ABSTRACT

THESIS: Investigating Vadose-Zone Hydrology in Alpine Karst Aquifers using Quantitative Groundwater Tracing Methods: Timpanogos Cave National Monument, Utah County, Utah

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In this investigation, we consider the chemical signatures of water samples collected in 2012 from four cave pools within Timpanogos Cave National Monument (TICA), a unit of the National Park Service (NPS) in American Fork, Utah. A parallel investigation of the American Fork River in the Monument served as a basis of comparison between groundwater in the caves and surface water in the canyon. Results highlight the variation in source waters to these cave pools in this alpine karst setting. Two independent dye trace attempts in this study have not established a connection between the surface near the canyon rim at the south border of the Monument and the cave pools or the river. Ion chemistry of the pools reveals elevated sulfate concentrations. Analyses of these sulfate concentrations and other reaction products suggest the possibility of combined carbonic and sulfuric acids as speleogenetic agents. Enrichment of $^{13}$C in dissolved inorganic carbon above expected values provides initial support of this hypothesis. The enrichment of sulfate in the cave pools when coupled with higher concentrations of fluorine, suggest increased interaction with bedrock influenced in the past by hydrothermal activity. This is especially relevant in pools with steady minute water-level fluctuations during the course of the study. Other pools have greater water-level variation and unexpectedly have a very consistent
chemical composition. One hypothesis is that the source waters for the pools with stable geochemical character are from the talus near the canyon rim.