ORIGIN AND EVOLUTION OF MANTLE MELTS BENEATH VITIM PLATEAU

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Detail study of mantle xenoliths from Vitim picrite basalt tuff including ICP MS, EPMA analyses and isotopy were used to reconstruct the mantle melts produced different pyroxenite and lherzolite assemblages using published ***Kd's*** for *Cpx*-melt (Hart, Dunn,1993). Five major types of melts were distinguished.

1) **Picrite-basalt liquid** forming black giant grained pyroxenites and megacrysts compile the high-T° trend on the diagrams with some inflections due to polybaric crystallization (fig.1) (Ashchepkov, Andre, 1993,1995). They form intermediate segregations or magmatic chambers estimating from PT conditions for black pyroxenites: 1350-1300°C, 27-25 kbar; 1220-1150°C, 23-21 kbar; 1100-1000°C, 17-16 kbar and then to 950-850°C, 10-12kbar. The associations changes from *Cpx-Opx* to *Cpx-Ga-Opx*, then *Cpx-Ga*, *Cpx* only *Cpx-Opx-Ga-Pl*, *Cpx-Il-Phl*. Many subtrends suppose to be formed in branched vein system and several pulsation of magma. The unequilibrium associations crystallized from evoluating melts including remaining liquids. But usually they results from the repeated pulsation of magma within the same magmatic channels. The last portions were more high -T° and contaminated in wall rock lherzolites and fluid enriched. Pyroxenites and megacrysts have the ***REE*** patterns of coexisting liquids (fig.2) and isotopic features very close to host picrite basalts (***Sr*** ^{87}/ ***Sr*** ^{86}=0.7039-0.7046 - ***OIB*** type magmas) . The multi-element spidergram for coexisting liquid relative to primitive mantle (***TR/PM***) show the flat pattern suggesting the origin from the tholeiitic or primitive mantle source (fig.3).

2) **High T° primitive hybridic picritic liquid** formed series of dark-green and green poicilitic clinopyroxenites and websterites are intermediate between intergranular lherzolite melt and picrite basalts revealing rather high content of ***Cr*** as well as ***Ti*** in pyroxenes suppose to be produced by submelting of lherzolites under the influence of volatiles derived from intruded basalts or high contamination of basaltic magma in lherzolite material. These magams have the most flat ***REE*** pattern varying ***La/Sm*** and ***Gd/Yb*** ratios due to the diversified volatile content and high *Ga* control possibly due to reactions on the contacts.

3) **Low T° hybridic fractionated liquid** derived *Ga* pyroxenites and garnetites is slightly contaminated and highly differentiated having the ***REE*** pattern correspondent to the carbonatite's ***Kd*** (Klemme et al, in press) (flat or with minimum and inflections from ***Ce*** to ***Gd***) influenced by ***CO_2*** in remaining liquid. Inclined slopes of ***REE*** pattern soppose high differentiation degree in moving system. Mineral chemistry in such gray *Ga* pyroxenites are very close to those from *Amph-Phl*-bearing veins. These pyroxenites represent the vein system derived from the intermediate basaltic magma chamber. Lower temperatures determines lower *Cr* content and degree of contamination.

4) **Anathectic melts produced Cr-diopside websterites** are close in composition to host lherzolites but slightly more radiogenic in ***Sr*** ^{87}/***Sr*** ^{86} and ***Ti*** enriched. Such melts are produced by submelting of host lherzolites under the influence of volatile derived from basaltic system. They have more differentiated ***REE*** and ***TR/PM*** patterns then basaltic melts. Varied degree of crystallization differentiation is controlled by *Cpx* and Ga precipitation. Their minimums and inflection in ***LREE*** suppose an origin from carbonitite-like melt.

5) **Intergranular liquid in lherzolites** surrounding basaltic system slightly differ from those produce ***CrDi*** veins. In some phlogopite-bering lherzolites reconstructed by ***Kd*** (Hurt & Dunn,1993) coexisting melts are the most differentiated judging by ***REE*** and ***TR/PM*** line

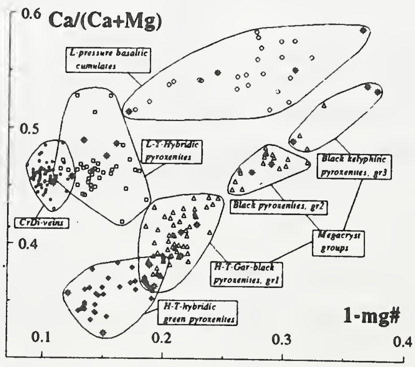

Fig.1. The trends of the deep seated melt evolution (1-mg#) vs (Ca/[Ca+Mg])-temperature , traced by Vitim pyroxenite xenolith.

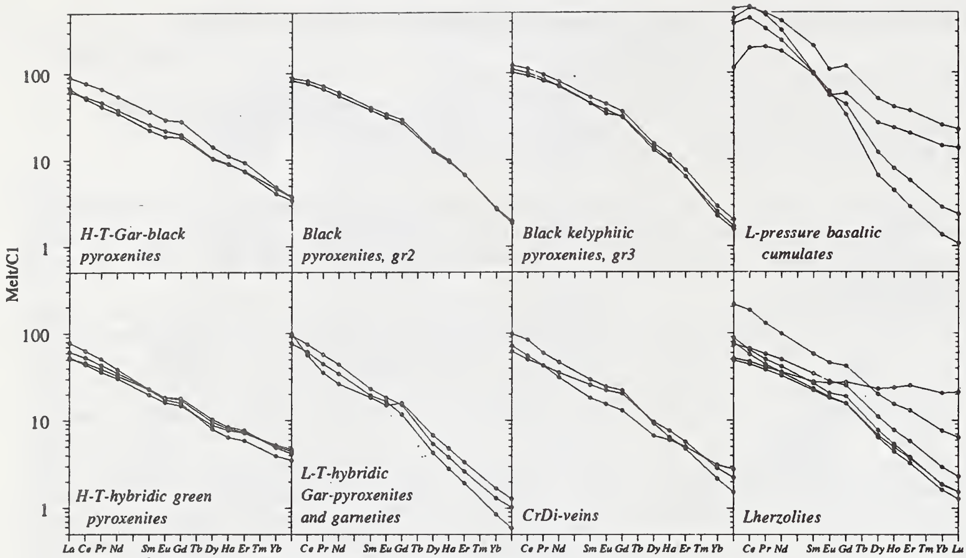

Fig.2. REE patterns for melts coexisting with clinopyroxenes from the pyroxenite xenoliths of Miocene picrite basalt tuffs (Vitim plateau).

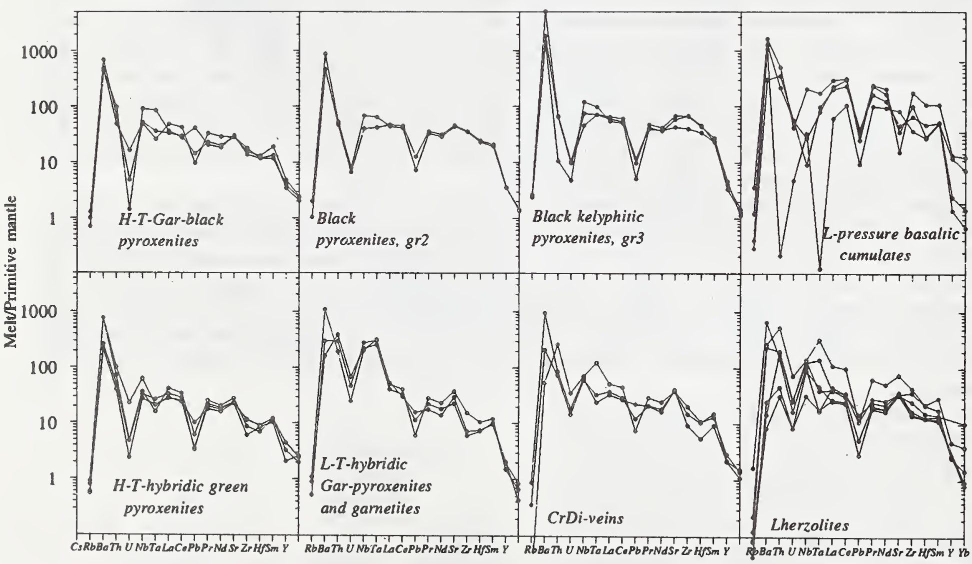

Fig.3. Multicomponent spidergram for melts coexisting witn clinopyroxenes from the pyroxenite xenoliths of Miocene picrite basalt tuffs (Vitim plateau).

inclinations. Lherzolites are represented mainly by unequilibrium associations judging by ***Kd's*** for *Ga* and *Cpx* and their isotopy. The *Ga* were crystallized from the liquid with the ***Kd*** close to carbonatitic while *Cpx* mainly from silicate melts. It means that in the melting process Ga was melted entirely while *Cpx* only partly. The series of *Cpx* ***REE*** patterns suggest crystallization from the moving system. The ***Sr- Nd/Sm*** isotopy of lherzolite *Cpx*'s are correspondent to ***DMM*** or ***MORB*** source (Ionov, Jagoutz, 1988). The origin of intergranular liquid is referred to the melting phenomena influenced by volatile streams connected with the deep seated sources or some distant basaltic systems.

Calculated PT conditions for all group of pyroxenites allow to reconstruct the mantle column for the time of picrite basalt eruption. All type of melts reveal their definite PT paths to the surface representing different convective geotherms and every petrographic variety of pyroxenites drops at the definite part of PT plot. Green hybridic H- T° pyroxenites most H- T° black pyroxenites and some rare deformed sheared-like lherzolites from the deepest part correspondent to the pressure about 26-28 kbar and temperatures 1380-1250°C. *CrDi* veins mainly concentrate at the interval 24-22 kbar together with rare black polymineral pyroxenites and some ferriferous *CrDi* enriched in ***Ti, Ga*** - websterites and most of common *Ga* lherzolites. The most thick veins are found at the lower T° part of this interval what means the concentration of liquid at the front of percolation. The next temperature interval 1100-1000°C 15-17 kbar is correspondent to the hydrous and other hybridic veins while *Ga* gray hybridic pyroxenites are correspondent to lower temperature conditions 900-1000°C. The *Phl* lherzolites drops to this interval. The next level is represented by low pressure basaltic *Pl-Ga*-bearing cumulates sometimes with kaersutite and phlogopite 850-950°C, 10-12 kbar and common spinel lherzolites rare containing kaersutite. Last portions of basaltic magmas intruded the crust crystallized entirely producing *Ga-Kaer* clinopyroxenites.

Model of melt differentiation in the moving systems suppose the growth of the channels from lower magmatic chamber according to magma fracturing (Sobolev, Siplivets, 1986) and simultaneous precipitation of black pyroxenites on the walls. At the intermediate stops they produced magmatic chambers and related vein systems due to the enrichment in volatiles after crystallization differentiation. Repeated pulsations used the channels already formed. The effect of varied of differentiation character from rapid fractionation in the veins to the equilibrium crystallization in chambers that gives positive and negative anomalies of ***Pb, W, Cu, Ni*** due to the lost of sulfide liquid during derivation of fluids in openning magmatic systems. Crystallization of the *Phl* and Ilm on the contacts brings to the ***K*** and ***Ti*** minimums. Permanent reactions with *Ga* on the walls brings to the growth of ***Gd/Yb*** ratio. Reactions on the contacts seems to be important for ***K*** magmas with small volumes of melts. Mixing with submelted lherzolite *Cpx* brings to the changing in ***Sr*** isotopy. It was found that to change ***Sr*** ^{87}***/Sr*** ^{86} from 0.7044 to-0.7039 it is necessary to mix 95% of basalt with ***Sr***=600ppm and 95% of lherzolite *Cpx* with ***Sr***=0.7020. This solve the disagreement between the "deep seated" isotopic signatures of basalts and correspondence of their major components to the PT conditions of more shallow level usually explained by partial melting. Effect of the separation of the ***REE*** in the moving magmatic column simply explain zonation of minerals and changing of slopes of ***REE*** patterns for the megacrysts. Mirror-like ***REE*** patterns found in highly differentiated gray pyroxenites are produced in case of separation and migration of the enriched in ***REE*** heard of magmatic column containing the most differentiated magmatic liquid. The subtraction of more fractionated melt brings after the mixing with remaining liquid in some reservoir to the decreasing of ***REE*** concentration, increasing of ***HREE*** and ***LREE*** slopes and specific distributions in ***TR/PM*** patterns characterized for example for series of rocks in some concentric ultrfmafic massif (Inagly) (Zinngrebe, Foley, in press).

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