



Evaluation of chemical-physical conditions controlling the production of light hydrocarbons at the Ciomadul area

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The Ciomadul volcanic complex is the youngest volcano in the Carpathian-Pannonian area. A very intense release of carbon dioxide from mofettas, bubbling pools and diffuse emissions characterizes the study area. In 2015 and 2016, several sampling campaigns were carried to collect gas samples for characterizing the chemical and isotopic features of the light hydrocarbons in these emissions.

Methane and other light hydrocarbons are usually found in ppm levels in volcanic fluids, whereas in the Ciomadul gases methane concentrations surprisingly ranges between 0.06 up and 2.38 vol.%. According to the classical interpretation of the stable isotopic signatures of methane the $\delta^{13}\text{C}_{\text{CH}_4}$ and $\delta^2\text{H}_{\text{CH}_4}$ values of the collected samples (from -28.3‰ to -7.8‰ VPDB and -144‰ to -124‰ VSMOW, respectively), suggest a thermogenic origin with some possible contribution from an abiotic source. Similar isotopic values were also measured in fumaroles from volcanic systems (e.g., of Panarea and Pantelleria) and geothermal systems (e.g., Mt. Amiata, Larderello and Latera), and were interpreted as likely produced by abiotic processes.

Although such an interpretation of the isotopic composition of methane is still questionable, an attempt to obtain information about the physical-chemical conditions dominating at the methane $\text{C}_2\text{-C}_3$ hydrocarbons source region was here carried out using gas-geothermometers. Geothermometric calculations in the $\text{CH}_4\text{-CO}_2\text{-H}_2\text{-Ar}$ system seems to indicate that gases attained equilibrium in a liquid phase at $150\text{-}250^\circ\text{C}$ and -3.6 to $-4 R_H$.

Such chemical-physical conditions are consistent with a thermogenic origin, although it does not exclude mixing with an abiotic component. However, the cause(s) for the relatively high concentrations of methane characterizing these gases is still matter of debate and merits further investigation.