



## Strontium isotopes in thermal waters of the Kuril Island Arc, NW Pacific

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Isotopic ratios  $^{87}\text{Sr}/^{86}\text{Sr}$  were measured in dissolved Sr from more than 40 hot springs of the Kuril Island Arc from Paramushir Island at the north of the arc to the southernmost Kunashir Island. The Kuril Arc is characterized by three main types of hydrothermal activity: (1) steam-heated  $\text{SO}_4$  waters; (2) acid  $\text{Cl-SO}_4$  or  $\text{SO}_4\text{-Cl}$  waters, and (3) neutral  $\text{Na-Cl}$  coastal springs partially mixed with seawater. The all three types are also different in  $\text{Ca/Sr}$  ratios: variable in the  $\text{SO}_4$  steam-heated waters, close to the volcanic rock ratios in the acid  $\text{Cl-SO}_4$  waters and sometimes similar to the seawater ratios in the coastal springs. In all steam-heated and  $\text{Cl-SO}_4$  waters  $^{87}\text{Sr}/^{86}\text{Sr}$  values are close to the host (mostly Holocene) volcanic rock ratios of  $0.7032 \pm 0.0002$  with a more or less uniform along-arc distribution until Kunashir Island. Acid waters from hydrothermal systems of Mendeleev and Golovnin volcanoes at Kunashir Island show more variable  $^{87}\text{Sr}/^{86}\text{Sr}$  values from 0.7033 to 0.7045 that indicates water-rock interaction with the older basement rocks found on the island. Dissolved Sr in the coastal  $\text{Na-Cl}$  springs show variable  $^{87}\text{Sr}/^{86}\text{Sr}$  from the volcanic rock values to close to the seawater value of 0.7091. For these waters, it is not easy to distinguish between a simple mixing with seawater and the result of water-rock interaction even applying  $\text{Mg/Sr}$  and  $\text{Ca/Sr}$  ratios. The most spectacular data were obtained for boiling springs at Ushishir caldera in the middle of the arc. These coastal springs discharge slightly acidic water with  $\text{Cl}$  a bit higher than in seawater,  $\text{Ca}$  up to 1000 ppm and  $\text{Ca/Sr}$  ratio as in seawater. Nevertheless, the values of  $^{87}\text{Sr}/^{86}\text{Sr}$  are close to the value for surrounding volcanic rock of  $0.7032 \pm 0.0001$  that may indicate an intense Sr exchange between water and rock at a low water/rock ratio and high temperature as it has been shown for the vent fluids at spreading ridges (i.e. Albarede et al., 1981). This work was supported by a grant from the Russian Science Foundation # 15-17-20011.

Albarede F., Michard A., Minster J.F., Michard G.  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios in hydrothermal waters and deposits from the East Pacific Rise at  $21^\circ\text{N}$ . *EPSL*, 55 (1981), 229-236