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Methods for Optimizing Extraction of Bacterial DNA from Field Systems

Arsenic contamination of groundwater poses immense health risks to more than 100 million people worldwide. Exposure to elevated levels of arsenic in groundwater is linked with several cancers, cardiovascular disease, impaired neurological activity, and increased mortality. Although arsenic is naturally occurring across the planet, local geology can elevate concentrations in groundwater to unsafe levels. In South and Southeast Asia, the prevailing hypothesis for arsenic mobilization suggests that heterotrophic bacteria reduce iron in the subsurface in order to metabolize organic carbon. The reduction process liberates arsenic that is bound to the iron, releasing it into the groundwater. The organic carbon sources in the mechanism above are not well-characterized; carbon sources may be geologic and stem from peat or sediment, or they may be anthropogenic, resulting from latrines or other human organic waste, or they may be a mixture of the two. Current research focuses on characterizing the carbon sources by collecting samples of the microbial community in groundwater via filtration; the DNA collected from the filters is then extracted, purified, and radiocarbon dated in order to date and thus constrain the organic carbon sources. This research project attempts to improve the current methods for bacterial DNA extraction by identifying the sources of carbon contamination in current methods and modifying those methods to maximize purity and yield. *Escherichia coli* samples frozen at each step in the current processing method provided information on where carbon contamination came from. A variation on Qiagen's soap-based extraction buffer solutions, a Tris-EDTA and NaCl solution, and 1.5M sodium perchlorate were used to extract DNA from lab-grown *Escherichia coli* samples, artificial filters, and field filters to compare their effects on yield and purity with and without filters. Data on the sources of carbon contamination and the comparative efficacy of buffers will be used to optimize bacterial DNA extraction and contribute to understanding the factors that support arsenic mobilization.