



Stable isotope and chemical investigation of CO₂-rich springs in the Eastern Carpathians, Romania

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The Eastern Carpathian Mts. (Romania) have the highest concentration of CO₂-rich cold springs in Europe, related mostly to post volcanic CO₂ degassing along both point sources, and through several deep faults. To investigate the source and circulation of waters in the region, we have analyzed the chemical and stable isotopic composition of surface and ground waters in the area. Chemically, the ground waters are rich in Li, Ca, Na, Mg and sulfates, as a result of long flow paths through alkali-mafic magmatic rocks. Stable isotopes ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) in cold springs show variations that generally follow those in surface waters and precipitation, while thermal springs seem to be disconnected from the seasonal variability. A slight shift towards lighter $\delta^{18}\text{O}$ is noticeable, indicating mixing with CO₂ from deeper sources.

Both chemical and stable isotope data seem to indicate a meteoric origin of the waters; however, in some cases, its underground residence time is long enough to mask this surface origin, pointing towards a deep circulation along faults, resulting in equilibration with CO₂ possibly originating from local magma reservoirs.