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Promoting Nova Scotia at PDAC 2017

The Prospectors and Developers Association of Canada (PDAC) conference was an exciting place to be in 2017. There was a lot of optimism on the trade floor. Atlantic Gold's new mine, under construction at Moose River Gold Mines, was a topic of interest for many booth visitors. It is uncertain if the new mine was the main attraction or if there was just an overall optimism that the mineral industry has turned the corner on the down cycle, nonetheless the Nova Scotia booth was a busy place. It was a pleasant surprise to see several major mining companies expressing interest in Nova Scotia's mineral resources.

Representatives of the Geoscience and Mines Branch were fortunate to have Minister of Natural Resources Lloyd Hines and Deputy Minister Julie Towers attend the conference. Their time in the booth was limited by busy schedules, but they managed to meet with several companies exploring for minerals in Nova Scotia, both at the booth and in private meetings. The Minister's Breakfast was very well attended. Minister Hines introduced Steven Dean, Chairman and CEO of Atlantic Gold, who provided a presentation on the status of the company's new Moose River Gold Mine. Atlantic Gold displayed a spectacular section of gold-rich drill core at their booth (see photo below). The core was collected during a recent drill program at Fifteen Mile Stream.

At this year's PDAC conference, Minister Hines had the opportunity to meet with a government contingent from the Brazilian State of Mato Grosso, including Secretary of State for Economic Development Ricardo Tomczyk. The Brazilian delegation was very interested in the claim-staking process in Nova Scotia and the



Gold is abundant in this core from Atlantic Gold Corp.'s Fifteen Mile Stream prospect, Halifax County. Atlantic Gold displayed the core at PDAC 2017.

province's Mineral Incentive Program. DNR staff were joined in the booth by Troy Sawler of Nova Scotia Business Inc. and Melissa Nevin of the KMKNO Mi'kmaq Rights Initiative. They both provided insightful perspectives during the many discussions in the booth.

DNR geoscientists Trevor MacHattie and Geoff Baldwin sought out companies on the trade floor that are exploring for or mining low-sulphidation epithermal gold deposits. This is the deposit style identified in the Cobequid Highlands by the DNR Cobequid Highlands mapping team (see the article on p. 3). A mineral-staking closure was registered over the area with the best potential to host an epithermal gold deposit to allow the project team the opportunity to conduct further research in 2017. A request for proposals to explore in the closure area will be issued

in time for the PDAC 2018 conference. Several companies expressed interest in visiting the site this summer to see first-hand the geology, alteration and mineral showings.

Seven prospectors received Mineral Incentive Program Marketing Grants to cover their expenses to attend PDAC. In addition to the funding, they were also provided with a display panel and posters produced by DNR geologist Ron Mills. The prospectors were busy explaining their projects to interested companies, and some of them signed option agreements. Some were lucky enough to sign agreements for multiple properties.

My challenge was to fill in for Diane Webber, who has been the PDAC team leader for the past several years. Diane is currently on secondment to a director's position in

DNR (see *The Geological Record*, v. 4, no. 1, p. 5). It is difficult to anticipate the amount of work involved in organizing this event until you are suddenly dropped into the job. The event went smoothly, in large part because Diane was still providing guidance behind the scenes. There is also an amazing team of people that works each year to support Diane and the rest of the PDAC team members to make the conference a productive event for the province. I was delighted to have their support this year and can tell you the event would not have been the success it was without them. While some members of the Geoscience and Mines Branch directly support PDAC, virtually every member of the branch makes some contribution to the event. I extend my thanks to all.

Garth DeMont

Map, Database and App of Nova Scotia Geoheritage Sites Released

Nova Scotia has an official list of geoheritage sites, showcasing the province's exceptional geology and its deep cultural roots that are linked to mining and geological resources. Compilation of sites began with the Atlantic Geoscience Society's *Geological Highway Map of Nova Scotia* and grew incrementally with input from prospectors, geologists and historians. Three products now give the public access to information about the sites: Open File Map ME 2017-032 (https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2017-032.asp), its corresponding database, and a selection of geoheritage sites as a web-based ESRI StoryMap app formatted for smart phones, tablets, and larger computer screens. The StoryMap (<https://novascotia.ca/natr/meb/geoheritage-resources/geoheritage-virtual-tour.asp>) was the creation of Sonya Cowper of the branch's Information Services group.

The database will continue to be a work in progress, much the same as the Mineral Occurrences Database, and the StoryMap will be revised periodically to highlight different sites across the province. Nova Scotia is one the world's

greatest geological showcases, thanks to its geological past of accreting terranes and continents, and its brilliant coastal exposures. The geoheritage products will help Nova Scotians to take pride in the province's geological

endowment and its many cultural links to geology, and will raise our profile globally as a worthy destination for visitors.

John Calder and Jeff Poole



Economy Falls, Colchester County, is one of many geoheritage sites in Nova Scotia.

Low-sulphidation Epithermal Gold in the Cobequid Highlands

The northeastern Cobequid Highlands are underlain by a ~45 km long belt of intraplate bimodal rhyolite and basalt of the Byers Brook and Diamond Brook formations. This volcanic package is tilted subvertically and is otherwise largely undeformed, resulting in exposure of the full ~8-10 km thick volcanic stratigraphy. These volcanic rocks were emplaced in the Early Carboniferous in a strike-slip pull-apart basin and have a geochemical signature that compares favourably to the Miocene Nevada Rift and Snake River Plain in the western US, areas known to host significant low-sulphidation epithermal gold deposits, such as those of the Ivanhoe and Midas districts of Nevada.

Gold has been found in heavy mineral concentrates from streams in the eastern Cobequid Highlands south of Tatamagouche since at least 1993, when Seabright Resources reported as much as 2.51 ppm Au in heavy mineral concentrates; Seabright never identified a bedrock source in the area. Several exploration attempts have been made by local prospectors, but none have come closer to locating in situ gold. In 2011, DNR geologist Trevor MacHattie discovered gossan in a stream near Warwick Mountain that contained 659 ppb Au. Gold grains ~200 µm in diameter were panned out of the crushed material. Trevor also identified widespread As, Sb, Se and Cd anomalies in rock samples of basalt and rhyolite that were analyzed using DNR's in-house desktop XRF (Olympus x5000). Low-level gold anomalies were also found elsewhere through the volcanic belt.

The gold discovery and geochemical anomalies triggered a burst of exploration activity in the area. Much of the exploration focused on additional gold-in-streams heavy concentrates, but Sugarloaf Resources drilled two holes at a site near a second Au occurrence in bedrock, ~1 km east of the discovery outcrop. The company did not intersect significant gold concentrations, but core from each hole showed silicification,

sericitization and sulphidation.

Geochemical analyses revealed highly anomalous As, Cd, Sb and Se, but the company subsequently dropped the ground due to low gold concentrations.

Subsequent work by DNR in 2015 emphasized following up on the widespread silicified and sulphidized rhyolites, as well as localized areas hosted in basalt, leading to the more recent recognition that this area is highly prospective. Because much of the ground in the area was no longer under any exploration licence, it was decided to close what was at the time deemed to be the most prospective portion of the volcanic belt in order to put together a more complete data package to aid exploration companies. At the time, the intention was to complete the mapping of the area of high prospectivity and begin laying the groundwork for community engagement in the Tatamagouche area.

During the 2016 field program, it became apparent that bedrock in many of the streams containing the largest gold-in-sediment anomalies did not have the As, Sb or other tracer element anomalies that were present at and around the original discovery outcrop. Consequently, the program was expanded to include a detailed stream sediment survey, and in fall 2016 a pilot suite of 152 silt samples were collected, sieved to 250 µm and analyzed by XRF to look for As and base metal anomalies to isolate potential prospecting targets. This has already led to the identification of several areas that will be revisited in 2017. Likewise, a pilot till-sampling program was undertaken in fall 2016, and the samples are currently being analyzed by ActLabs in Ancaster, Ontario. These data led to the conclusion late in the 2016 field season that the epithermal gold potential of the eastern Cobequid Highlands was much more widespread than previously thought. Consequently the mineral closure was expanded to cover the entire 45 km belt (Fig. 1). Currently the plan is to complete the sampling,

mapping and prospecting of the mineral closure in 2017, with targets of collecting an additional 170 till samples and 670 silt samples, producing a bedrock geology map at a scale of 1:10 000, and following up on identified stream and till anomalies through heavy-mineral concentrate sampling and bedrock prospecting. Additionally, Dr. Jacob Hanley at Saint Mary's University is conducting deposit research on some prominent showings in the closure area.

We intend to publicly release the compiled data at the PDAC conference in 2018, and will invite exploration companies to submit exploration proposals as tender to stake this new, highly prospective, district-scale exploration opportunity. Proposals will be accepted and reviewed throughout spring and early summer of 2018, allowing time for interested parties to review the data, conduct due diligence on the property, and consult with DNR geologists on site. The review process for proposals will focus on the ambition and feasibility of the exploration plan, as well as the bidder's financial and technical ability to complete the proposed program.

Geoff Baldwin

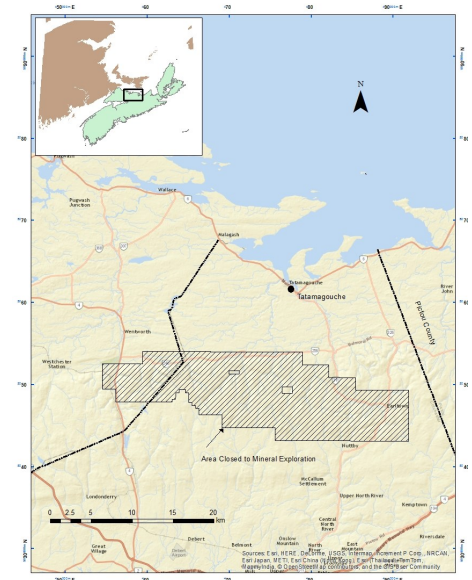


Figure 1. Map showing the location of the area closed to mineral exploration.

Geologist Tamara Moss Begins Work in Stellarton

I am pleased to announce that Tamara Moss has successfully competed for the position of Exploration Monitoring Geologist with the Geoscience and Mines Branch (Registry of Mineral and Petroleum Titles) of DNR. The monitoring process covers exploration activities throughout Nova Scotia and consists of visits to exploration sites, liaison with industry personnel, and the review of current assessment reports and other material submitted by mineral rights holders. The position was formerly held by Don Weir, who retired in 2016 (see *The Geological Record*, v. 3, no. 2).

Tamara received a B.Sc. from Dalhousie University in 2006 and an M.Sc. from Acadia University in 2010, where her thesis project was a study of the petrography and lithogeochemistry of the Quebrada Blanca copper-molybdenum deposit in Chile. Tamara has also worked in northern Ontario, Nova Scotia and Quebec, in both mines and exploration projects. She has also worked for the Ontario Geological Survey and spent one summer as a field assistant with DNR in Nova Scotia.

Tamara's experience in the mineral industry will be a great asset to the registry in the evaluation of mineral exploration assessment reports and to provide insight to mineral exploration activities. Tamara began her new role with DNR on May 8, 2017, at the department's Stellarton Core Library.

Please join me in welcoming Tamara to her new position with the Nova Scotia Department of Natural Resources!

John MacNeil

New Tailings Management Facility for Atlantic Gold's Touquoy Mine

In September 2017, Atlantic Mining NS Corp., wholly owned by Atlantic Gold Corporation of Vancouver, plans to begin processing ore at its \$130 million Touquoy gold project at Moose River Gold Mines, N.S. At full capacity (2 million tonnes of ore per year), the open pit and milling operation will recover 87,000 ounces of gold per year. To liberate the gold from the ore, the company plans to grind the ore to the size of very fine sand. Once the gold has been extracted, the fine sand, suspended in a thick slurry, will be pumped to the 130 hectare tailings management facility (pictured below). Some of the water from this facility will be recirculated back to the mill and the balance will go to a water treatment plant before being released to Scraggy Lake.

This is the first new tailings management facility constructed in the province since the 1990s. The facility was designed by Stantec Consulting Ltd. according to the latest Canadian Dam Association guidelines under the guidance of Engineer of Record Paul Deering, P.Eng. Independent of the Stantec design team, a Review Board, comprising three internationally recognized geotechnical specialists Peter Lighthall, P.Eng., Karlis J. Jansons, P.Eng., and Alan Martin, P.Eng. was established by the company to critically review the design. Construction of the tailings management facility is overseen by Stantec. Ultimate responsibility for the design, construction, operation and closure of the tailings management facility rests with the company.

Patrick Whiteway



Photo of Atlantic Gold's tailings management facility, Moose River Gold Mines, Halifax County. Photo courtesy of Atlantic Gold Corporation.

From the Mineral Inventory Files

The Moshers Island Formation is an Important Metallotect

A metallotect is generally defined as a specific tectonic, geological, mineralogical or geochemical feature which hosts mineral deposits and played a key role in controlling their formation. Nova Scotia's lower Paleozoic Meguma Supergroup has an excellent example of a metallotect in the Moshers Island Formation (MIF) and its laterally equivalent Bloomfield (Yarmouth area) and Beaverbank (central mainland) formations. Prior to their designation as formations by DNR's C. E. White in 2010, these rock units were informally known as the Goldenville-Halifax Transition Zone (GHT) and their association with mineral deposits has been recognized since the 1970s.

The MIF is a 200-500 m thick metasilstone sequence at the top of the Goldenville Group and marks a distinctive contact between the Goldenville and Halifax groups throughout the Meguma Zone (Fig. 1). Many of the beds in the MIF are calcareous and high in manganese (10-20% MnO). In 1986 Zentilli et al. (GSC Paper 86-1A, p. 423-428) recognized that these beds also contain elevated levels of other metals such as Ba, Zn, Pb, Cu, Mo, W and Au. Although elevated metal concentrations in the Meguma are not unique to the MIF, a characteristic feature of the MIF is the presence of pink "coticle" beds and manganiferous nodules (lenses) consisting essentially of massive, spessartine garnet. It's thought that the Mn enrichment and elevated metal content of these rocks is the result of Mn-carbonate precipitation from pore fluid near the sediment-water interface during early diagenesis by oxidation of organic matter. The metal enrichment that accompanied these diagenetic processes was facilitated by highly anoxic conditions on the ocean bottom when the sediments were deposited. These conditions of formation resulted in the MIF's evolution into a sequence of chemically peculiar, carbonate- and metal-rich rocks that were very receptive to migrating hydrothermal fluids.

There is a diverse inventory of mineral deposits in MIF rocks (Fig. 1). There are locations, such as the Lake Charlotte and Rocky Lake Mn prospects, where exploration for Mn took place. The MIF is compositionally homogeneous so wherever it occurs, it will likely have a consistent Mn content. As a result, the MIF could be considered as one laterally continuous Mn occurrence, although unfortunately from an economic standpoint, almost all of this Mn is tied up as refractory Mn-garnet. There are numerous other more economically significant prospects within the MIF. At the Eastville Zn Prospect (*NS Minerals Update*, v. 17, no. 1) sphalerite occurs as fracture-controlled and disseminated skarn at three sites along 10-15 km of MIF strike length. Within the Southwest Nova Scotia Tin Domain several metasediment-hosted Sn-Zn-Cu-In-Ag prospects occur in MIF rocks. These include the Dominique (*NS Minerals Update*, v. 22, no. 2), Egypt Road and Dunn's Lake prospects near Wedgeport and the Duck Pond, Gardners Meadow Brook and Pearl Lake prospects (all in MIF rocks) along strike to the southwest of the large greisen-hosted East Kemptville Sn-Zn-Cu-Ag deposit. At the Lazy Head W, Zn, Cu, Mn prospect near Canso,

scheelite, sphalerite and chalcocopyrite occur in MIF rocks in two stratiform skarn beds, 1.5 m thick each, that occur along 80 m of shoreline exposure.

The MIF is also associated with several Meguma Zone lode Au deposits. Production at the Blockhouse Au District, which occurs within MIF rocks, came from a rich ore shoot on the Prest quartz fissure vein that averaged 2.5 oz. Au/ton. This ore shoot occurs at the intersection of the Prest vein with a particular, 1-2 m thick siliceous bed within the MIF country rock. This same relationship was also noted at the Fifteen Mile Brook Au District north of Liverpool where Au enrichment occurs in the main producing quartz fissure vein where it intersects beds of the enclosing MIF country rock. Similarly, at the Cow Bay Au District just outside Dartmouth, several discordant cross-veins occurring within MIF rocks were found to be enriched in Au where they cut through peculiar, pyrrhotite-rich beds of the wallrock. Prospectors and mineral exploration geologists exploring properties in proximity to the MIF metallotect should keep in mind its genetic implications.

G. A. O'Reilly

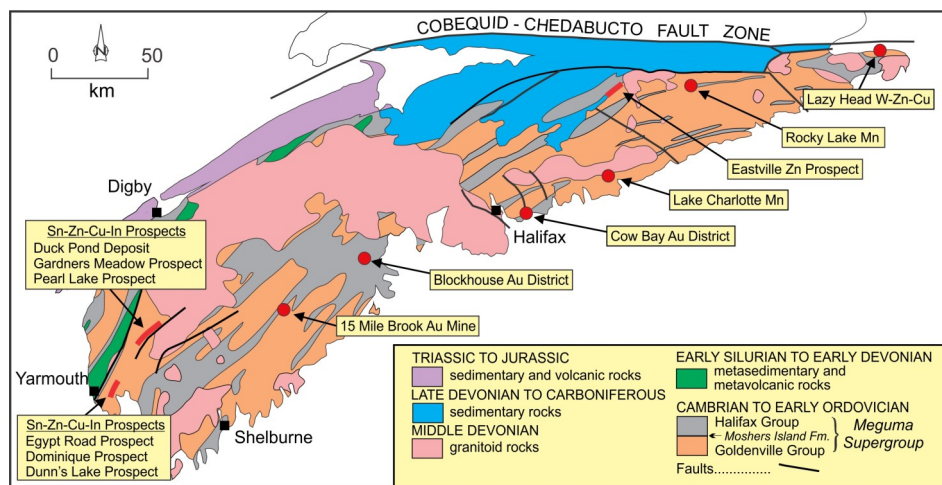


Figure 1. Geology map of the Meguma Zone of mainland Nova Scotia showing the distribution of the Moshers Island Formation and several of its mineral deposits.



Garth Prime stands at the edge of a boulder field in Digby County.

Garth Prime Retires

The retirement of Garth Prime is a great loss to the Geological Services Division of DNR. Garth started with the department in the mid-1980s, working first with Rob Naylor on oil shale and later with Bob Boehner on Carboniferous mapping in the Antigonish area and eastern Cape Breton Island. Garth started his academic career as a biologist but eventually saw the light and studied geology at Dalhousie, where he received his M.Sc. Garth joined the industrial minerals group as an aggregate specialist and building stone expert in the late-1980s. Since then Garth has travelled the back roads of the province documenting pits and quarries and evaluating their potential. Garth's many publications over the years have greatly enhanced our understanding of these crucial resources. He took a leading role in promoting the designation of public lands near municipalities as aggregate resource areas. Garth's love of nature and his passion for documenting his research led to an affinity (and almost an obsession) for photography (see the photo below). Whenever I needed a photograph I could always depend on Garth to have one in his archives. Garth will be missed for his vast knowledge of aggregates in Nova Scotia, but most of all for his quiet, modest presence among his co-workers. Good luck Garth.

Bob Ryan



Garth found this northern ring-necked snake under a rock one morning and captured a photo before the dew could roll off its back.

Special Note

E-mail Notification

If you would like to receive an e-mail notice (with hot links) when new maps, digital products and publications are released, or when a new issue of *The Geological Record* is released, please send your e-mail address to DNR.Library.List@novascotia.ca.

Dates to Remember

June 8 and 9, 2017

Mining Society of Nova Scotia, 130th Annual Meeting, Keltic Lodge, Ingonish, NS. For more information please visit the web site: <http://www.miningsocietyns.ca/>.

August 18-20, 2017

Nova Scotia Gem and Mineral Show and Sale, Parrsboro, NS. For more information please visit the web site: <https://fundygeological.novascotia.ca/gemshow>.

October 26-28, 2017

Atlantic Universities Geoscience Conference, Memorial University of Newfoundland, St. John's, NL. For more information please visit the web site: <http://ees.acadiau.ca/event-reader/augc2017.html>.

November 1-4, 2017

Mineral Resources Review 2017, Delta St. John's Hotel and Conference Centre, St. John's, NL. For more information please visit the web site: <http://nr.gov.nl.ca/nr/mines/mineral.html>.

November 5-7, 2017

2017 Exploration, Mining and Petroleum New Brunswick conference, Fredericton Convention Centre, Fredericton, NB. For more information please visit the web site: http://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/conference/Conf_home.html.