

## EVALUATION OF THE ORIGIN OF SULFATE IN THE WATER SOURCE KLJUC, SERBIA

N. Miljevic<sup>1</sup>, D. Boreli-Zdravkovic<sup>1</sup>, G. Dusan<sup>2</sup>, B. Mayer<sup>3</sup>

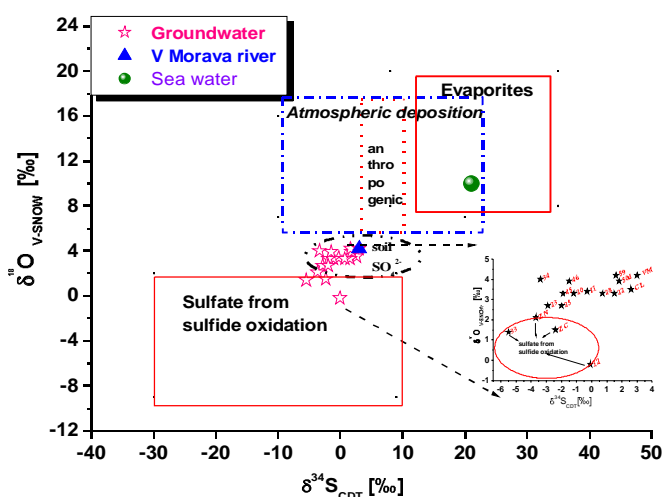
*emiljevi@vinca.rs*

<sup>1</sup>Jaroslav Cerni Institute for Development of Water Resources, Jaroslava Cernog 80, 11226 Belgrade, Serbia

<sup>2</sup>Vinca Institute for Nuclear Sciences, POB 522, 11001 Belgrade

<sup>3</sup>Department of Geoscience, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, Canada

The sulfur and oxygen isotope ratios of sulfate ( $\delta^{34}\text{S}_{\text{SO}_4}$  and  $\delta^{18}\text{O}_{\text{SO}_4}$ , respectively) in groundwater are commonly used in aquifer studies to identify sulfate sources and describe biogeochemical processes. A sampling campaign was carried out during low flow conditions (September 2007) in central Serbia. Sixteen samples taken from piezometers completed in the aquifer and from the river were analyzed for pH, electrical conductivity (EC), redox potential (Eh),  $\delta^2\text{H}_{\text{water}}$ ,  $\delta^{18}\text{O}_{\text{water}}$ ,  $\delta^{34}\text{S}_{\text{SO}_4}$  and  $\delta^{18}\text{O}_{\text{SO}_4}$  as well as major ions. The groundwater pH was neutral (6.8–7.3) at shallow depths (5.7–9.5 m bgl) with redox potential of 339–372 mV. The sulfate concentrations in groundwater samples obtained from the study area varied from 56.2 to 165 mg/l and  $\delta^{34}\text{S}_{\text{SO}_4}$  values ranged from -5.5 to +2.6‰ with similar values in river water (Fig. 1).



**Figure 1.** Schematic diagram of the isotopic composition of typical sulfate sources including data for groundwater and the Velika Morava River in the vicinity of the Kljuc groundwater source.

There is a weak trend of increasing  $\delta^{34}\text{S}_{\text{SO}_4}$  values with increasing sulfate concentrations in the area indicating that bacterial dissimilatory sulfate reduction is not occurring. A few samples with slightly lower  $\delta^{34}\text{S}_{\text{SO}_4}$  ( $< 0$  ‰) have also lower  $\delta^{18}\text{O}_{\text{SO}_4}$  ( $< 2$  ‰) values, suggesting that these may have a component of  $^{34}\text{S}$ -depleted sulfate from sulfide oxidation [1].

1. Hosono T, Chung-Ho Wang, Umezawa Y, Nakano T, Onodera S, Nagata T, Yoshimizu C, Tayasu I, Taniguchi M (2011) Multiple isotope (H, O, N, S and Sr) approach elucidates complex pollution causes in the shallow groundwaters of the Taipei urban area. *Journal of Hydrology* 397:23-36.