Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 162

Thermal Gradient, Mantle Layering and Geochemistry Beneath Aldan Shield According to the Kimberlitic Deep Seated Disintegrated Inclusions

Igor Ashchepkov (ashchepkov.igor@uiggm.nsc.ru)[1], **Nicolai Vladykin** (vld@igc.irk.ru)[2], **Ovchinnikov Yuri**[1], **Genadiy Anoshin** (anosh@uiggm.nsc.ru)[1], **Pavel Gerasimov** (pasha@uiggm.nsc.ru)[1] & **Anatoliy Saprykin** (saprykin@che.nsc.ru)

[1] Novosibirsk-90, Ac. V.Koptyug ave.3, UIGGM SD RAS, Russia
[2] Irkutsk 664001, Favorsky str. 1a, IGC SD RAS, Russia

Concentrate from kimberlite-like Jurassic diatrems Gornaya, Ogonek and Aldanskaya dyke Amga river, Aldan shield (Siberia) was analyzed by EPMA and LAM ICP MS in Analytic Centre UIGGM SD RAS. Mineralogy. Pyrope garnets locate on CaO-Cr_2O_3 plot mainly in lherzolitic field. CaO rise to pyroxenite field starting from 5% Cr_2O_3 for Ogonek and Aldanskaya and from 4% for Gornaya pipe. Abundant -almandine garnets comes from basic cumulates and granulites. Clinopyroxenes refer to: 1) lherzolitic Mg-rich, Al-poor from craton keel, 2) Cr-diopsides from Gar-Spinel peridotites of modern platform and orogenic massifs, 3) Fe-Cr-rich metasomes containing mica and fluid inclusion, 4) eclogites (omphacite), 5) crust LT cumulates and granulites. Orthopyroxenes compile compact field near mg#^{N}0.93 expanding to more Fe- rich fertile compositions. Cr- Spinels (7-58% Cr_2O_3) are separating into: 1) Cr-rich in intergrowth garnets, 2) 50-40% Cr_2O_3-pyrope lherzolites (35-40 kbar) 3) 33-30% Cr_2O_3 (30-25 kbar); 4) 20-26% Cr_2O_3 shallow Ga peridotites (like Vitim picrite-basalts) 11-15% Cr_2O_3 typical for Ga-Sp peridotite inclusions from modern volcanic world-wide. Range 60-30 is close to Archean peridotites from E.Sayan (Gornova, Petrova, 1999). Amphiboles: rare alkaline amphiboles, pargasites including Cr-bearing ones, various hornblendes. Micas: Cr-fucsites intergrown with Cr-rich garnets and spinels; Cr- phlogopites from metasomes; Ti-biotites from cumulates and basic gneisses. Geochemistry of pyroxenes and garnets and their parental melts. Pyrope garnets reveal REE patterns with Ce minima concave down-ward in MHREE that is typical for knoringite-rich garnets (Shimizu et al., 1997, etc.). Deeper clinopyroxenes demonstrate LREE rich spectrums with left-shifted hump. Modeling of parental melts reveal that samples with higher varieties suppose garnet- rich (eclogite-like) substrate with the melting degree < 1% while more shallow Cpx are typical lherzolitic with the lower modal garnet and higher melting degree. Chromatographic minima suggest origin from percolating (Burgess, Harte, 1998) Ca-enriched melts. The more minimum and lower Lu the higher Ga modal abundance in substrate. Parental melts for cumulative garnet and clinopyroxenes are enriched and differentiated with original plum-basalt signatures. Thermobarometry Orthopyroxene thermobarometry (Brey&Kohler90-McGregor74) was used for analyzed pyroxenes and available published kimberlite xenoliths data for the comparison. In combine PT diagram deep LT trends corresponds to the central parts of Siberian Platform (Udachnaya, Boyd et al, 1997), Slave Craton (Jericho, et al., 1999), FennoScandia (Kukkonen & Peltonen,1999), and South Africa (Nixon et al., 1973). All these geotherm reveal conductive lines only in interval 55-30 kbar with deeper HT excitation branches. The colder conductive branch the deeper excitation is. Upper parts for Obnazhennaya and Udachnaya PT trends reveal sub-adiabatic gradients colder for the first pipe. Al-poor pyroxenes of Gornaya and Ogonek pipes corresponds to Obnazhennaya adiabatic gradients, to 42-43 mVt/m2 (Somerset or South Africa) in conductive part and to Thumb (Smith, 1999) in excitation branch. PT estimates for fertile pyroxenes give advective SE-type(O'Reilly et al, 1984) geotherm typical for modern plum areas. Amount of hot fertile clinopyroxenes in concentrate is lower then orthopyroxenes and constructed Cpx geotherm show more cold gradient also with splitting.

Layering

Cr-in-garnet thermobarometry (Rayan et al., 1997), Ca enrichment of Cr garnets and TRE geochemistry suppose pyroxene rich mantle to start deeper then 30 kbar for Gornaya and from~33 kbar for other pipes. Lherzolitic moderately depleted mantle upper then 25-27 kbar is changing to more fertile mantle peridotites. Eclogite lenses are in depleted part. Cumulates traces Moho and more Fe-rich varieties correspond to crust.

Discussion.

TP gradients and layering of craton mantle suppose creation of upper part at the stages of craton nucleation from the Hi-scale melting degree of mantle diapirs, then growth from the underplating subduction mantle wedges and slabs and further interaction with the hot asthenosphere or rising plumes. Unusual layering of Aldan mantle with fertile upper part may suppose either: 1) primary origin from the relatively slow and cold mantle diapirs; 2) fertilization by plume melts; 3) intrusions of fluid rich mantle material from the asthenosphere in local fractured permeable zones. Pyroxenite layers from ~120 km typical for Obnazhennaya (Ovchinnikov, 1991) and in marginal or rifted cratonic zones are produced by Ca-Si rich intruded plum- or subduction-related melts while in the central parts of cratons eclogites from this horizons (Kopylova, 1999) are of subduction origin.

Conclusions

Siberian (and other) Craton margins have pyroxenite rich and metasomatic deep substrate and fertilized upper parts. Supported by RFBR grants 99-05-65688.

Journal of Conference Abstracts
Volume 5(2), 163

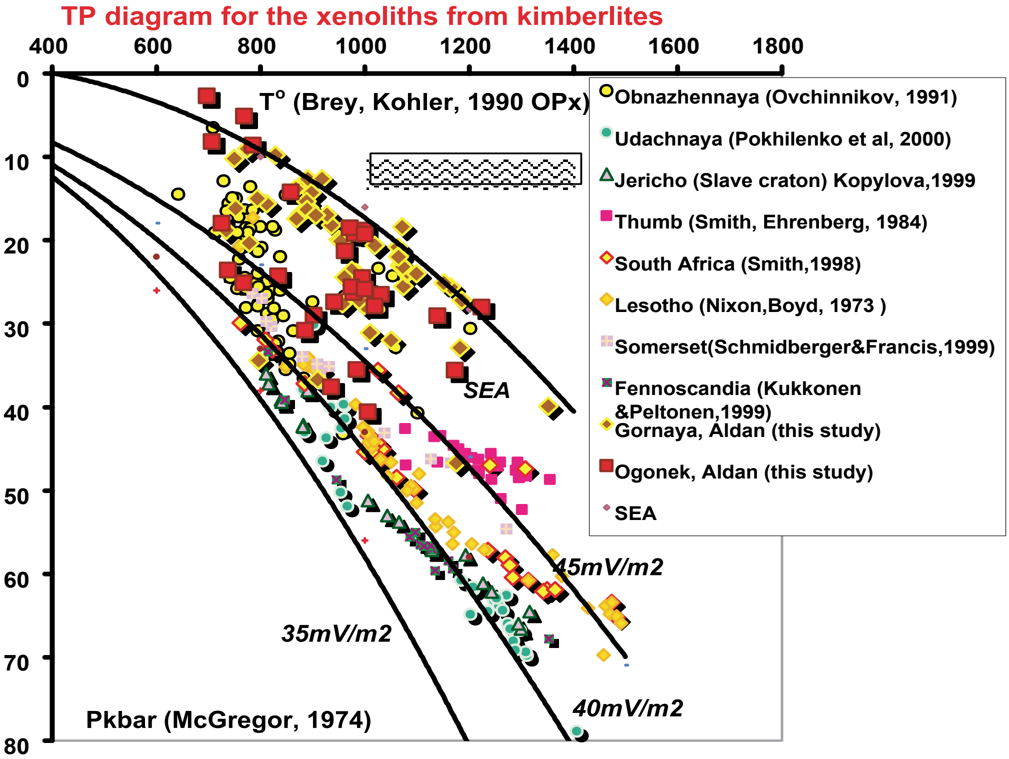

Figure 1: TP diagram for the xenoliths from kimberlites

Boyd FR, Pokhilenko NP, Pearson DG, Mertzman DG, Sobolev NV, Finger LW, *Contrib.Mineral.Petrol.*, **128**, 228-246., (1997).

Brey GP Kohler T, *J.Petrol.*, **31**, 1353-1378, (1900).

Burgess SR & Harte B, *7IKC extended abstracts. Cape Town*, 122-126, (1998).

Nixon PH, *Lesotho kimberlites. Lesotho national development corporation*, 350, (1973).

Kopylova MG, Russell JK & Cookenboo H, *J. Petrol*, **40/1**, 79-104, (1999).

Smith D, *Geochemical Society Special Publication*, **6**, 1999, (171-188).