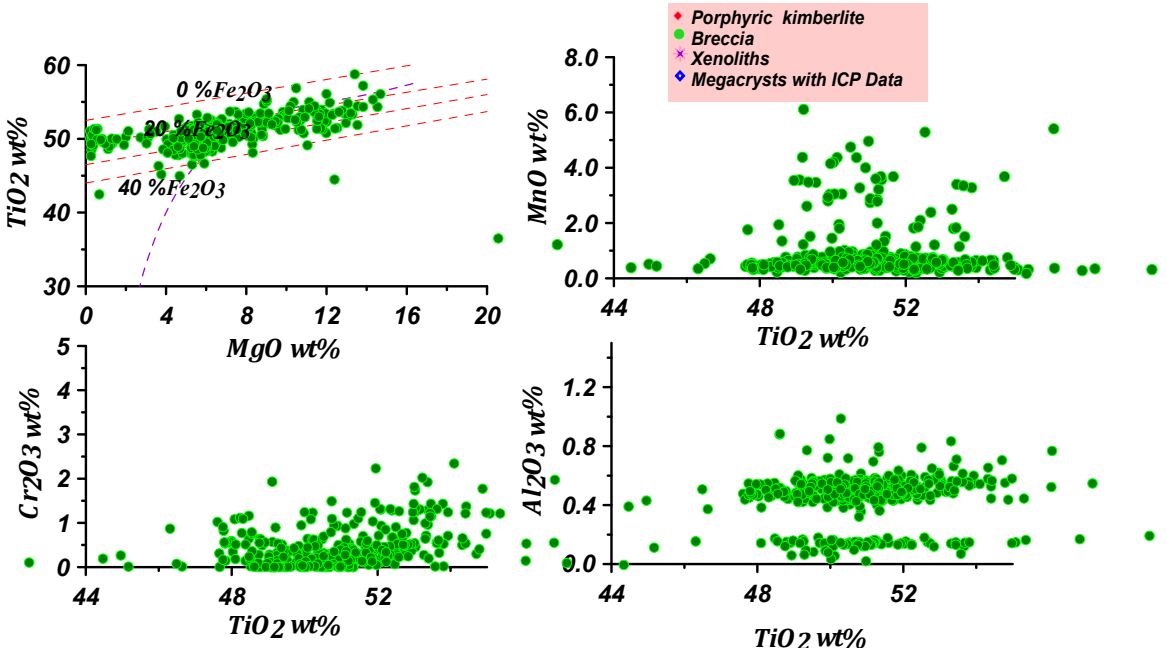


Fig. 5. Variations of Cr picroilmenites from Leningrad pipe.

At least two phases may be determined by Al2O3 level



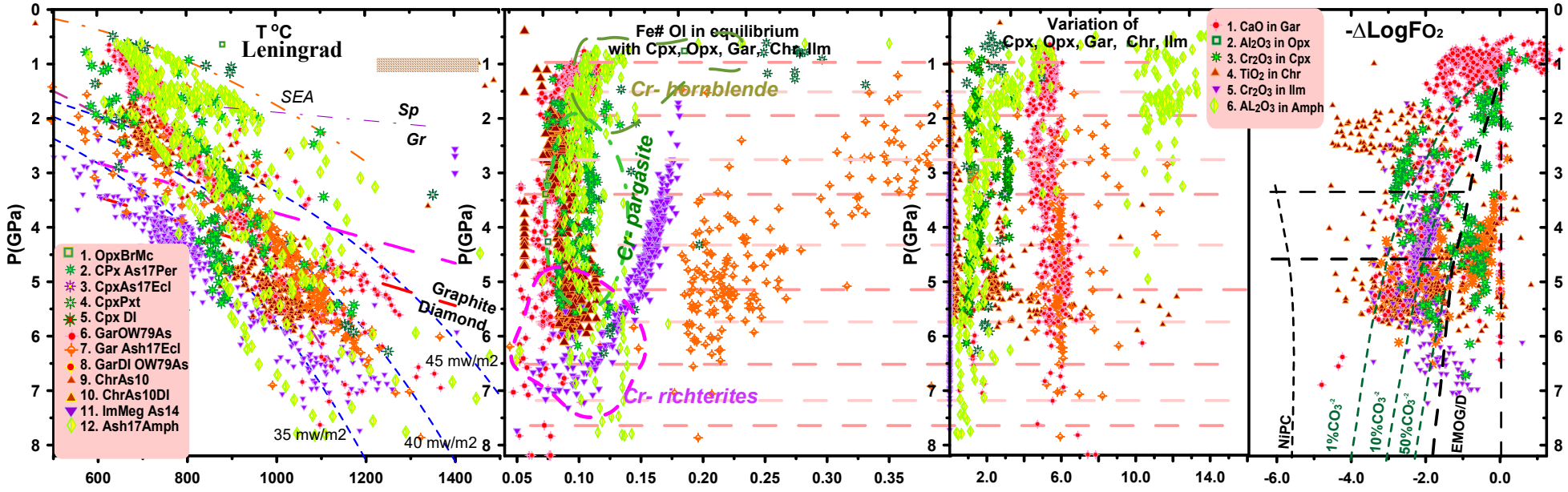
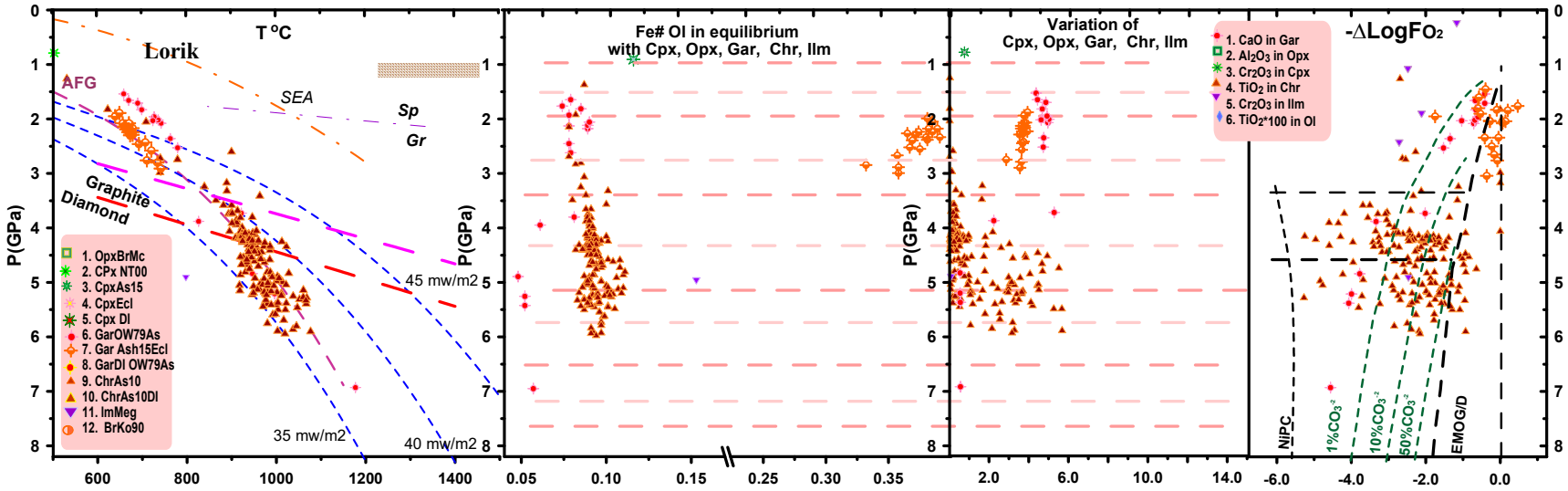


Fig.6. PTXfO_2 diagram for the minerals xenocrysts from Leningrad pipe.

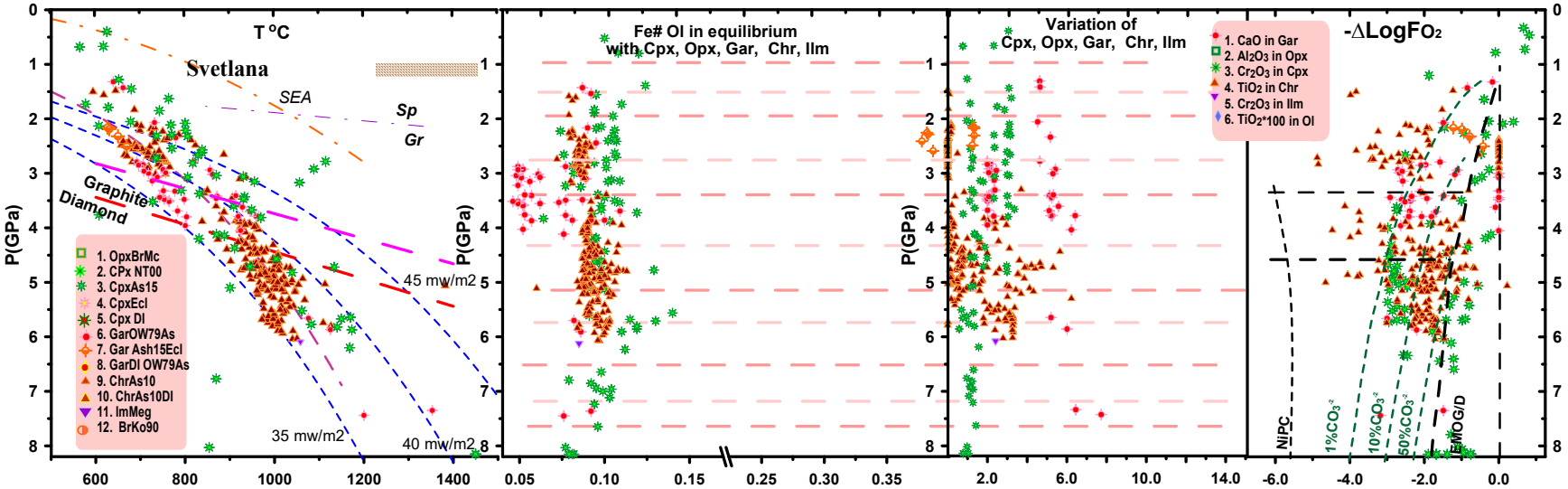
Signs: 1. Opx: T°C (Brey and Kohler, 1990)-P(GPa)(McGregor, 1974). 2.. Cpx: T°C- (Nimis and Taylor, 2000) P(GPa) - Ashchepkov et al., 2017(forCr -diopsides);3.The same for Ferich Cr -diopsides s. 4.The same for eclogites and and pyroxenite)Gar: 6..T°C (O'Neill and Wood, 1979) -P(GPa) (Ashchepkov et al ., 2017), 7.The same for eclogites; 8.The same for diamond inclusions. Chromite 9.T°C (O'Neill and Well, 1987)-P(GPa) (Ashchepkov et al., 2010); 10. The same for diamond inclusions. 11. Ilmenite megacrysts T°C (Taylor et al., 1998)- P(GPa) (Ashchepkov et al., 2010); 12. T°C-P(GPa) (Brey and Kohler, 1990). The compositions of the diamond inclusions is taken from (Bulanova, 2004).

The field for P-FO2 diagrams after Stagno et al. (2013). The horizontal dashed line at 3.5 and 4.5 GPa corresponds to the Graphite-Diamond boundary at 35 and 40 mWm-2 respectively.

The complex nature of the processes in mantle lithosphere beneath the Leningrad pipe is visible in PT diagram with the very high geotherm branches / Amphiboles of different type trace practically all of them . The Cr horblendes ar divided on hi Al type and les Al enriched The are covering the 2-0,8 Ga interval . The pargasites are tracing middle part of the interval from 2,5 to 54,5 Gpa . The richterites are dipper and are found to 7,5 GPa interval. The later phase give more Hi-T branches in general which are close to Cpx and amphiboles. The richterites give low T geotherm correspondent to those of diamond inclusion in garnets. And as wellit gives the deviations to the Ht geotherm for ilmenites and hi-TP garn garnets tracing convective branch



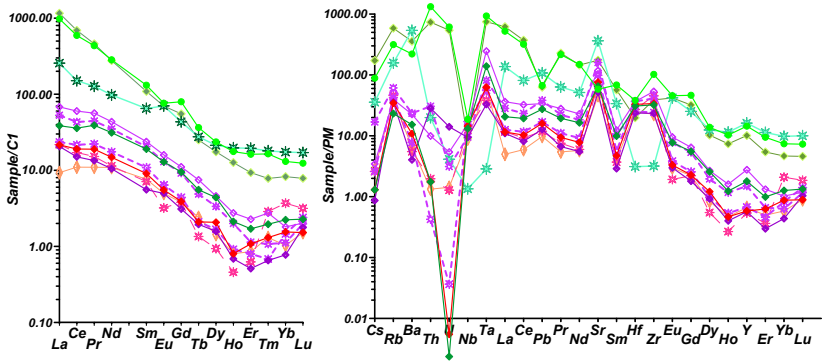
PTXfO$_2$ diagram for the minerals xenocrysts from Lorik pipe.



PTXfO$_2$ diagram for the minerals xenocrysts from Svetlana pipe.

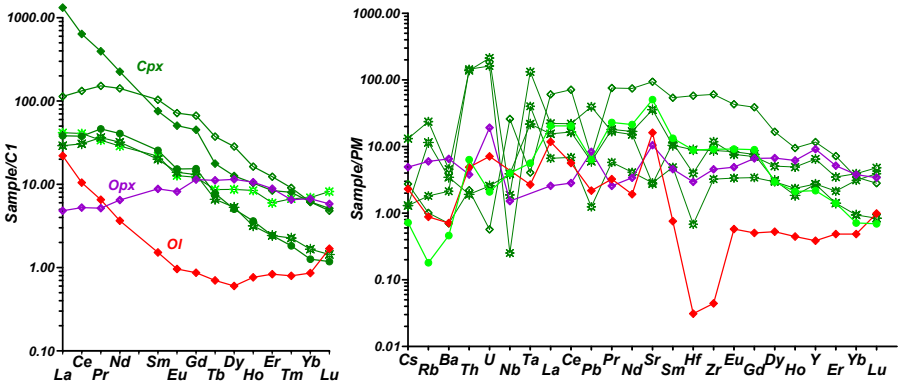
TRE patterns for amphiboles and other minerals from Leningrad pipe

Cr richterites from Leningrad pipe

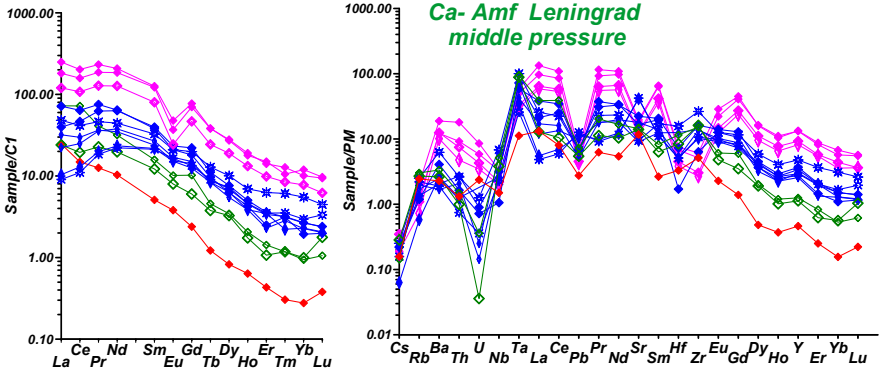


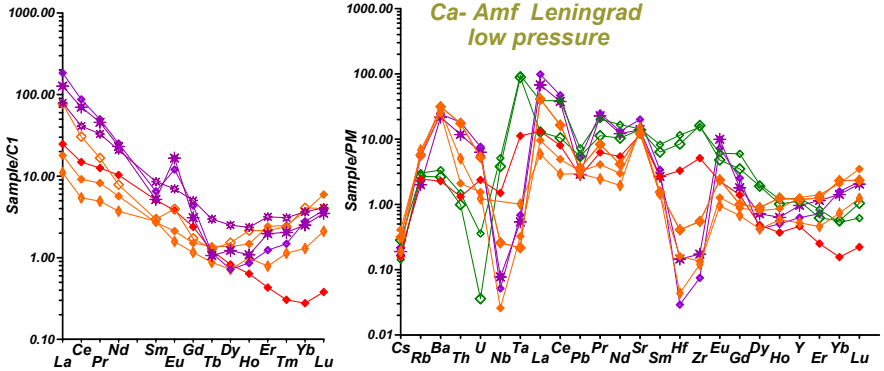
Richterites which reffer to LT branch are higher in LREE and REE levels and are more enriched in LILE. They show Nb minima but high Th –U corresponds to the enriched low Fe- type. The high T amphiboles are enriched in HFSE probably due to interaction with the protokimberlites.

CPx, Opx, Ol from Leningrad



Clinopyroxenes re divided in to three groups. Those with lower REE concentrations have huge U-Th peaks but minima in Hf and Nb and possibly were formed from evolved carbonatite (protokimberlite melts). The others with the higher REE levels reveal different REE spectra and LREE – LILE enrichments , and small HFSE peaks





The geochemistry reveal the vast variations of the TRE and REE spectra.

Pargasites with the high REE levek have Eu and HFSE minima and possibly were formed after eclogites. The major pargasite group have varying La/Sm ratios and are inclined REE patterns, and reveal small HFSE maxima, and sho lower LILE enrichment,

The low pressure Cr – Hornblendes have the signs of the fluid interaction with concave REE patterns and peaks of Ba , the HFSE minima reflect high oxygen fugacity. The anomalies of Eu suggest the crust material participation. The

Conclusions.

- **Leningrad pipe contain huge number (500 EPMA analyses) of various amphiboles (7 groups according to geochemistry) which reveal the variations from Cr – horblendes through Cr- pargasites to Cr richterites referring to the different PT conditions from lithosphere base to Moho. This suggest high H2O potencial in mantle column and relatively low temperature nature of mantle metasomatites.**
- **Leningrad pipe have at list 3 phases which determine complex nature of geotherms and trends of amphiboles, chromites and ilmenite and other minerals.**
- **The geochemistry reveal the vast variations of the TRE and REE spectra. The low pressure Cr – Hornblendes have the signs of the fluid interaction with concave REE patterns and peaks of Ba , the HFSE minima reflect high oxygen fugacity. The anomalies of Eu suggest the crust material participation. The Some HFSE enrichment possibly suggest the interactions with the evolved carbonatite protokimbelrite melts**
- **The chemistry of pyropes suggest very deep level od the xenogenic material capture 18 wt. % Cr2O3 suggesting the asthenospheric origine. In general Leningrad and nearby pipes show high amount od the sub-ca garnets suggesting the relatively high diamond grade.**
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Thank you for attention!!!!