USGS NSF GRIP Opportunity

USGS Center:	Minnesota Water Science Center
Project Title:	Arsenic in Minnesota groundwater—Occurrence and relation to hydrogeologic and geochemical factors
Project Hypothesis or Objectives:	Minnesota is a geographic nexus of drinking water wells with arsenic (As) concentrations above 10 micrograms per liter (https://apps.health.state.mn.us/mndata/webmap/wells.html), the current regulated drinking water standard. The complex distribution of elevated-As drinking water wells in Minnesota glacial aquifers is a long standing public health problem. The strong geographic heterogeneity of elevated-As wells, the relatively low As concentration in aquifer sediments, and the lack of a correlation between solid-phase and aqueous-phase As concentrations have contributed to the difficulty of minimizing this human health problem. This project will build upon previous work that identified a correlation between the occurrence of elevated groundwater arsenic and certain glacial sediments, well construction characteristics, water chemistry, redox conditions, and sediment chemistry. This project will combine a uniquely rich set geologic and geochemical data. The data include historic geologic and water chemistry data, and newly acquired water chemistry, sediment chemistry, and geologic interpretations. These rich data sets will be analyzed using sophisticated statistical modeling, geochemical modeling, GIS modeling, and other techniques to increase understanding of arsenic occurrence in space and time. This increased knowledge of hydrologic and geochemical systems will support efforts to protect human health by providing guidance to well drillers to reduce the likelihood of their customer's exposure to groundwater arsenic contamination and to target exiting well owners with information about arsenic testing and treatment.
Duration:	6 - 12 months
Internship Location:	Mounds View, Minnesota

Area of Discipline:	The projects pertains to Earth Sciences (hydrogeology, geochemistry, GIS), Chemistry (environmental chemistry, geochemistry, geochemical modeling), Engineering (water resources, environmental chemistry, GIS).
Expected Outcome:	Results of this study will contribute to the scientific understanding of arsenic in groundwater in Minnesota and could be applicable to other glaciated areas of the world. Development of a process-based understanding of arsenic contamination in groundwater in Minnesota meets the strategic goals of the USGS in evaluating natural physical and chemical hazards that impact human health and the environment. The study will further contribute to the USGS mission of increasing understanding of geologic-sourced contaminants in groundwater and factors that control the concentrations of these contaminants. The intern will benefit through professional growth gained by applying academic knowledge of statistical analysis, geochemical modeling and/or GIS modeling to better understand the causes for a real-world public health problem. The intern will also benefit from mentoring opportunities with the project PI (https://profile.usgs.gov/merickso) and other USGS scientists; networking opportunities with academic, private-sector, and other governmental scientists; and likely co-authorship on one or more scientific publications.
Special skills/training Required:	The intern would need to have skills or expertise in at least one (but not all) of the following areas to be successful as part of the project team: 1) multivariate statistics applied to highly censored environmental data and statistical modeling; OR 2) theoretical, technical, and applied GIS skills; OR 3) geochemical modeling of redox-sensitive parameters.
Duties/Responsibilities:	The project requires a number of different skill sets, and the intern's specific role will depend upon her/his specific area of interest and expertise. The intern could play an important role in any of the following major activities (s/he does not need to have a significant role in all areas): The intern could participate in the sophisticated statistical analysis of the data sets. The project will involve tens of thousands of geochemical measurements, well construction descriptors, and geological records. The intern could assist in selecting appropriate statistical analysis/modeling methods, and completing the statistical analyses/modeling. The intern would collaborate with other project scientists to integrate statistical analyses and results with the other parts of the project analyses. Or the intern could participate in sophisticated GIS modeling using the data sets. The project will involve tens of thousands of

geochemical measurements, well construction descriptors, and geological records. Minnesota's electronic well record database contains more than 450,000 wells, and detailed geologic and hydrogeologic interpretations are complete in large areas of the state (http://www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html). The intern could assist in selecting appropriate GIS tools, completing the GIS manipulations/modeling, and developing novel coverages, web tools, or displays of results. The intern would collaborate with other project scientists to integrate GIS analyses and results with the other parts of the project analyses.

Or the intern could participate in geochemical modeling using the data sets. The project will involve tens of thousands of water and sediment geochemical measurements and field measurements. The intern could assist in selecting appropriate geochemical modeling methods, and complete the geochemical modeling. The intern would collaborate with other project scientists to integrate geochemical modeling and results with the other parts of the project analyses.

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