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First systematic geochemical assessment of the St. Ana crater, Ciomadul volcano, Eastern Carpathians, Romania

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Ciomadul volcano is the youngest volcano within the Carpathian-Pannonian Region. Its last eruption occurred 32 ka ago and resulted in the formation of St. Ana crater, that hosts a lake with a surface area of 22 ha, a maximum depth of ∼7 m and 12 m thick sediments. This volcanic area is characterized by intense cold gas emissions in the form of bubbling pools, mofettes and mineralized sparkling waters. These emissions occur mostly along the eastern-southeastern margin of the volcano at the older lava dome areas but gas emissions and sometimes bubbling can be observed also in the water of the crater lake.
In 2017 we started a survey to constrain the amount of gas released from the crater through measurements of diffuse degassing from the soil. We also tried to constrain the hydrochemistry of the lake and to quantify the amount of carbon-dioxide dissolved in the water by performing 39 drillings on the ice of the lake in wintertime and sampling the water meter by meter from the bottom.
The temperature of the lake was constantly 4^0C in wintertime, the pH of the water ranged between 3.35 and 7.12. Based on the chemical and isotopic parameters (δ18O ranging between -10.63 and -1.08‰ VSMOW, δD ranging between -89.4 and -27.2 ‰ VSMOW), the water of the lake is of Ca-HCO_3 type and meteoric origin. The amount of TDIC varies between 1 and 10 mg, while the 13CTDIC values range between -6.17 and -19.77 VPDB suggesting the concomittent presence of different sources for CO_2 vary between magmatic, atmospheric and organic, and several secondary processes in the shallow water of the lake modify the isotopic ratio of the gas.
The values of the diffuse CO_2 from soil varied between 1.9 and 2.3 x 10^2 g/m2 day, much lower in comparison with the older structures of Ciomadul, where values up to 8.2 x10^4 g/m2 day were also detected.
The locations of the strongest degassing do not coincide with the youngest eruption centre of the Ciomadul, for which we may assume that the fractures enhancing fluid circulation occur at the older, more tectonized volcanic structures, while the crystal mush beneath the younger edifices act as a seal. The CO_2 could come from deeper sources, possibly from mafic degassing magma body at the crust-mantle boundary.

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