Data Mining: an Important Component of the Cobequid Highlands Mapping Project

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The Cobequid Highlands Mapping Project is acquiring a large amount of new bedrock map data and an extensive geochemical database from bedrock, stream sediment and till samples. There is also a large amount of existing geochemical and geological map data available in mineral exploration assessment reports. Mining of this historic assessment report data commenced in 2016, with a systematic claim map by claim map sheet review of assessment reports documenting mineral exploration surveys in the study area. The focus of the review is identification and compilation of undocumented mineral occurrences and geochemical data.

Capturing new mineral occurrences and updating existing mineral occurrences in the mineral occurrence database is a simple process. Mineralized boulders and bedrock are identified in the assessment reports and their locations plotted in the project's GIS database. Descriptive data on the occurrence are then captured in the DNR Mineral Occurrences Database. Defining what constitutes a mineral occurrence is often the biggest challenge. Historically, the Nova Scotia Department of Natural Resources Mineral Occurrences Database recorded occurrences of minerals identified in bedrock, boulder and placer samples. Mineralized rocks found in drill core are recorded in the department's Drillhole Database.

Geochemically defined mineralization is not recorded in the department's Mineral Occurrence Database if the mineral exploration company does not identify mineral phases producing the anomalous geochemical results. In some reports, geochemical samples contain high concentrations of metals (>1%), but no mineral phase is identified. Although they are not presently captured in the Mineral Occurrences Database, these geochemical data would be useful for attracting mineral exploration investment to the province. Developing a methodology to mine the geochemical data from assessment reports is a component of the Cobequid Highlands Mapping Project.

In the future, it will be a requirement for mineral exploration companies to provide analytical and sample location data in digital, tabular spreadsheet format in their assessment reports. This will make it easy for geological mappers to extract the data and incorporate them in the project's GIS databases. The digital datasets will also provide an opportunity to run statistical analyses on the data to calculate background and anomalous levels for the individual elements, or multivariate analyses to model relationships between elements. All the historic assessment report geochemical datasets are only available currently as PDF scanned copies of hard copy lab data sheets. In addition, most sample location data are only available as plots on grid maps, making it difficult to obtain map coordinates for individual samples. It is rare to find statistical analyses of geochemical data included with the analytical data in the historic assessment reports, so it is impossible to calculate background and anomalous element concentrations for the dataset without retyping all the data into a new spreadsheet.

Several assessment reports in the study area contain soil and stream silt geochemical data, but they are not in the form that provides easy re-use of the data. It would be too time consuming to retype the data from the analytical sheets into a new spreadsheet, so a two-step process was developed to mine the data. Geochemical data sample location maps were exported out of the PDF assessment report files, saved as jpeg images, and subsequently ortho-rectified in an ARCGIS project. The digital map files are scanned images of hard copy paper maps, so there are location errors introduced when the maps are ortho-rectified in ARCGIS. In some cases, large digital maps were split into four

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quadrants and ortho-rectified individually to reduce stretching required to ortho-rectify the full map.

Once the location data were captured consideration turned to the analytical data available in the assessment report. In the case of assessment reports containing statistical analyses, anomalous levels contained in the datasets were typed into an Excel spreadsheet along with the location data for each sample. The geochemical data captured from assessment reports without an associated statistical analysis are subjective in nature. This later dataset is useful in identifying areas for follow-up geochemical surveys, but it has limited value. It is, however, capturing the geochemical data in a more accessible digital format.

Several significant soil, stream silt and rock geochemical anomalies were captured in this data mining exercise. An example of the valuable data captured in this process is found in the Silica Lake area on NTS map area 11E/11B. Figures 1 and 2 show rock sample locations and analyses for Thorium (Th) and Zirconium (Zr) captured from Gulf Minerals's 1980s assessment report files. The reports do not record if the samples are from boulders or bedrock. The anomalous concentrations of thorium and zirconium are significant, and likely reflect the presence of mineral phases for both elements, but no mineral phases are described in the assessment report. In this case, because the mineral phases were not described in the report, the samples were not included as mineral occurrences in the Mineral Occurrences Database. Farther west from this location, Gulf Minerals identified Rare Earth Elements (REE) associated with elevated concentrations of thorium and zirconium. This was one of the areas drilled by Gulf Minerals, but no holes were drilled to follow up on the anomalous geochemical data from rock samples in the Silica Lake area.

The Silica Lake area did not see exploration again until 2011 when Clear Lake Resources conducted a

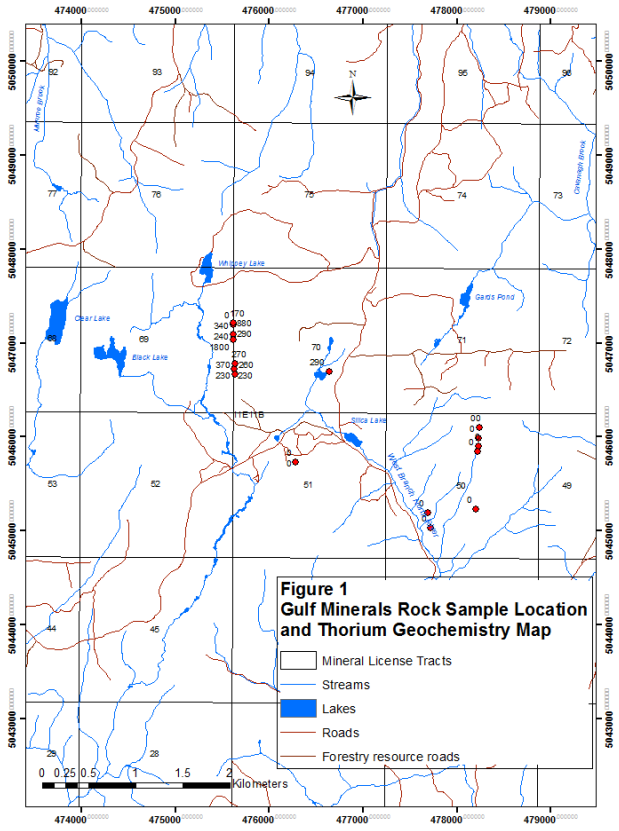

Figure 1. Map of sample locations and analyses for thorium from Gulf Minerals's 1980s assessment reports on the Silica Lake area.

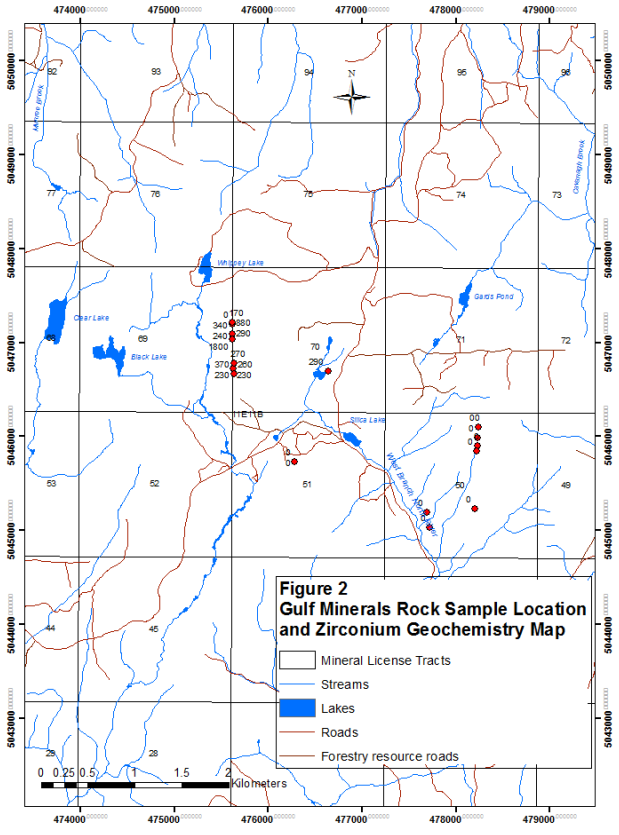

Figure 2. Map of sample locations and analyses for zirconium from Gulf Minerals's 1980s assessment reports on the Silica Lake area.

small prospecting and ground spectrometer survey in search of a REE deposit. While the company was aware that Gulf Minerals conducted exploration in the area, they did not compile the historic geochemical data. If they had done so, or if data from the Cobequid Mapping Project data mining exercise were available to them, it might have changed the focus and outcome of its exploration surveys.

The Gulf Minerals data outlines an area worth further evaluation by companies exploring for a REE deposit. Although not shown on the figures included in this report, the Gulf Minerals rock samples collected in the Silica Lake area contain elevated concentrations of Au, Bi, Mo, Sb, Pb, Zn and Fl. Clear Lake Resources geochemical analyses also detected elevated concentrations of Au in some of its samples. The Silica Lake area is presently covered by a Nova Scotia Department of Natural Resources mineral staking closure. The closed ground will be opened through a Request for Proposal (RFP) release in 2018. Data mined from the assessment reports will be included as part of the data released through the RFP process.

Data mining for the Cobequid Highlands Mapping Project will continue in 2017. In addition to compilation of interesting and exciting geochemical anomalies, seven new mineral occurrences were added to the Mineral Occurrences Database and significant revisions were made to eight existing mineral occurrence records.