



Identifying Mixing Components by Natural Tracers in the Lake Hévíz System

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One of the largest natural thermal lakes in the world, Lake Hévíz is located in the southwestern part of the Transdanubian Range's karst system (Hungary). It is fed by springs with different temperatures, which are located in a cave beneath the lake. The mixing of cold and hot waters generates the lake's sulphuric therapeutic water, and it is responsible for the cave formation at the bottom, resulting in the lake's unique ecosystem. The presented research aimed at the comprehensive geochemical characterization of waters in the wider surroundings of the lake (lake water, springs, observation, drinking water, and thermal water wells). Investigating the geochemical characteristics of water took on a novel perspective through the innovative application of radionuclides as natural tracers. Within the framework of this investigation, we utilized uranium, radium, and radon isotopes to identify the mixing of fluids and infer the mixing end members in the Hévíz karst system. Alpha spectrometry was applied on selectively adsorbing Nucfilm discs as an inventive approach to measure uranium and radium isotopes. Moreover, stable isotopic ratios of hydrogen and oxygen ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) were determined to supplement the information on waters with different origins. Hydrochemical water analysis for measuring the concentration of major ions and trace elements was carried out using ICP-MS, ion chromatography, and UV-Vis spectrophotometry. The inferred fluid end members and their compositions are anticipated to provide insightful information on the hydrogeological functioning of the Lake Hévíz karst system, which is indispensable in sustainable water resource management and understanding climate change's impact.

Keywords: Thermal lake; Hydrogeochemical characteristics; Mixing fluids; Radionuclides; Stable isotopes; ICP-MS, Nucfilm, Alpha spectroscopy