ABSTRACT

Thesis: Karst Processes, Isotopic Analyses, and Contributions to Global Carbon Cycle Modeling from the Vadu Crisului Karst Basin, Romania.

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Pages: 81

This investigation aims to quantitatively evaluate karst processes and aid in the refinement of estimates for contributions of karst landscapes to the global carbon cycle. This is accomplished by considering the chemistry of water from the field and in discrete samples analyzed in the laboratory, and continuous monitoring data or chemical data collected between October 2016 and December 2017. An isotopic analysis of $\delta^{13}C$ (in dissolved inorganic carbon and in bedrock), SUVA, C:N ratios and the isotopic character of $\delta^{18}O$ and δD from precipitation and aquifer samples were used to evaluate the relative contribution of different sources of carbon to the aqueous system. The investigation includes the net export of dissolved solutes, suspended sediments, and organic carbon, within the Vadu Crişului karst basin in the Pădurea Craiului Mountains of northwest România.

The ranges of measurements for $\delta^{18}O$ and δD were consistent with those seen in other studies near this region. Water isotopes experienced marked drops during recorded storm events in alignment with other chemical data. Deuterium excess most closely resembled that of precipitation

during summer and fall months with the stability of the isotopic signature being attributed to the greater influence of infiltration over that of direct flow of water to the system.

Dissolution at Vadu Crisului is principally driven by the carbonate equilibrium reactions, and direct meteoric recharge only accounts for 4-13 % of observed discharge. Most recharge enters the karst basin through infiltration into dolines and epikarst on the karst plateau, and this results in a broadly stable chemical signature of spring water. Storm events do have a significant impact on mechanical and chemical processes operating in the karst basin; the addition of PIC and TSS flux increase landscape erosion rates by 1.1–1.2 % and 7.9–8.3 %, respectively, above the denudation rate computed by dissolved solutes (36.5–56.9 mm/ka). The modeled annual flux of DIC from this karst basin, 1.67–2.19 x 10^5 kg/yr, scales to a global CO_2 flux of 0.71–1.06 x 10^{10} kg/yr. Adding modeled flux of DOC increases the estimates of CO2 flux by 12–22 %, a significant, and often un-accounted for, addition to the global carbon cycle.