Geophysical Research Abstracts, Vol. 9, 06649, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06649

Peculiarities of island arc volcanism on different mantle-crust substrata

Yu. Mironov

Vernadsky State Geological Museum, Moscow, Russia (mironov@sgm.ru / Fax +7 (095) 2920586)

Many researches connect variations in compositions of volcanic complexes along island arcs belts to a different degree of development of their segments, which is accompanied by increase in thickness of the earth crust. Other researches emphasize the leading role of certain geodynamic parameters, which sharply change at segment boundaries. We have tried to assess an impact of mantle-crust primary heterogeneities on these variations. For this purpose we analyzed data concerning composition of island arcs volcanites in the Pacific and Indian oceans. The mantle-crust heterogeneities are proved with both geophysical data and according to the ratio of long-life isotopes Sr, Nd, and Pb in volcanites. Modified Zindler-Hart's «mantle tetrahedron» was used for isotope systematization of rocks. It is characterized with important role of the component F ("focal") together with conventional end-members (depleted mantle - DM, high uranium HIMU-mantle, lower continental lithosphere EM1, and continental crust EM2). It is an average characteristic of well-known intratetrahedron components (FOZO, C, PREMA, and others), improved with multivariate statistic. Three main isotope types of volcanites were detected. These types are divided in space, forming extensive belts of island arcs. The Sumatra-Sunda-Banda belt is characterized with intensive enrichment of melts by continental crust substance (type F+EM2). Volcanites of the inner Western Pacific belt (Kyushu, Ryukyu, Luzon, Halmahera) correspond to the mixture F+ EM1. Ensimatic arcs prevail within the outer belt (Kuriles, Izu-Bonin, Mariana, Tonga-Kermadek). General dispersion of their rock's composition is determined by F and DM. Volcanites of some short segments within this belt, formed on the ancient continental crust (New Zealand, Honshu), are enriched with radiogenic ^{87}Sr (component EM2). At the same time Kamchatka volcanic complexes formed on the younger continental crust do not demonstrate the named enrichment due to long half-

life of the parent radionuclide ^{87}Rb. Magmas melted from different isotope reservoirs differ systematically from each other both for primary composition and differentiation peculiarities. Primitive basaltic melts from reservoir EM1 (and more from EM2) as a whole are enriched by all high-incoherent elements (La, Ce, Nd, Sm, Eu, Gd, K, Rb, Th, U, Ba, Sr, Cs, Pb, Zr, Hf, Nb, P) in comparison to the melts from reservoirs DM and F. Nevertheless, these distinctions are gradually decreased during magma differentiation. Primary magmas with high share of DM are enriched with Mg, Ni, and Cr in comparison with melts close to clear component F. Some elements (Tb, Lu, and Y), which are middle-incoherent in all other cases, begin accumulate rapidly in melts from reservoir F since andesitic stage of differentiation. The compositions of different isotope types of volcanites cross each other on the main classification diagram SiO_2 vrs Na_2O+K_2O within the area of normal alkalinity. Nevertheless, total alkalinity as a whole increases consecutively in the series of reservoirs F+DM – F+EM1 – F+EM2. The exception is the Kamchatka rocks, which correspond to isotope type F+DM. Their petrohemical compositions are close to rock's compositions from ensialic arcs of the inner belt (isotope type F+EM1). The most reliable indicators of ensimatic arcs are: 1) presence of low-alkalinity boninite-marianite-dacite-rhyolite complexes, which prevail on the earliest stages of the evolution; 2) weak (mainly basalt-andesite) differentiation of normal alkalinity complexes; 3) virtually total absence of high-alkalinity complexes. Strong differentiated normal-alkalinity and subalkaline complexes prevail on all stages of evolution in the ensialic arcs. If continental crust substance is involved in magmagenesis alkaline high-potashium complexes can originate together with the named above ones. Hence, the primary heterogeneities of mantle-crust substrata are a very important factor of island arc magmatism. It detects not only peculiarities of compositions and differentiation of melts but some features of the general magmatic evolution.