Hydrogeochemistry of the Mutnovsky volcano (South Kamchatka)

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The Mutnovsky volcano (52°21'N, 158°16'E, 2323 m) is located 75 km southward from the town of Petropavlovsk Kamchatsky. In terms of explosive activity and heat discharge, this volcano is presently among the most active volcanoes of the Kamchatka volcanic belt. In 2003 and 2005, we sampled springs, pools, and mud pots of the Donnoe fumarolic field. Sampling of aqueous solutions was accompanied by in situ measurement of pH, Eh, and Cl- and F- contents. The springs studied in the Mutnovsky volcano crater have diverse composition, but most of them belong to acid waters (pH ~ 2.5-3.5). The solutions have high contents of Al, Ca, Mg, Na, Mn, Fe, As, Cu, Ti, Co, Cr, and P. The highest contents of these elements previously known from the Kuril-Kamchatka volcanic arc at Kunashir Island are one to three orders of magnitude lower. The solution is also characterized by high concentrations of Au, Mo, and Zr, which are not usual for hydrothermal springs in areas of basaltic andesite volcanoes, and extremely high contents of B and Sr. Modeling was conducted with the method of using a Selector Win program in continuous reactor modification [1]. Large-scale extraction of components from basalts requires the presence of oxidized high-temperature gases, which could be formed in the upper part of the volcanic-hydrothermal system via mixing of magmatic fluids with overheated vapors of oxygen-enriched surface water. High-temperature mixed gases (surface water vapor and magmatogenic acid gases) are formed along the external boundary of condensation. The newly formed aggressive gas can leach most elements from host basalts. The gas is partially condensed to mix with magmatic fluid, while solutions are diluted and cooled in the course of their ascent. The next geochemical barrier (the second boiling zone) is characterized by the exsolution of some components (primarily, water vapor and small amount of acid gases) into the gas phase, while the remaining portion is enriched in some elements (Cr, Ni, V, Ti, and others) up to the required level. Thus, we assume that the hydrothermal spring in the Donnoe field is related to the zone of enriched brines arising at the secondary boiling boundary. This assumption is confirmed by thermodynamic calculations.

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References

[1] Karpov I.K., Chudnenko K.V., Kulik D.A., Bychinskii V.A. (2002) *American Journal of Science* vol. 302, 281-311.

Archaean enriched mantle reservoir beneath east Indian Shield

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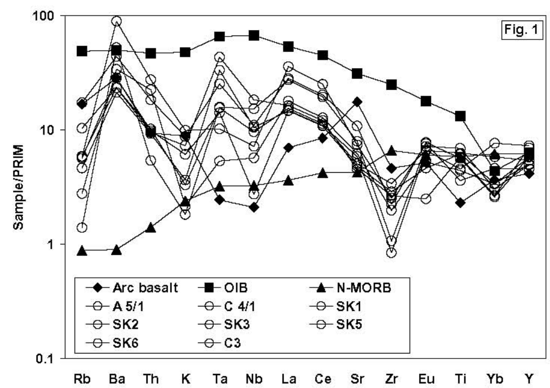
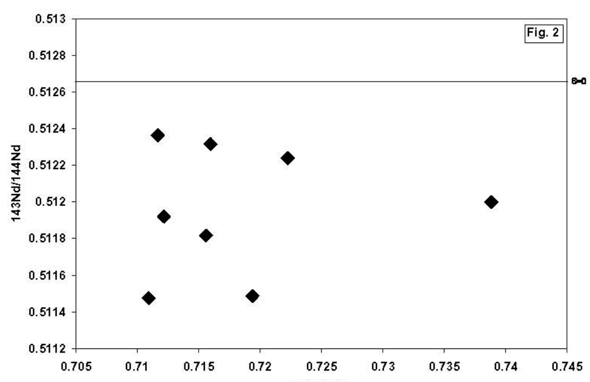
Prograde hornblende-bearing mafic granulite xenoliths, associated with massif-type charnockite, is a significant feature of the collisional Eastern Ghats orogen (Kar, 2003). These mafic xenoliths have geochemical signature of arc-derived basalts (Fig. 1). No correlation in Sr-Nd isotopic compositions is observed and hence mixing of different mantle components can not be envisaged. But present day low $^{143}Nd/^{144}Nd$ values and high $^{87}Sr/^{86}Sr$ values indicate an enriched mantle reservoir as the source of these mafic xenoliths (Fig. 2). The 1.8 Ga Rb-Sr isochron represents the isotopic homogenization during granulite event in a collisional setting. Nd-model dates, calculated after Milisenda *et al*., 1994, *ca* 2.7 Ga (2688 to 2784 Ma), represents the time of extraction from the mantle. Also the enriched mantle reservoir in this segment of the east Indian Shield might have resulted from a previous crust-mantle interaction or crustal recycling (Shan Gao, 2004), during *ca* 3.0 Ga granulite event in the Eastern Ghats belt (Bhattacharya, 2001).





References

Kar *et al*., (2003), *Contrib .Mineral. Petrol.*, **145**, 707-729.
Milisenda *et al*., (1994). *Precam Res*. **66**, 95-110.
Shan Gao *et al*., (2004). *Nature*, **432**, 892-897.
Bhattacharya *et al*., (2001). *Geol. Mag*., **138**, 609-618.