Identifying Carbon Fuel Sources through RNA Extractions of Microbial Communities in Vietnam Groundwater

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Throughout Southeast Asia, the reduction and dissolution of iron oxides by microbial communities releases naturally occurring sedimentary arsenic into groundwater. In Vietnam, these metabolic activities cause large scale contamination of aquifers, affecting drinking water and crop irrigation for millions of people. Although it is known that subsurface microorganisms utilize carbon as a source of energy, this study aims to discover the source and age of carbon being used. Dating the carbon found in bacterial RNA can provide information on carbon cycling as well as how these processes may be changing due to groundwater pumping. Memtrex-NY Pleated Nylon water filters were used to sample four wells from both Pleistocene and Holocene depths with variable depositional history and arsenic levels along the Red River Delta near Hanoi, Vietnam. Despite previous studies suggesting that Holocene aquifers contain the highest levels of arsenic contamination, recent papers argue that intensive groundwater pumping is contaminating Pleistocene aquifers as well. The goal of this summer was to test all four sites to determine if ample RNA could be obtained for radiocarbon dating and next generation Illumina Sequencing. A minimum of 100 ug of RNA is required for radiocarbon dating, so RNA was extracted from one ring of each filter to determine which site had the highest nucleic acid yield. It was hypothesized that the filters from Holocene depths (P606 and YMW2) would have the highest yield, youngest organic carbon, and higher levels of arsenic release. However, the VPNS5 ring provided in the highest yield and was located on a boundary between Holocene and Pleistocene aquifers, making it a valuable site to study the movement of arsenic between older and younger aquifers. Moving forward, the RNA from the VPNS5 filter will be fully extracted and dated to analyze the source of the carbon and how it may be affecting the contamination of nearby Pleistocene aquifers.