(U-Th)/Ne Dating of Mineralizing Fluid Flow in the Paradox Basin

J. L. Everard[1], S. E. Cox[2], P. W. Reiners[3], L. R. Bailey[3]

[1]Department of Environmental Science, Barnard College; [2]Department of Geochemistry, Lamont-Doherty Earth Observatory of Columbia University; [3]Department of Geosciences, University of Arizona

The Paradox Basin is a Paleozoic Basin in the Southwestern United States that holds geologic, hydrologic, and economic importance. As such, it is desirable to understand the history of the Paradox Basin in terms of geologic forcings, hydraulic fluxes, and fluid-flow reactions. To establish this history, radioisotopic dating techniques can be leveraged, such as ones based on the decay of radioactive uranium and thorium isotopes to stable lead daughter products over time. Past efforts have focused on measuring the helium atoms produced during this decay series – a system known as (U-Th)/He dating. However, helium is a lightweight noble gas that is known to leak out of mineral structures at very low temperatures. Thus, this approach frequently records cooling ages rather than actual formation ages. Using ^{21}Ne, which is produced in oxide minerals as a result of this same decay series and is better retained in mineral structures, we gain additional information about the high-temperature history of the samples that can allow us to determine rock formation ages and refine our understanding of the history of the Paradox Basin. Here, we design and construct an extraction line for a new mass spectrometer setup that will be dedicated to measuring these neon isotope concentrations. Initial background-corrected mass scans show partial resolution of $^{40}Ar^{++}$ and $^{20}Ne^{+}$ and determination of the isotopic composition of air standards. Samples collected during field work in the Paradox Basin in May 2022, as well as samples collected during previous trips, were cleaned and magnetically separated, and neon isotope composition measurements are currently in progress. Not only will our new setup allow us to elucidate the timing of mineralizing fluid flow in the Paradox Basin, but it will also be applied to a wider range of studies, including clarifying the age of the Great Unconformity in Colorado and dating iron oxides that serve as an indication of radium contamination in groundwater in Wadi Rum, Jordan.