Toward international geoscience standards and interoperable web services for British Columbia geology and mineral resources

Cui, Y.[1,a], Diakow, L.J.[1], and Miller, D.[1]

[1] British Columbia Geological Survey, Ministry of Energy, Mines, and Petroleum Resources, Victoria, BC, V8W 9N3

[a] corresponding author: Yao.Cui@gov.bc.ca

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Ministry of Energy, Mines and Petroleum Resources

Abstract

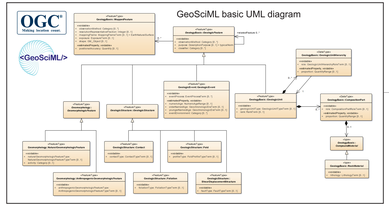
The British Columbia Geological Survey (BCGS) is implementing the international geoscience standard GeoSciML and its extension EarthResourceML, to deliver geoscience data products and to develop interoperable geospatial web services compliant with these standards. As a first step, the bedrock geology map of the province is available in the Web Map Service (WMS) interface, using vocabularies adopted by the IUGS Commission for the Management and Application of Geoscience Information (CGI). We also have mineral occurrences from our MINFILE database available as WMS, compliant to EarthResourceML Lite, with details converted to the CGI vocabularies. Our next step is to make these data available on OneGeology, the portal for worldwide geoscience data. Our current geology and mineral occurrence data are maintained using BCGS specifications in data collection, compilation, and data production, and will continue to be accessible through MapPlace 2, the Survey's geospatial web service. However, it will take significant effort and time to have our data, specifications, and web services fully compliant with the international geoscience standards. We take this as an opportunity to update our data models and specifications, to produce consistent data with standardized classification systems and terminology, and to eventually enable interoperation in data sharing, data exchange, and data integration.

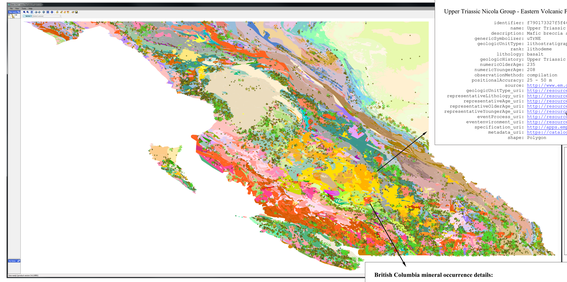
Introduction

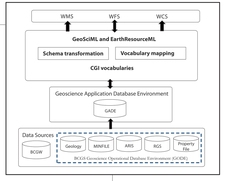
Different organizations use different classification systems and terminology to capture geology and mineral occurrence data, which causes difficulties in data sharing, data exchange, and data integration. The Open Geospatial Consortium (OGC) has published open standards on geospatial data and interfaces to enable interoperability and data exchange. Based on the OGC Geography Markup Language (GML), the International Union of Geological Sciences (IUGS), through its sub-committee Commission for the Management and Application of Geoscience Information (CGI), developed international geoscience standard Geoscience Markup Language (GeoSciML) and its extension EarthResourceML. The British Columbia Geological Survey has begun to implement these standards.

GeoSciML compliant web services

GeoSciML is a data model and data transfer standard for exchanging digital geological data, from basic map data to complex relational geological features, based on GML. The latest version of GeoSciML (4.1) was accepted by OGC and adopted by the IUGS in 2017. The IUGS-CGI provides vocabularies to encode geological details with standardized classification systems and terminology. To make it easier to implement, a simplified version of the standard, GeoSciML Lite, is available to deliver a small subset of the full GeoSciML model. GeoSciML Lite has simple map schema for geological units, faults, contacts, boreholes, geomorphological units, geological specimens, and site observations.

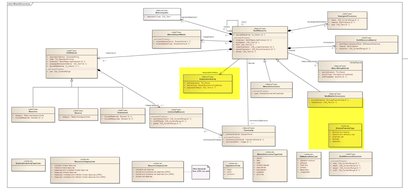






EarthResourceML

EarthResourceML, an extension to GeoSciML, is designed to exchange digital mineral resource data, such as mineral occurrences, mines, and mining activities. The model can include details such as geological features, commodities, mineral resources and reserves, production of concentrates, refined products, and waste materials. To ease implementation, EarthResourceML Lite is simplified from the most recent version (2.0.1).



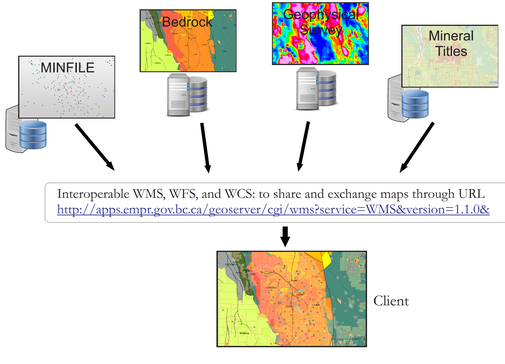
Why GeoSciML and EarthResourceML?

To share and exchange consistent geological and mineral resource data

Different classification systems and terminology are used to capture geological and mineral resource data within the same organization and, more so, between organizations. Standardization based on GeoSciML and EarthResourceML allows consistent data models and vocabularies, which is needed for data sharing, exchange, integration, and interoperation. This is particularly important for the British Columbia Geological Survey, who integrates data from other groups, such as the Geological Survey of Canada and universities, and for the mineral industry, who then use BCGS data for their projects.

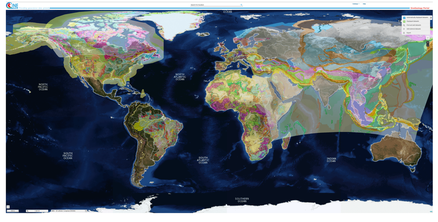
To enable interoperable geospatial web services

Adopting GeoSciML and EarthResourceML allows the BCGS to develop geospatial web services based on the OGC Web Map Service (WMS) and Web Feature Service (WFS) interfaces. Through a network link (URL), users can access BCGS geological maps and mineral occurrences via WMS using GIS software or web browsers, without concerns about data downloading, data versioning (always up-to-date), data formats, coordinate systems, or operating systems. Data available at the feature or coverage levels (e.g., WFS and WCS) would enable data mining by computer systems, independent of human operators.



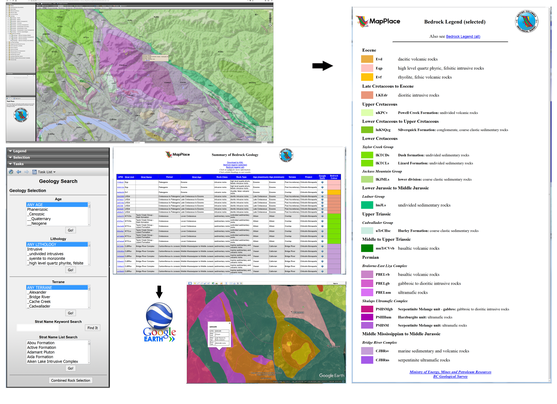
Implementation at the BCGS

For public testing, we have mapped our data models to the GeoSciML and EarthResourceML Lite versions, and matched our bedrock geology and mineral occurrence classifications and terminology to the CGI vocabularies as WMS. Currently, only generalized provincial geology is available on OneGeology; our next step is to have these WMS layers available.



Data delivery on MapPlace 2 web services

The BCGS provides bedrock geology and mineral occurrence data under the Open Government License - British Columbia. These data are freely available to the public as downloads via MapPlace 2, the Survey's geospatial web service, with advanced spatial and non-spatial tools to search, summarize, report, and download results as KML. In the case of bedrock geology, the legend for selected features is automatically generated as a web page.



Discussion

Specifications and vocabularies

Significant effort and time are required to make our data fully compliant to the GeoSciML and EarthResourceML models and the CGI vocabularies For instance, we will have to extract and encode geological details at levels compatible to the GeoSciML standard and CGI vocabularies. Some of the BCGS data lack certain requirements set out in the international geoscience standards. For example, in MINFILE, our mineral occurrence inventory, start and end dates of mineral exploration may be lacking. Similarly, the simplified Lite versions and CGI vocabularies lack terminology to adequately represent all our data. For example, the CGI vocabularies for rock types and ages are simple and unable to represent heterogeneous rock units or those that formed during a protracted time span. We take these challenges as an opportunity to update our data models and specifications and to encourage CGI to make the vocabularies more universal.

Limitations

Although WMS is useful, the technical capacity to build sophisticated information systems to benefit from WFS and WCS is required. There are many challenges in exchanging any data at feature or coverage level, including impediments in web-based authentication. Currently the OneGeology portal is slow and its functions are rudimentary. Most geological maps available on OneGeology are at scales of 1:1 million or smaller, which are of limited use to the mineral exploration and mining industry. Nonetheless, we remain optimistic about future developments, and the British Columbia Geological Survey will continue to contribute to the OneGeology effort.

Summary

The British Columbia Geological Survey is adopting the international geoscience standard GeoSciML and its extension EarthResourceML to deliver our bedrock geology and mineral resource data. The WMS layers based on the 'Lite' versions of these standards are available to the public for testing and will be on OneGeology soon. Significant effort and time are required to make our data models and vocabularies fully compatible to GeoSciML. We will continue to deliver these data products on MapPlace 2, the Survey's geospatial web service.

Acknowledgements

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