

Minnesota Geological Survey County Geologic Atlas Program Update: Arrowhead Pilot Project

Dale Setterholm, Dr. Tony Runkel

Minnesota Geological Survey

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Message:

- Atlas Program achieving goals overall.
- Pilot Project undertaken in parts of St. Louis and Lake counties to determine what is needed, what methods are effective, and what will costs be for completing Part A of geologic atlases.
- Previous work has accomplished significant bedrock geologic mapping, surficial geologic mapping, and database compilation. All will need updating.
- There are many water issues, and water management activities that would benefit from atlases in these counties:
 - iron mining related
 - water supply- Biwabik IF
 - brackish waters, and low well yields
 - new mining and mineral processing
 - wellhead protection
 - documenting hydrologic conditions
- This is a challenging area for atlases because there is less readily available data, there are large areas with limited road access, the geologic features that control water movement are difficult to map.
- Pilot areas chosen to represent many of the data, cultural, and geologic settings present in this area (lots of data vs. very little, shallow and deep bedrock, roads vs. no roads, etc.).
- Goal is to:
 - understand and map controls on ground water flow rate and direction in glacial sediments and bedrock
 - document current water use (County Well Index)
 - connect regional mapping with site specific investigations
 - provide a common framework for related investigations of water, biology, and other natural resources.
- Specific needs
 - Glacial geology
 - Thickness, character, and inferred water-bearing characteristics

- Utilize existing drillholes, shallow and deep drilling, landform analysis, geophysical investigations, existing wells with hydrologic information
- Bedrock geology
 - Shape and elevation of bedrock surface utilizing outcrops, drillholes, geophysics
 - Bedrock type by utilizing outcrops, drillholes, and geophysics
 - In many bedrock types of this region fractures host and transmit water
 - Fractures are difficult to map, and only some host significant flow
 - Other parties may need to test some fractures for flow characteristics and also test the system of fractures with multiple wells, pumping, and monitoring
- Pilot study substantially achieved these goals. Greatest weakness is access to the subsurface in areas of thicker glacial sediment. This can be overcome in a more fully developed and supported project.
- Outcomes:
 - Atlases will improve water management in a variety of situations
 - Atlases will support many water related studies and improve their outcomes
 - Atlases will support more detailed studies of proposed mines and facilities and connect these studies to the broader landscape
- These atlases (Part A only) combined are estimated to cost \$2.8 million, or about 8 times the cost of a single typical county atlas:
 - Area is 20 times the area of a typical county
 - Data is relatively sparse and more data gathering is needed
 - Geologic setting is complex
 - \$2 million for 53,000 hours of effort
 - \$450,000 for contractor to drill 50 rotasonic holes (typical atlas gets 3-8 holes)
 - \$152,000 for vehicles and mileage (this may improve)
 - \$112,000 for food and lodging for personnel in field
 - \$38,000 in equipment and supplies
 - \$29,000 in laboratory analyses
- To move forward
 - Agreements with counties for in-kind service
 - Funding for project
 - Coordination with atlas work statewide (staffing, equipment)
- Current proposal (hearing next week) will get overall funding to desired threshold to finish work statewide in 14 years. These funds could be applied to Arrowhead atlases. Current funding could start projects.