

Hydrogeochemical characteristic of mud volcanism manifestations on Sakhalin Island

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Abstract [Резюме](#) [RUS](#)

There are four areas of mud volcanism traditionally set off on Sakhalin Island. Each of them is characterized by one or more eruptive mudflow seepage domains of different morphology. This article considers the results of a study of regional features of the chemical and isotopic ($\delta^{18}\text{O}$ and δD) composition of groundwater discharging from all known mud volcanoes in the region. A pooled analysis of available literature data showed the studied waters to be heterogeneous in their geochemical parameters. This heterogeneity is most significantly manifested for the total mineralization, which average values vary from 0.1 to 22.5 g/l in the waters of different mud volcanic seepage domains. Mud volcanic waters in the region are also represented by different hydrochemical types, but $\text{HCO}_3\text{--Cl--Na}$ waters are the most common. The isotopic characteristics testify the waters of the South Sakhalin, Pugachev, and Vostochny mud volcanoes to be formed as a result of mixing the original sea waters buried under sedimentation with meteoric and dehydration waters. One of the key factors in the metamorphization of these waters is the influx of large amounts of CO_2 into the channels of mud volcanoes, which contributes to more intensive leaching of aluminosilicate water-bearing rocks and leads to an increase in the content of Na^+ and Mg^{2+} in mud volcanic waters. By the pooled geology and geochemical data, we made an assumption that the waters of Daginsky and Lesnovsky mud volcanic manifestations do not refer to mature groundwaters of deep circulation, thus being not generally typical for mud volcanoes. Water-formation temperatures of the South Sakhalin, Pugachev, and Vostochnyy mud volcanoes calculated using the Mg–Li hydrochemical geothermometer vary from 51 to 105 °C, which corresponds to depths range from 1.3 to 2.6 km. Water-formation temperatures of the Daginsky thermal and mineral springs calculated using the K–Mg geothermometer average 70 °C, which corresponds to the occurrence of an aquifer feeding this fluid system at a depth of 2.1 km.

Keywords

mud volcanoes, groundwater, chemical composition, stable isotopes,
water–rock–gas interaction, Sakhalin Island

For citation: Nikitenko O.A., Ershov V.V. Hydrogeochemical characteristic of mud volcanism manifestations on Sakhalin Island. *Geosistemy perexodnykh zon = Geosystems of Transition Zones*, 2020, vol. 4, no. 3, pp. 321–350. (In Russ. & Engl.). <https://doi.org/10.30730/gtrz.2020.4.3.321-335.336-350>

Для цитирования: Никитенко О.А., Ершов В.В. Гидрогеохимическая характеристика проявлений грязевого вулканизма на острове Сахалин. *Геосистемы переходных зон*, 2020, т. 4, № 3, с. 321–350.

<https://doi.org/10.30730/gtrz.2020.4.3.321-335.336-350>

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