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Spatially distinct magmatic gas emissions at the long-dormant Ciomadul volcano (Eastern Carpathians, Romania): constraints on the flux of carbon-dioxide

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The Ciomadul volcano is located in the South Harghita Mountains (Eastern Carpathians, Romania) and it is the youngest volcano (600-32 ky) built by the Neogene volcanism in the Carpathian-Pannonian Region. Although the volcano seems to be inactive, several features suggest that melt-bearing magmatic body could still exist beneath it (Harangi et al., 2015). This volcanic area is characterized by intense cold gas emissions (CO_2, CH4), in the form of bubbling pools and mofettes. The isotopic compositions of carbon, 13C CO_2 up to -3‰ VPDB and helium up to 3.1 Ra suggest magmatic origin of the gas.
The last eruption of the volcano occured 32 ky ago resulted in the formation of the St. Ana crater, hosting a lake. The lake has a surface area of 22 ha, a depth of ∼7 m and sometimes bubblings are present in its water.
Since 2016 we started a survey to constrain the amount of gas released from the volcanic area by diffuse degassing from the soil, covering the peripheral volcanic regions, and then the main St.Ana crater. The measurements in the St.Ana crater covered the whole lakeshore with a total of 1947 measurements, using the accumulation chamber method (Chiodini et al. 1998), in meteorologically stable conditions.
The CO_2 fluxes in the crater varied between 0.85 and 12.36 x 102 g/m2/day. These values are much lower that those measured in the older volcanic structures of Ciomadul (Bálványos and Puturosul, 500-600 ky), where values up to 8.2 x 104 g/m2/day were reached (Kis et al., 2017).
Based on a comparison between the diffuse CO_2 degassing from the older structures and in St. Ana crater, we may conclude that the locations of the strongest degassing do not coincide with the youngest eruption center of the Ciomadul. We may explain this by assuming that the fractures enhancing fluid circulation occur at the older, more tectonized volcanic structures, while the still compact rocks and crystal mush beneath the younger edifices act as a seal. A second assumption is that CO_2 could come from deeper sources and find an uprising path at the periphery of the volcanic structures.

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