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AQUEOUS GEOCHEMISTRY OF GROUNDWATER IN A REGION AFFECTED BY BALKAN ENDEMIC NEPHROPATHY

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EXTENDED ABSTRACT

The environmental hypothesis for the cause of Balkan Endemic Nephropathy (BEN) suggests that the spatial distribution of BEN is related to the biogeochemistry of the environment (e.g., soils, water and food). Little is known about the hydrogeochemistry of groundwater from such regions. Therefore, samples of well, tap, and spring waters were collected from BEN and non-BEN areas in the Vratza region of Bulgaria. In the field, samples were 1) collected using clean techniques; 2) analyzed for alkalinity, pH, temperature, conductivity, redox, and nitrogen species; and 3) split into subsamples, filtered and preserved for further analyses. In the laboratory, major anions and nutrients were determined by ion chromatography and major, minor, and trace elements determined by either atomic absorption or HEX-ICP-MS. Graphical (e.g., x-y plots, Piper plots) and geochemical (thermodynamic models using PHREEQC) and general statistical techniques (e.g. Student t) were used to study the data. Selected results include**:** 1) the water for the region is a calcium-bicarbonate water, 2) most chemicals in both types of locations were not above recommended drinking water standards; 3) arsenic concentrations were typically higher in BEN samples than non-BEN samples; 4) uranium concentrations were above WHO suggested limits in many well and spring water samples, whether from a BEN or non-BEN village; 5) nitrate$^-$ levels were very high in well water from both BEN and non-Ben villages, were higher in springs from BEN villages than non-BEN villages, and may indicate possible pathways for contaminants to enter the groundwater system; and 6) Cl:Na ratios along with NO_3 levels indicate possible human influences on the water supply The results show biogeochemical differences between BEN and non-BEN villages. However, these differences are not fully understood and therefore cannot be related to the cause or distribution of BEN at this time. This ambiguity is in part related to a lack of data on groundwater biogeochemistry and the hydrogeology of the area. More work needs to be done on water quality in the Balkans to address not only historical heath issues (e.g., BEN), but also new and immerging environmental and environmental health issues.

Key words: Balkan Endemic Nephropathy, metals, nitrate, geochemical modeling, uranium speciation, ICP-MS, PHREEQC