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Sulfur and carbon isotopes in volcanic gases of the Kuril Island arc, NW Pacific

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Sulfur and carbon isotopic composition of the total sulfur and CO_2 were analyzed in more than 30 samples of fumarolic gases from 7 volcanoes of the Kuril arc sampled in 2015-2017. Fumarolic temperatures varied from 98 to 722°C. Isotopic composition of CO_2 was analyzed from samples of "dry gas", whereas the sulfur isotopic composition was measured from the total sulfur precipitated as BaSO4 after oxidation of the alkaline condensates. Sulfur isotopic composition of the total sulfur varies in a wide range of 0 ‰ to +10 ‰ (V-CDT) without a visible along-arc trend. There is a broad negative correlation between δ34S and the fumarolic vent temperature. For fumaroles with t >400^{0}C (higher than the boiling point of native S), the values of δ34S vary in a narrow range of +3 $\pm$ 0.3 ‰Ṫhe variability of δ34S in low-temperature fumarolic gases may be attributed to two main processes: precipitation of native S (enrichment in 34S) and dissolution of SO4 in the acidic boiling brine beneath fumarolic fields (depletion in 34S). Both processes can be modelled using an appropriate thermochemical computer code.
Values of δ13C-CO_2 varied in a range of -5.2 to -1.3 ‰ (V-PDB) and showed an irregular along-arc distribution. The MORB-like values of $\sim$ -5‰ are characteristic for high-temperature fumaroles of the northern Ebeko volcano, Pallas volcano, Ketoy Island, in the middle of the arc, and Kudryavy volcano at the southern Iturup Island. Fumaroles of both volcanoes (Sinarka and Kuntomintar) at Shiashkotan Island with temperatures from 130 to 441°C emit CO_2 enriched in 13C, with δ13C from -1.3 ‰ to -2.6 ‰Ṫhe southernmost Mendeleev and Golovnin volcanoes at Kunashir Island with a distance of 20 km between their summits emit CO_2 with δ13C of $\sim$ -4.5‰ (5 samples) at Mendeleev volcano and $\sim$ -2.4‰ (6 samples) at Golovnin volcano.
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