HETEROGENEITY OF THE UPPER MANTLE BENEATH THE SIBERIAN PLATFORM

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Several main types corresponding to certain stages of ancient metamorphic,magmatic and metasomatic processes,as well as more recent magmatic and metasomatic events,can be established in xenoliths from kimberlites of the Siberian platform among granular-types of ultrabasic nodules, presenting,according to majority of researches,mantle part of lithosphere(Sobolev,1974; Dawson,1980). The rocks suggesting ancient restite metamorphic origin are the most abundant among granular-type of xenoliths. These rocks are represented by spinel,spinel-garnet and garnet harzburgites,lherzolites.Sufficiently clear mineral orientation,sharp depletion of modal mineral composition in garnet(spinel) and clinopyroxene,impoverishment of bulk chemistry in basaltoid components are most specific to the above rocks.Large(1,5-4,0 cm) relict crystals of orthopyroxene with strongly deformed lamellar ingrowths of garnet(spinel) and clinopyroxene are occasionally found.Exsolution lamellae of these minerals would recrystallize into fine polygonal grains.The earlier stage of the rock existence evidently involved harzburgite restites(olivine+high-temperature orthopyroxene) subjected to cooling and intensive recrystallization with garnet(spinel) and clinopyroxene squeezing out to intergranular segregations.The shift of reaction in spinel-garnet paragenesis towards garnet formation after spinel is likely to indicate global cooling of the ancient mantle lithosphere subsequent to ancient crust formation.

Evidence of ancient premetamorphic magmatism has been established for rocks of pyroxenite-olivine-websterite serie. Large(2-15 cm) relict crystals of pyroxenes having laminar fabric(Fig.1) due to regularly aggregated plates of two pyroxenes,garnet or spinel lamellae allows their interpretation as exsolution texture in primary high temperature pyroxene.All the substitution stages of laminar pyroxenes by medium grain matrix of these oriented minerals+olivine are traced.The "hot" phase temperature obtained from calculated compositions of laminar pyroxenes ranges from 1260 to 1500°C(Fig.2).Garnet develops both around spinel lamellae in large crystals and around matrix spinel grain sometimes at the expense of matrix pyroxenes and those of laminar relict crystals(Fig.1). In scarce samples with contacts between lherzolites,harzburgites of restite type and websterites,pyroxenites both rocks being in contact are deformed and similar in composition of minerals which suggests the contact prior to the rock deformation and chemical equilibration of minerals at recrystallization.Differentiated pyroxenite-olivine websterite serie corresponds to peridotite and pyroxenite komatiites(Solovjeva,Vladimirov, 1984) in bulk chemistry and on the basis of P-T data occurs in all lithosphere. Yet hot orthopyroxene-olivine restites(Fig.3)were likely to be introuded by large magmatic chambers of protokomatiitic melts corresponding in general to Nisbet a. Walker LLLAMA model(1983) and ideas by Kirkley et al. (1984).

Mineral association with phlogopite,sulphides,apatite,graphite,amphibole and probably titanates of crichtonite series has been found in the rocks of harzburgite-lherzolite and websterite-pyroxenite series.It exibits superposed character but texturally and chemically is equilibrated with main minerals.Apatite and graphite have been found in different samples of orthopyroxenites and websterites from "Udachnaya" pipe,where they together with phlogopite,garnet and clinopyroxene cement large exsoluted crystals of pyroxenes.This stage of metasomatism in the lithospheric mantle is likely to follow its total cooling,entrainment into the crust or crystallization of protokomatiitic melts.This results in the lithosphere fragility allowing permeability by asthenospheric fluids of KREEP-type (Fig3).Three groups of rocks are conventionally allocated to more recent postmetamorphic magmatites,basically,on the grounds of weak or no recrystallization evidence under stress conditions.Garnet lherzolites of probable magmatic type from Udachnaya pipe differ from those of restite type in such parameters as enrichment of rocks by garnet and clinopyroxene,cumulative banding,composition heterogeneity,presence of paragenic phlogopite,more ferroginous composition of minerals,sulphide globules presenting,probably,former drops of sulphide liquid in siliceous one.High mag-

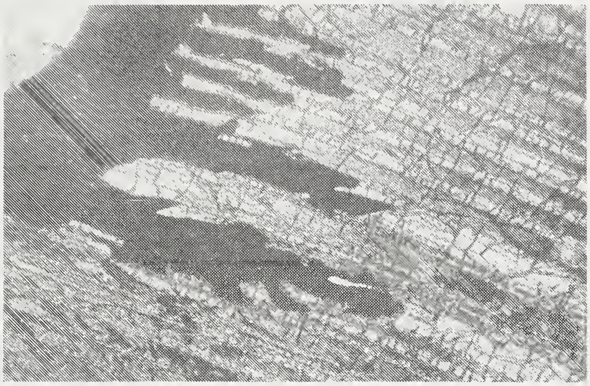

Fig.1. Curved plates of orthopyroxene(light) and clinopyroxene(grey) in laminar crystal.Garnet(black) remplaces orthopyroxene.X nicols,magn.30.

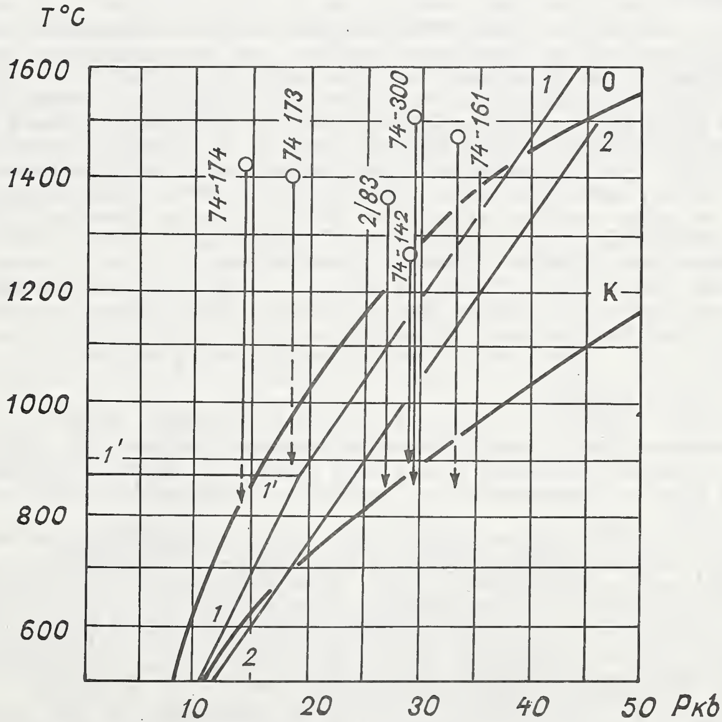

Fig.2. Evolution of large laminar pyroxenes from pyroxenites,websterites from Obnazhennaya and Udachnaya pipes in P-T field.Circles -"hot" stage of homogeneous pyroxenes, arrows indicate decrease of temperature involving exsolution.0 - oceanic geotherm;K - shield geotherm;I-I,I'-I',2-2 - lines of spinel-garnet transitions (MacGregor,1965;Ringwood, MacGregor, Boyd, 1964).Temperatures are estimated by pyroxene solvus(Davis & Boyd, 1966;Boyd & Nixon,1975). Pressure - by Al_2O_3 isopleths (MacGregor,1974).

nesian eclogite serie from the Mir pipe is also assumed to have magmatic origin. Samples with diamond, accessory phlogopite as well as those having porphyraceous texture (Solovjeva et al., 1980) are found among the above rocks. Rocks similar in bulk chemistry to some types of mica kimberlites (Solovjeva et al., 1984) presented by mica ilmenite and rutile pyroxenites can be considered as magmatic ones (Solovjeva et al., 1984). Metasomatism preceding protokimberlite formation likely associates with these magmatites.

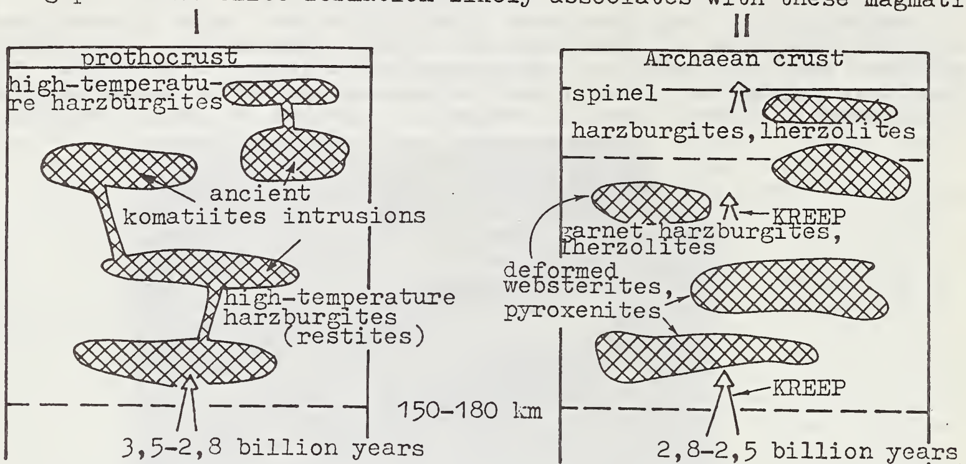

Fig.3. Evolution model of ancient lithospheric mantle. I - upper mantle extracted protocrust is composed of "hot" harzburgite, introuded by komatiite melts. II - cooling and recryslallising lithospheric mantle becomes permeables for KREEP-type fluids.

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