MAIN EPOCHS OF UPPER MANTLE ACTIVIZATION IN THE SIBERIAN PLATFORM

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Results of isotopic dating of rocks and deep xenolith minerals from kimberlites from nine fields of the north-eastern Siberian platform, obtained using different methods (Sm-Nd, Rb-Sr, K-Ar,Ar-Ar,Re-Os,Pb-Pb) in different laboratories of the wordl, show a significant isotopic and age heterogeneity of the regional mantle. This reflects several stages of differentiation and transformation of upper mantle material(deformation,melting and metasomatosis) in the period of 3.2-0.14 b.y. ago.

The earliest stage (3.2-2.0 b.y.) has been recorded by Sm-Nd and Re-Os determinations for depletion periods,dunites and a megacrystal period from the Udachnaya pipe (Pokhilenko et al., 1993; Boyd et al., 1994). The latter contain low-Ca pyropes with signs of metasomatic enrichment having Sm-Nd model ages of 2.7 and 2.0 b.y. Depleted garnet peridotites from the Mir pipe yield close Sm-Nd (3 b.y.) and Rb-Sr (2.1 b.y.) model ages. Older ages are related to mantle depletion, whereas younger ones to deep metasomatosis. A garnet peridotite from Obnazhonnaya pipe has a Sm-Nd age of 2.6 b.y. (McCulloch, 1989) and isotopic indications of depletion. Eclogites from the Udachnaya pipe yield a similar Sm-Nd isochron age (Jacob et al.,1993). Sr isotopic compositions of the eclogites (0.70226-0.7070) correspond to characteristics of both depleted and enriched mantle.

The following stage (1540-1720 m.y.) has been recorded by Sm-Nd, K-Ar and Rb-Sr data on eclogite xenoliths from the Obnazhonnaya and Sludyanka pipes, a garnet lherzolite from the Mir pipe, as well as phlogopites from garnet peridotites and pyroxenites from the Udachnaya pipe (Zaitsev et al., 1984; Gerling et al., 1969;Zhuravlev et al., 1991; McCulloch, 1989). Initial Nd isotope composition of the samples from the Mir pipe indicates a depleted character of the mantle, whereas the rocks from Udachnaya (in terms of Sr) indicate an enriched mantle source.

Next stage (1.3 b.y.) is characterized by a deep metasomatosis event. A garnet pyroxenite from the Obnazhonnaya pipe with a Sm-Nd age of 1320 m.y. yields ε_{Nd} = -2.62 (McCulloch, 1989), whereas serpentinized xenoliths from Leningradskaya pipe with a whole-rock isochron age of 1313 m.y. have initial Sr isotope composition of 0.7043. In both cases, the samples show characteristics of an enriched mantle.

Eclogite xenoliths from the Mir pipe and garnet peridotites from the Udachnaya pipe with Rb-Sr ages of, correspondingly, 1220 m.y. and 1203 m.y. (Zaitsev et al., 1985), as well as garnet peridotites from the Mir pipe with a Sm-Nd age of 910 m.y. (Zhuravlev et al., 1991) are consistent with depleted mantle material. Serpentinized xenoliths from Leningradskaya pipe with a Rb-Sr isochron age of 1088 m.y. (Zaitsev et al., 1985) represent an enriched source.

The period from 600 to 850 m.y. witnessed intense events, including metasomatic transformations. Peridotite xenoliths from the Mir, Udachnaya, Komsomolskaya, Jubilee, and Evenkiyskaya pi-

pes have Rb-Sr whole-rock isochron ages of 600-866 m.y. and initial Sr isotope composition within 0.7031-0.7111 (Zaitsev et al., 1985). K-Ar ages of xenoliths from the Obnazhonnaya pipe (Malkov, 1979; Firsov and Sobolev, 1969), of phlogopite and olivine megacrysts from a number of pipes in the Chokurdakh field and from the Leningradskaya, Joe and Sharik pipes fall within 506-866 m.y. An eclogite xenolith from the Obnazhonnaya pipe has a Sm-Nd age of 674 m.y. and ε_{Nd} of -5.5 (enriched mantle) McCulloch, 1989); various eclogites from the Mir pipe yield Rb-Sr ages of 531-664 m.y. and initial Sr isotope composition of 0,7068-0,7072 (Zaitsev et al., 1984).

The Phanerozoic stage of mantle events is recorded by Rb-Sr, Sm-Nd and K-Ar ages of eclogite and peridotite xenoliths and phlogopite megacrysts from the Udachnaya, Mir, Obnazhonnaya and Evenkiyskaya pipes. In the eclogites, isotope compositions of Nd (ε_{Nd}=+5 and +9; Zhuravlev et al.,1987; Karpenko et al., 1987) and Sr (0.7008-0.7035; Zhuravlev et al., 1987; Karpenko et al., 1987; Zaitsev et al., 1985) correspond to a depleted mantle source. Various peridotites and pyroxenites show initial Sr isotope composition of 0.7033-0.7085).

The Mesozoic stage is recorded in xenoliths of phlogopite-ilmenite harzburgites from the Obnazhonnaya pipe which yield a Rb-Sr isochron age on phlogopites of 140 m.y. and initial Sr isotope composition of 0.7087.

It appears that the formation of diamonds also had several stages. Pb-Pb model ages of sulphides of peridotitic paragenesis from the central zones of diamonds from the Udachnaya pipe are 2.25-2.2 b.y. and 1.8 b.y. (Rudnick et al., 1993). Similar sulphide inclusions in diamonds from the Mir pipe yeild somewhat younger Pb-Pb model ages (1.4-1.5 b.y.). According to Rudnick et al. (1993), the core zones of diamonds grew in a geochemical environment close in U-Pb systematics to the primitive mantle, whereas sulphides from the intermediate zones are consistent with a U/Pb-enriched mantle substrate. Some sulphides of eclogitic paragenesis have a Pb-Pb model age of around 1 b.y. This is in accord with Burgess and others' (1992) data on ^{40}Ar-^{39}Ar ages of eclogitic clinopyroxenes in diamonds from the Udachnaya pipe. Clinopyroxene inclusions from the central, intermediate and peripheral growth zones in diamonds yield, respectively, 1149, 831 and 344-575 m.y.

Comparison of isotope datings and isotope systematics of xenoliths with PT-conditions of their formation reveals several points of interest. There shows up some trend of relationship between isotope ages and depths of origin of xenoliths. Xenoliths with the oldest isotope datings come from shallower depths. For some pipes, higher-temperature xenoliths yield younger isotope ages.

The epochs of mantle processes are directly recorded in the presence of products of basic, kimberlite and alcaline-ultrabasic (with carbonatites) magmatism in the Yakutian province.

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