Isotopic and geochemical evidences of magmatic origin of Precambrian calcifires (North-East of Russia)

D.I. MATUKOV V.K. KUZMIN K.I. LOKHOV E.M. PRASOLOV AND E.S. BOGOMOLOV

Centre of Isotopic Research, VSEGEI, St Petersburg, Russia; shrimp@vsegei.ru

In this investigation we are clarifiyng origin of calsifires, which are forming lenses and layers up to 200 meters thick in palaeoarchean gneisses and crystalline schists of Okhotsk series (Khoronzha mountain, Okhotsk massive, near to 3.7 Ga).

Isotopic composition of carbon $\delta^{13}C$ vs PDB and oxygen $\delta^{18}O$ vs SMOW in carbonates were studied by Thermo Delta mass-spectrometer and U-Pb system in zircons was studied by means of ion microprobe SHRIMP-II.

On the diagramm $\delta^{13}C$ - $\delta^{18}O$, the points related to unaltereted calcifires are forming distinct trend (from $\delta^{13}C$ = -2‰ and $\delta^{18}O$=+8‰ to +8‰ and +17‰ correspondingly), which is close to that of the "primary" and hypabissal carbonatites [1]. All measured isotopic compositions are clearly distinctive from archean limestones, dolomites and marbles. This indicate that studied rocks have magmatic origin. Isotopic compositions of carbon and oxygen of lower and upper parts of the bodies are different: lower parts are isotopically lighter for both elements as compared with their upper parts. This peculiarity, as well as observed trend, possibly is connected with effect of calcifires formation in presence of abundant fluid phase. Carbon of carbon dioxide should be heavier than coexisting carbonate to approx. 2.5‰ at 300-500^{o}C. Thus during crystallization of carbonates in closed system, the carbon of residual fluid must become progressively heavier. Migrating upwards the fluid phase played important role in formation of the upper parts of calcifire layers. As the observed wide range of variation of $\delta^{13}C$ (8‰), the fractionation process should be multistage. Correlated variations of $\delta^{18}O$ could be connected with isotopic fractionation between carbon dioxide and carbonate as in the case of carbon. But in the case of unclosed system as respect to oxygen, the effect can be a result of mixing with water rich metamorphic fluids.

Concordant age of zircons from calcifires was estimated as 1928±10 Ma (n=8).

Isotopic geochemical peculiarities of calcifires and their zircons indicate to event of carbonatite magmatism in palaeoprotherozoic time in the rocks of Okhotsk series.

References

[1] Zaicev, Bell (1995) *Contrib. Mineral. Petrol*., **121,** 128-134.