Geophysical Research Abstracts, Vol. 7, 06494, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06494

Island arc belts in the Pacific and Indian oceans: isotope-geochemical features of the mantle-crust's substratum and Quaternary volcanic rocks

Yu. Mironov
Vernadsky State Geological Museum, Moscow, Russia (mironov@sgm.ru)

Many researchers connect variations in compositions of volcanic complexes along island arc belts to a different degree of development of their segments, which is accompanied by increase in thickness of the earth's crust. Other researchers attach a leading importance to some geodynamic parameters (type and thickness of the earth's crust, age of a subducted plate, an inclination of a subducted zones, etc.), which sharply vary on borders of segments. We have tried to estimate a degree of connection between lateral geochemical variations and primary heterogeneity of the mantle-crust's substratum, which is fixed on ratios of long-living isotopes Sr, Nd and Pb. For this purpose we have analyzed the data on compositions of Quaternary volcanites from the island arc belts at Pacific and Indian oceans.

For isotope systematization of rocks we used the modified Zindler-Hart's "mantle tetrahedron" in which alongside with traditional end-members (depleted mantle – DM, high- Uranium HIMU-mantle, and two types of enriched mantle – EM1, EM2) the component F ("focal") is of great importance. It represents average characteristic of all known intratetrahedron components (FOZO, C, PREMA etc.), updated by methods of multidimensional statistics. We define three Sr-Nd-Pb isotope types of volcanites. These types are spatially separated and compose extended island arc belts. The strong enrichment of melts by substance of the upper continental crust (F+EM2) is typical for Java - Banda – Sunda belt (Indian ocean). The volcanites from the "internal" Western-Pacific island-arc belt (Honshu–Kyushu-Ryukyu–Philippines-Sulawesi-Halmahera) correspond to a F+DM+EM1+EM2 mix. Mixture F and DM defines the basic dispersion of compositions of volcanites from "external" belt of island arcs, except for short ensialic segments (New Zealand, Honshu). Thus the volcanites, which

compositions are close to component F, are widely distributed in the extended segment of this belt (Izu-Bonin, Kuriles, Kamchatka and Commander islands). Characteristic feature of volcanites from "external" belt is the steady impurity of a specific component, which is close to EM1 on the majority of isotope characteristics, but differs extremely low values 207Pb/204Pb (outside "mantle tetrahedron"). Basalts from paleorifts of the western part of the Pacific lithospheric plate, which is subducted under Eurasia, as well as rocks of Hawaii - the largest islands within the limits of the same plate, have similar isotope specificity. It is necessary to note, that basalts from modern spreading ridges in the Pacific Ocean concern with other isotope type - DM+HIMU.

The magmas connected to different isotope reservoirs have regular distinctions not only in compositions, but also in features of their differentiation. Primitive basaltic melts from reservoirs EM1 and EM2 as a whole are enriched by high-uncoherent elements (La, Ce, Nd, Sm, Eu, Gd, K, Rb, Th, U, Ba, Sr, Cs, Pb, Zr, Hf, Nb, P) and depleted by Ca, Fe, V, Sc in comparison with melts connected to reservoirs DM and F. These distinctions on uncoherent elements are gradually erased, and on Ca, Fe, V and Sc, on the contrary, noticeably increase during magma differentiation. Primary basaltic magmas with high share DM are less differentiated and enriched by Mg, Ni, and Cr in comparison with melts, adequate on isotope compositions to component F. Some distinctions on high-uncoherent elements (first of all Nb, Cs, La and U) between melts from reservoirs F and DM become appreciable on basaltic andesite's stage of differentiation and further amplify. Approximately simultaneously, since andesite's stage, the melts from reservoir F start to be enriched sharply with Tb, Lu and Y, which in all other cases possess the lowered degree of incompatibility. Thus, many distinctions on compositions of volcanogenic complexes between island arc belts or their extended segments are defined by specificity of composition of mantle-crust's substratum. It is the most important, that low-alkaline magmas can be connected to any isotope reservoirs while for formation of alkaline and subalkaline complexes involving substance of ancient subcontinental lithosphere (reservoirs EM1 and EM2) is necessary. Therefore hypotheses about the geodynamic factors supervising alkalinity of magmatic complexes, require audit. The work is supported by program of Presidium of Russian Academy of the Sciences "World Ocean", and grant of the President of the Russian Federation.