

British Columbia Geological Survey Activities in 2009

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INTRODUCTION

The British Columbia Geological Survey (BCGS) is committed to supporting a thriving, safe and responsible mining industry for the benefit all British Columbians. We accomplish this by providing expert advice to government on mineral resources, globally competitive geoscience expertise, data to attract mineral industry investment, and geoscience information to the public.

The BCGS focused on creating new products from existing data, completing five significant field projects (four with partners), delivering key programs like MapPlace and the BC Mineral Development Office, and working to support a wide variety of clients. Many of our programs involve co-operative partnerships with universities, other government agencies, First Nations, local communities and industry.

The BCGS continued its long collaboration with the Geological Survey of Canada (GSC) with the start of a new major program in the north, called 'Edges'. It was the last year of the GSC's Targeted Geoscience Initiative in southern and central BC. Geoscience BC, a key partner of the BCGS, had another very active year contributing new geophysical, geochemical and other geoscience data. Projects with Geoscience BC in 2009 included a surficial mapping and till sampling program southwest of Houston, MINFILE and Property File updates in the QUEST area (Quesnel Trough), and uploading Geoscience BC data on MapPlace. The BCGS worked with the Resource Development and Geoscience Branch, its sister branch in the Ministry of Energy, Mines and Petroleum Resources (MEMPR), on several projects. The BCGS also continued its active support of the National Geological Surveys Committee and the Committee of Provincial Geologists.

The BCGS and its staff were recognized by both industry and government for the successful delivery of programs and results. The Fraser Institute, in its annual 'Survey of Mining Companies 2008/2009', ranked British Columbia seventh globally with regards to the quality of our geological database. Geoscience results from west of Williams Lake and northern Vancouver Island, released at Mineral Exploration Roundup in January 2009, led to 2800 and 1500 hectares of staking of BCGS mineralization discoveries, respectively. The Geoscience Assistant Program was a finalist for a Premier's Award in the partnerships category and received an honourable mention.

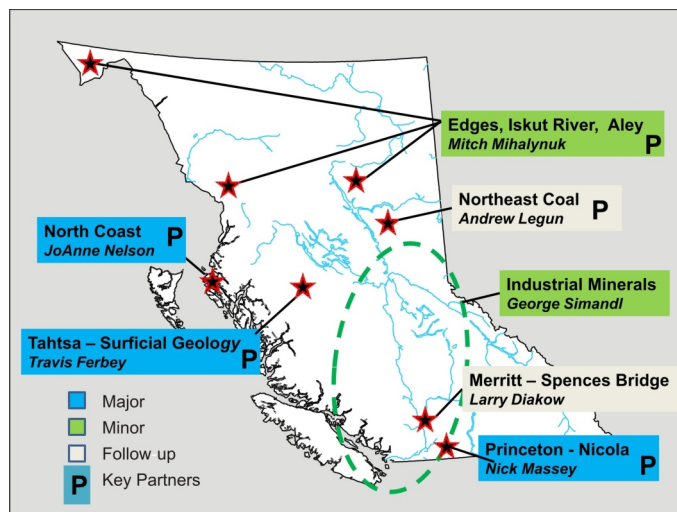


Figure 1: British Columbia Geological Survey field project areas, 2009.

BCGS FIELD ACTIVITIES

The British Columbia Geological Survey makes it a priority to generate new geoscience data and products, including bedrock and surficial geology maps and deposit studies. The survey collaborated with a number of partners, including the GSC, Geoscience BC and several companies, to deliver most of the field surveys. The location of the 2009 field projects are shown in Figure 1. Our objective is to help diversify local economies by attracting mineral exploration activity that may lead to new mines. In all parts of the province, both mineral exploration and mining are essential drivers of local employment and tax revenue, and directly support the development of regional infrastructure.

Field mapping and mineral deposit studies (Figure 1) were continued in the Merritt area, the Peace River coalfields and the Princeton area (Massey et al., Massey and Oliver, Oliver et al., this volume), and on industrial minerals in east-central BC (Simandl, this volume). The Edges project in northern BC started in 2009 with the primary fieldwork in the north coast (Nelson et al., this volume) and Iskut River areas (Mihalynuk et al., this volume). The other new field project was the Tahtsa Lake area Quaternary geology and till geochemistry survey in the region southwest of Houston and northeast of the Huckleberry mine (Ferbey, this volume).

In addition to these 2009 projects, several other projects were brought to completion. These include age determinations of mineralization and 'Mine Dykes' at the Copper Mountain alkalic porphyry Cu-Au-Ag deposit (Mihalynuk et al., this volume), and a discussion of the geochemistry of Permo-Triassic volcanic and plutonic rocks of

This publication is also available, free of charge, as colour digital files in Adobe Acrobat® PDF format from the BC Ministry of Energy, Mines and Petroleum Resources website at <http://www.empr.gov.bc.ca/Mining/Geoscience/PublicationsCatalogue/Fieldwork/Pages/default.aspx>.

the Sitlika assemblage near Takla Lake (Schiarrizza and Massey, this volume). Several follow-up studies were also completed on BC mineral properties and regions. These include investigations of the Nb–Th–Sr–rare earth element mineralogy and sulphur isotope geochemistry of the Eaglet property (Hora et al., this volume); a geological characterization of carbonate-hosted Pb–Zn mineralization at the Cariboo Zinc property in the Quesnel Lake area (Paradis et al., this volume); and an evaluation of reduced intrusion-related gold mineralization west of Cranbrook (Soloviev, this volume). A technical paper on the effects of analytical method on regional geochemical surveys (Lett and Jackaman, this volume) rounds out the contributions.

Ongoing Projects

Geological highlights from Massey and Oliver (2009) included mapping northwards from Whipsaw Creek into the Granite Creek and Tulameen River areas, concentrating on the Nicola Group rocks. Field observations confirmed that the Eastgate–Whipsaw metamorphic belt is lithologically distinct from the Nicola Group to the east. The presence of volcanogenic massive sulphide (VMS) mineral prospects (e.g., Redstar) reinforces the necessity of understanding the geological differences between the Eastgate–Whipsaw metamorphic belt and the Nicola Group rocks for effective exploration. Shelley Oliver, a graduate student completing an MSc thesis at The University of British Columbia, further redefined the geology of the Eastgate–Whipsaw metamorphic belt through a petrographic and structural study (Figure 2).

Major New Projects

EDGES: MODELLING THE EVOLUTION OF THE NORTHERN CORDILLERA RESOURCE ENVIRONMENT FROM THE EDGES OF EXOTIC TERRANES

Edges is a highly focused multiyear geological mapping initiative involving formal collaboration between the Government of Canada, the Province of British Columbia, the Yukon Territory, Geoscience BC, the United States Geological Survey and the Alaska Department of Geological and Geophysical Surveys. A key project in the federal Geoscience for Energy and Minerals (GEM) program, it began field operations in 2009 in BC and will last until 2013. Support is being contributed by all participating agencies.

The ultimate goal of the initiative is to improve the effectiveness of resource exploration and discovery in the northern cordillera by outlining resource-rich environments in British Columbia, the Yukon and Alaska. The geological targets are the exotic outer terranes with their enclosed pre-accretionary syngenetic and epigenetic deposits, and the metal-rich Triassic through Paleogene magmatic arcs and associated accretion zones that resulted from interaction of the terranes with the western margin of ancient North America. The target areas include parts of northern and central BC where the geological map base is either several decades out of date or at a scale insufficient to evaluate mineral potential using modern tectonic interpretations.

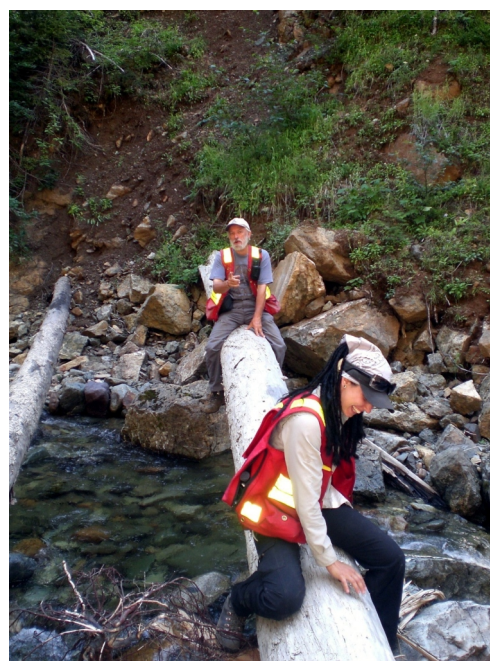


Figure 2: Shelley Oliver and Nick Massey during fieldwork in the Whipsaw Creek area, southern British Columbia.

NORTH COAST PARTNERSHIP PROJECT (EDGES)

JoAnne Nelson completed a successful initial field season mapping on Porcher Island and the adjacent Grenville Channel south of Prince Rupert (Figure 3). Her activities were carried out with help from Brian Mahoney (and his graduate students) from the University of Wisconsin, George Gehrels of the University of Arizona, Cees van Stahl from the GSC and Richard Bryant from the Lax Kw'alaams First Nation. The north coast project team

completed geological mapping of an area measuring 30 by 50 km;

traced rock units of the Alexander terrane of southeastern Alaska into northwestern BC, including those that are known to host VMS mineralization; and

determined that geological indicators of VMS-style systems occur in two trends, one on northeastern Porcher Island and, offset across the Salt Lagoon fault, on northeastern Pitt Island, and the other on the mainland coast east of the Grenville Channel fault and Telegraph Passage.

ISKUT RIVER PARTNERSHIP PROJECT

Mitch Mihalynuk, along with University of Victoria graduate student Toby Stiers and Murray Jones of Equity Exploration Consultants Ltd, spent ten days last fall studying precious-metal-rich, polymetallic massive sulphide mineralization at the Rock and Roll deposit, within the Coast Belt of northwestern BC. The short-term goal of the project is to determine the stratigraphic and structural setting of the Rock and Roll deposit. The longer term goal is to evaluate the potential for similar mineralization within the Iskut and adjacent regions. This work was the initial phase of a BCGS partnership with the University of Victoria and

Pacific North West Capital Corp (and field representatives, Equity Exploration Consultants Ltd).

TAHTSA LAKE PARTNERSHIP PROJECT

Travis Ferbey, in partnership with Geoscience BC, the Northwest Community College and the Smithers Exploration Group, completed a till geochemistry survey northeast of the Huckleberry mine and southwest of the past-producing Equity Silver mine, in NTS 093E/15 (west-central BC). This is an area that has high potential to host porphyry $\text{Cu}\pm\text{Mo}\pm\text{Au}$ and polymetallic vein occurrences, and possibly VMS-type deposits. Quaternary till cover presents a challenge to traditional prospecting and makes the area ideally suited for a mineral potential assessment using till geochemistry. In total, 100 till samples were collected for analysis (Figure 4). Samples were collected regionally and near known metallic mineral occurrences to characterize detrital dispersal and to document precious metal, base metal and pathfinder element values.

Observations made at 164 field stations suggest that Quaternary sediments within the study area are less areally extensive and thinner than anticipated, and therefore may not be as significant a hindrance to mineral exploration as previously thought.

BCGEOLOGY MAP QUEST AREA UPDATE

The BCGS, Geoscience BC and the GSC are collaborating to update the province's digital geology map at 1:100 000 scale for the Quesnel Trough area in central BC. The update area corresponds to Geoscience BC's QUEST Project geophysical survey footprint, which extends from Williams Lake to Mackenzie. Jim Logan is leading the project with help from Colin Barnett (Geoscience BC) and Bert Struik (GSC).

A workshop was held on March 11–13, 2009 to bring Travis Ferbey, Ray Lett, Jim Logan, Mitch Mihalynuk, JoAnne Nelson and Paul Schiarizza from the BCGS together with Fil Ferri (Resource Development and Geoscience Branch of MEMPR), Bert Struik and geophysicists from the GSC, and Colin Barnett, Peter Kowalczyk and other contractors from Geoscience BC.

The workshop was the first step in integrating all bedrock mapping and geophysical and geochemical data for the region. Subsequent work by geology team members was required to determine the final map pattern. A key objective is to interpret and update bedrock geology in areas with significant glacial overburden, particularly in the Prince George region. Initial results were released in poster format at the Kamloops Exploration Group (KEG) annual conference in April 2009. The final map will be integrated into MapPlace by Pat Desjardins and Yao Cui, and released as a Geoscience Map early in 2010.



Figure 3: JoAnne Nelson, mapping on Porcher Island, western British Columbia.

MAPPLACE AND DATABASE ACTIVITIES

MapPlace

MapPlace, our internet portal and one of the most effective geoscience online map systems globally, continues to improve with the addition of new data layers and improved interface tools. MapPlace has provided clients with efficiencies in research time, data costs and analysis. Data themes and applications available on MapPlace include mineral potential, bedrock and surficial geology, publications, mineral and petroleum tenure, MINFILE, assessment reports, and geochemical and geophysical surveys. Yao Cui



Figure 4: Russ Gawa, a graduate from the Reclamation and Prospecting Program at the Northwest Community College, collecting a till sample, west-central British Columbia.

and Pat Desjardins contributed geomatics expertise to MapPlace data and application enhancements and integration of servers.

New data and updates on MapPlace in 2009 include regional geochemistry catchment basins and regional geochemistry survey (RGS) locations snapped to 1:20 000 scale rivers; mineral tenure archives for January 2007 and January 2008; physiographic subdivisions and volcanic centres; wildlife habitat areas, ungulate winter range, fish-sensitive watersheds and guide outfitters; MapPlace2Go updates with current mines and exploration properties; reanalysis of 3479 archived stream and lake sediment samples that cover parts of NTS areas 093E, F, L and M (Geoscience BC Report 2009-5); and infill stream sediment and water geochemical data for 1007 samples from NTS areas 093F and K (Geoscience BC Report 2009-11).

Property File and Databases

Property File, a collection of an estimated 100 000 unique industry documents and maps, continued to grow during 2009. Recent Property File donations were made by Ken Dawson and the families of Cam Stephens and Dennis Groc. As of December 2009, 9598 Property File documents were available online, including 396 documents from the Falconbridge Collection, 1649 documents from the Cyprus-Anvil Collection, 304 documents from Chevron Collection, 476 documents from the Placer Dome Collection, 1328 documents from the Rimfire Collection, 2969 Mine Plans and 2070 documents from the Library Collection. These are retrieved through the Property File search application or through links from MINFILE. This volume includes an update on the Property File project (Hancock and Barlow, this volume) and a case study on using the database in conjunction with MapPlace.

Geoscience BC funding for two QUEST projects contributed to updates to Property File and MINFILE. The QUEST Property File project added 2619 new Property File items and new information to 481 MINFILE occurrences, and created 17 new occurrences. The QUEST MINFILE update included updates to 497 occurrences, including 135 new ones. Sarah Meredith-Jones is the MINFILE contact.

Users can now access more than 30 000 company mineral assessment reports using the Assessment Report Indexing System (ARIS) database over the web. Allan Wilcox works with clients to approve reports. An initiative is underway to encourage the mining industry to submit assessment reports in digital form to the Mineral Titles Branch. Benefits include higher quality, more efficient digital reports; quicker approval; and lower costs for printing, mailing, storage, scanning and processing.

Other database activity included standardizing data tables for efficient tracking of exploration activity in the province, moving all database applications to new servers, adding 18 new Mineral Deposit Profiles, updates to the publication catalogue, and an enhanced scale-based density display of RGS and MINFILE in KML format, with links to detailed reports.

Yao Cui developed a high-performance algorithm for delineating catchment basins and presented dynamic spatial data on Google™ Earth using free and open-source tools. Laura de Groot contributed to the conversion of more than 11 000 web pages to the new government standard and keeps staff on track with database management plans.

Mineral Resource Evaluations

The Level 2 Mineral Resource Assessment of the Atlin-Taku Land Planning Area, conducted in 2008, resulted in the publication of GeoFile 2009-5 (Atlin-Taku Mineral Resource Assessment), which included methodology; data tables; a Manifold® map; metallic and industrial mineral potential maps in PDF; a geology map in PDF; a geology map with tracks and geology legend; workshop photos; shape files; MINFILE, ARIS and RGS tables and reports; and an interactive map on MapPlace.

During the past year, Kirk Hancock, Sarah Meredith-Jones and Allan Wilcox provided 15 assessments of the mineral resource potential of different areas of BC for the Ministry of Aboriginal Relations and Reconciliation, to assist with treaty negotiations.

BCGeology Map: BC's Digital Bedrock Geology Map

The province's bedrock geology map for industry and government clients is a critical source of information for deciding on areas for exploration and assessing mineral potential. Updating is an important, ongoing task to weave the new data into the digital provincial product, BCGeology Map. The data-specification model and maintenance strategy are being developed and implemented by Yao Cui.

The Geology Map of BC (Geoscience Map 2009-1) is available on one sheet at 1:1 500 000 or 1:2 000 000 scale and as a Manifold® map file. The cartographically correct map has a simplified legend.

BC MINERAL DEVELOPMENT OFFICE

The role of the BC Mineral Development Office (MDO) in Vancouver is to promote investment in the province's mineral exploration and mining, both domestically and internationally. This includes delivering a multifaceted technical campaign to highlight the province's superior coal and mineral potential, renowned geoscience database and expertise, and attractive business climate. The MDO interacts with decision-makers in industry, including executive management, geologists and prospectors, and forms part of the wider marketing efforts of the Ministry of Energy, Mines and Petroleum Resources (MEMPR). The MDO also hosts incoming national and international companies and government representatives, and provides leadership for government trade missions. Some examples of MDO activities in the past year include

acting as a key player to profile information on BC's mineral resources, investment procedures and specific mineral commodities to Asian investors, including the Asia Investment Mission to China, Japan and Korea in October and the first provincial Virtual Trade Mission in June, presented via video-conferencing facilities to BC's trade offices in Beijing, Shanghai and Guangzhou;

preparing articles on BC's mineral resources and exploration and mining activity for numerous ministry and industry publications to promote the province; profiling BC mineral industry investment opportunities at numerous conferences, including the Mineral Exploration Roundup, the Prospectors and Developers Association of Canada (PDAC) Convention and the KEG annual meeting; responding on a daily basis to requests for assistance from prospectors, geologists, companies and the public; working on various land-use issues, including those associated with referrals from Mineral Titles; and helping co-ordinate a field tour and a forum on exploration and mining updates.

Marketing Coal and Minerals to the Asia-Pacific Region

The MEMPR continued an active Asia-Pacific marketing strategy to attract direct investment from Asia in BC exploration and mining projects (Figure 5). Asian countries are leading consumers of the province's coal and metal ores, and have a record of investment in BC's mineral industry. Key selling points are BC's rich geology, expert geoscience information, interactive online databases, continuing demand for commodities such as copper and coal, a Pacific Rim gateway, modern infrastructure and a skilled workforce. The BCGS provides the MEMPR with most of the technical expertise and professional delegates for international presentations and meetings with Asian companies. It is the point of contact for incoming international investors through the BC Mineral Development Office in Vancouver.

Regional Geologists

Regional Geologists play a vital role in providing detailed geological knowledge of the region in which they live and work, and gathering information on industry exploration and mining activity.

Regional Geologist	Office	Region
Paul Wojdak	Smithers	Northwest
Vacant	Prince George	North-Central and Northeast
Bruce Madu	Kamloops	South-Central
Dave Grieve	Cranbrook	Southeast
Bruce Northcote	Vancouver	Southwest

The MDO works closely with the regional geologists in attracting mineral investment to BC and in preparing publications such as *Exploration and Mining in British Columbia* and the *British Columbia Mines and Mineral Exploration Overview*.

TECHNICAL MARKETING

BCGS Open House

The BCGS hosted its first open house of the 21st century on November 13, 2009. This successful event, hosted



Figure 5: Business meetings between Canadian and Chinese companies in Beijing, organized by MEMPR as part of the 2009 Asia Investment Mission.



Figure 6: British Columbia Geological Survey open house crowd in discussions during a break.

in Victoria, drew a crowd of more than 85 participants (Figure 6). Ten MEMPR geologists and two professors from the School of Earth and Ocean Sciences at the University of Victoria presented technical talks on subjects that included epithermal gold and silver veins in the Toodoggone area; geology and mineral deposits of the Spences Bridge Group; geochemistry; geological database innovation; Cache Creek oroclinal entrapment; geology of northern Vancouver Island; the Wingdam Conglomerate; and the NEPTUNE Canada Ocean Observatory.

The open house was made possible thanks to sponsorship from the Pacific Section of the Geological Association of Canada. Planning for next year's Open House (November 10, 2010) is underway.

Conferences, Workshops and Field Trips

Staff participated in numerous conferences and workshops during 2009, as organizers, speakers and attendees. Highlights from conferences included

presentations by Graham Nixon and Paul Schiarizza, and participation by many staff at the Mineral Exploration Roundup 2009 (Figure 7);

participation in the PDAC Convention, at the MEMPR booth, on the trade show floor and helping host an Asian investor luncheon;

presentations by Nick Massey, Bruce Northcote, Yao Cui and Larry Jones at the KEG annual meeting in Kamloops;

a presentation at the Smithers Exploration Group Rock Talk, delivered jointly by Ray Lett and JoAnne Nelson;

Geological Society of America presentations and coordination of one session in Kelowna by Nick Massey, Mitch Mihalynuk, JoAnne Nelson, Paul Schiarizza and George Simandl;

a Geological Association of Canada–Mineralogical Association of Canada presentation by Steve Rowins; an overview of exploration activities presented at Minerals North by Jay Fredericks; and

presentations by Larry Diakow and Kirk Hancock at Minerals South.

Staff also shared their expertise by leading four field trips in 2009. Mitch Mihalynuk led a trip in northwestern BC at the request of Edges project leaders from the GSC and Yukon Geoscience Office. Steve Rowins and Graham Nixon led a two-day trip for 25 industry participants to the Merritt and Princeton areas to examine a variety of mineral deposits. Andrew Legun and retired MEMPR coal geologist Barry Ryan led a field trip and workshop in the north-eastern BC coalfield (Figure 8). The trip was sponsored by Peace River Coal Inc and Western Coal Corp. Dave Lefebure, Bruce Madu and Bruce Northcote led a field trip through BC for 11 Japanese senior executives. The trip was funded by the Japanese Oil, Gas and Mineral National Development Corporation (JOGMEC) and is a good example of BCGS technical marketing work being facilitated by Jay Fredericks and the British Columbia MDO.

Publications

During the past year, the BCGS published *Geological Fieldwork 2008*, 12 Open File maps and reports, 2 Geoscience Maps, 18 new industrial mineral deposit profiles, 10 GeoFile maps, reports and data files, and 2 Information Circulars. Staff published several articles in external journals. The BCGS also processed more than 600 company assessment reports for tenure maintenance and updated more than 1900 mineral occurrences.

With the Regional Geologists as principal authors, the BCGS published *Exploration and Mining in British Columbia 2008* and *British Columbia Mines and Mineral Exploration Overview 2008*, and co-ordinated articles on provincial industry activities in the Canadian Institute of Mining, Metallurgy and Petroleum *Mineral Exploration Review* and *The Northern Miner*.

All geoscience publications are available online at the BCGS website:

<http://www.empr.gov.bc.ca/Mining/Geoscience>

STAFF UPDATE

Sarah Meredith-Jones started as the new permanent Mineral Inventory Geologist in February. Sarah fills the position left open by Kirk Hancock as he moved to the MapPlace Geologist position left by Larry Jones, who became Director of the Resource Information Section of the BCGS.

The position of Director, Geoscience Initiatives, vacated by Brian Grant in early 2008 and filled in the interim on a part-time basis by Phillippe Erdmer, was filled by Ste-



Figure 7: Graham Nixon presenting at Roundup 2009 in Vancouver.



Figure 8: Andrew Legun explaining regional geology near Bullmoose Mine, on a field trip in the northeast BC coalfield.

phen (Steve) Rowins, who joined the branch in May of 2009. Arlene Veenhof, the new Administrative Assistant for the BCGS, started in June of 2009.

NEED MORE INFORMATION? WANT TO COMMENT?

The BCGS staff have considerable expertise and welcome the chance to share it. Our contact list is online at:

<http://www.empr.gov.bc.ca/Mining/Geoscience/Staff/Pages/default.aspx>.

We always appreciate your input regarding our many programs and activities. Please e-mail us at Geological.Survey@gov.bc.ca or call (250) 952-0429.

To learn about new publications, data releases and upcoming events, join the BCGS release notification list by e-mailing Geological.Survey@gov.bc.ca. Approximately 15–20 e-mail updates are sent per year.