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NOVA SCOTIA

Changes Coming to the Geoscience and Mines Branch at Nova Scotia Department of Natural Resources

In the Government of Nova Scotia's 2018-19 Budget Address, the transfer of DNR's Geoscience and Mines Branch to the Department of Energy was announced. The transfer will merge two teams with expertise in subsurface development and will enhance development opportunities in the province. The transfer will be structured to ensure government achieves a balance between protection, preservation, and sustainable development (see https://novascotia.ca/budget/documents/Budget-2018-19-Address.pdf, p. 12).

Teams consisting of subject-matter experts from the departments of Energy and Natural Resources have been established to facilitate the smooth transfer and melding of people, programs and policies during the transition process. The teams have been at work for several weeks and are aiming for a transfer date in the fall of 2018.

The transfer will include all of the staff within the Geoscience and Mines Branch, and the branch will continue its work in the current geoscience and mines program areas for 2018-19. In addition, branch staff will remain in their Founders Square offices at 1701 Hollis Street, Halifax, for the foreseeable future. The DNR Library will still occupy the same location, and will be available to industry and government users as it always has been. The Core Library in Stellarton and the Stellarton-based staff will also be part of the merger with Energy.

We're looking forward to working with our new colleagues in Energy, maintaining our relationships with colleagues in Natural Resources, and providing timely and effective service to Nova Scotians. I'm confident that the transfer will be significantly advanced by the time the fall 2018 edition of the *Geological Record* is published.

Donald James

Clients will still find the Library and Registry on the Third Floor, Founders Square.

Abundant Applications for Summer Student Positions with the Geoscience and Mines Branch

Since switching to job search engines such as Career Beacon, and now Success Factors, applications for summer positions with the Geoscience and Mines Branch have ranged from 100 to 150 a year since 2013. It is no easy task to review, rank, and select students for interviews from this list. After adapting to this year's application process, we ultimately reviewed over 200 student applications for four geological field assistants, one geological assistant based in Stellarton at the Core Library, and one positon in the Information Services unit. In addition, more than 50 applications were received for an engineering field assistant.

In 2018, the branch rehired Kali Gee (Saint Mary's University), who will be working with Trevor MacHattie on the completion of geological field mapping in the Cobequid Highlands, and a new study on the petrogenesis of parts of the South Mountain Batholith. In addition, Kali will be working toward her honours thesis on aspects of the hydrothermal-magmatic ore-forming systems in the Cobequid Highlands; the thesis is co-supervised by Dr. Jacob Hanley (Saint Mary's University) and Trevor.

Crystal Smith (Acadia University) is also a returning student, who will continue working with Denise Brushett on the till geochemistry and surficial-mapping program. Like Kali, she will also be working on her honours thesis, co-supervised by Dr. Ian Spooner (Acadia University) and Denise, investigating the geochemical and mineralogical dispersal in till from the East Kemptville Sn-Zn-Cu-Ag deposit in southwest Nova Scotia.

Miguel Vaccaro (Acadia University) is a new student working with Chris White on the completion of the Annapolis Valley bedrock map and continued bedrock mapping in the Cheticamp-Middle River area of Cape Breton Island. Miguel will also be involved in a new project to study the Goldenville and Halifax groups along the Eastern Shore.

Another new student to our ranks is Natalie McNeil (Saint Mary's University), who will be working with Geoff Baldwin. Geoff and Natalie will conduct a biogeochemical study in the old INCO gold prospect in Cape Breton Island, as well as investigating other metallic showings in the South Mountain Batholith and Antigonish Highlands, which will include regional and detailed high-resolution stream sediment sampling.

Kerstin Landry (Saint Francis Xavier University) is a new student who will work under the supervision of Mick O'Neill at the department's core storage facility. She will be working on the curation of diamond-drill core and other geological materials, and geological database compilation.

Sarah Byrne (Dalhousie University) is a new student, who is working with Eugene MacDonald and DNR Library staff on the management of our document collection. The metadata she gathers on the collection will allow us to more efficiently manage the documents, will help improve some aspects of search and retrieval, and will help facilitate sharing our metadata across different cataloguing systems.

The Mineral Management Division hired Mohammed AlMuktar this year. He will be entering his third year of the Mineral Resources Engineering program at Dalhousie in September. Mohammed will be working with Ernie Hennick on the Abandoned Mine Openings Program, which has six priority remediation projects this year: Sydney Mines, Cape Breton County; North Springhill, Cumberland County; and Montague Mines, Lake Charlotte, Goffs, and Harrigan Cove, all in Halifax County.

Chris White, Eugene MacDonald, Mick O'Neill, and Patrick Whiteway

St. John Ambulance provided Standard First Aid training for students and staff of the Geoscience and Mines Branch in May. Students hired for the summer received a full week of training before starting their project work. Staff members are also required to keep OH&S courses, such as First Aid and Defensive Driving, up to date.

First Grants Approved for Mineral Resources Development Fund

On April 6, 2018, the Nova Scotia Department of Natural Resources (DNR) announced a call for applications and proposals for funding from the new Mineral Resources Development Fund (MRDF). The 'Fund' replaces the previous Nova Scotia Mineral Incentive Program (2012-2018; see the *Geological Record*, v. 5, no. 1, p. 2).

There are seven funding streams that support private-sector mineral exploration, the development of new mines, university research, innovation in the mining sector, marketing and promotion of investment opportunities, training of young people, and initiatives to build public confidence in mining. A five-person Advisory Council is in place to provide DNR with recommendations regarding funding streams, management, and proposals for major projects intended to benefit the entire industry. Details on the funding streams and the MRDF Advisory Council can be found at https://novascotia.ca/natr/meb/mrdp.asp.

By the deadline on May 7, 2018, 68 applications and proposals were received, for a total request of $3.1 million in funding. Twenty-eight applications and proposals were approved. Currently, the MRDF will support 18 Prospector and Exploration grants, 2 Shared Funding grants, 4 Research grants, 1 Innovation grant, 1 Major Project grant, and 2 Education/Outreach/Engagement grants. Prospectors will also be supported by Marketing grants throughout the year, for travel and promotion of their prospects at international conferences. Successful grantees and their respective projects will be posted on the MRDF web page in the coming weeks. Please visit the MRDF web page (link in the preceding paragraph) for the latest information.

Diane Webber

What Can a Modern Study of Metamorphic Rocks in the Meguma Terrane Accomplish?

Allie Nagurney standing at the contact between the Mn-rich Moshers Island Formation (lower) and the Fe-rich Cunard Formation (upper). Photograph taken at West Dublin, Lunenburg County.

Last fall, Alexandra (Allie) Nagurney, a Ph.D. student in Metamorphic Petrology at Virginia Polytechnic Institute and State University in Blacksburg, Virginia, contacted the Geoscience and Mines Branch at DNR about the possibility of studying the metamorphic rocks in Nova Scotia as part of her thesis project. Over the last 5 to 10 years, much of the research in her group at Virginia Tech has focused on combining chemical analyses and thermodynamic modelling to determine the pressure-temperature history of rocks in the southern and central Appalachians. She wants to continue that work into the northern Appalachians with a focus on the southwestern Meguma terrane and the metamorphic rocks surrounding the plutons where the age of metamorphism is well documented.

Arrangements were made and she arrived on June 5, 2018, to conduct a detailed 10-day sampling 'spree', focusing on metamorphic rocks of varying grades from the same protoliths in the Government Point and Moshers Island formations of the Goldenville Group, and the Cunard Formation of the Halifax Group. Her goal is to document the regional and contact metamorphic P-T conditions of the rocks using modern metamorphic pseudosection technology. Recently, her group has also started working on understanding porosity in metamorphic rocks and how it changes during metamorphic heating with the same protolith.

This study will provide better understanding of the history of the Appalachian orogen and may also give us new insights on the effects of heat on porosity and its relationship to gold-bearing fluids in these higher grade metasedimentary rocks.

Chris White

A New, Real-Time Drought-Monitoring Network for Shallow Aquifers in Nova Scotia

The need for real-time monitoring of shallow aquifers was highlighted during a widespread drought in Nova Scotia in 2016. The drought was particularly severe in southwestern Nova Scotia, where it was the driest summer recorded in 137 years. This area of the province relies heavily on shallow dug wells for private water supplies, and more than 1,000 wells went dry in 2016. During the drought, there was a need to track aquifer levels so that emergency management staff could plan appropriate management responses and the public and media could be kept informed about the drought impacts.

Although Nova Scotia has a provincial groundwater observation well network (https://www.novascotia.ca/nse/groundwater/groundwaternetwork.asp), it could not be used to monitor rapidly changing conditions because it is not a telemetric, real-time system. The cost to convert the existing network to a real-time network using commercially available equipment was high, approximately $2,500 per site. With a need for real-time monitoring and a small budget, a low-cost 'Internet of Things' water-level meter was developed by DNR geoscientists, and the device was pilot tested in 2017.

The new water-level meters are permanently installed in each well and use an ultrasonic sensor to measure the water level. The sensor is connected to a microchip that transmits daily water-level data via WiFi. The data are graphed in real time and are available immediately for online viewing and download. The system can send a message when the water reaches a critically low level. Each water-level meter costs approximately $200 to build, and requires an annual operating cost of about $5 for batteries. The meters have been pilot tested in shallow dug wells in Nova Scotia and have performed well compared to pressure transducers and manual measurements. Example results can be viewed at the web site www.thingspeak.com/channels/316660.

The pilot monitoring network will be expanded in 2018 to provide greater coverage across the province. The approach relies on community volunteers to install a meter in their well and provide access to their home WiFi network. We are currently seeking well owners from across Nova Scotia to volunteer their wells to be part of the network. Suitable water wells need to meet the following criteria:

1. a dug well (not drilled);
2. the dug well must be made only of concrete well rings or crocks (old style wells made of rocks or a combination of rocks and well rings won't work);
3. a WiFi signal at the well (this can be checked with a smart phone to see if you can google something on your phone while standing at the well).

As a volunteer, the benefit to you is that your well-water level is measured daily and you can check it on the Internet. The benefit to the province is that water-resource managers can track shallow aquifer levels across the province, which is especially valuable during droughts. If you are interested in volunteering and would like further details, please contact John Drage at John.Drage@novascotia.ca.

John Drage

Top left: Photo of the water-level meter, with a Swiss Army knife for scale. Top right: Photo of the meter installed in a pilot test well in Halibut Bay. Bottom: Checking a pilot test well in Lockeport.

From the Mineral Inventory Files

The Western Extension of the Harrigan Cove Gold District

The Harrigan Cove Gold District is found just north of Highway #7 at the small community of Harrigan Cove, at the easternmost end of Halifax County (Fig. 1). The deposit is a typical example of one of the numerous, metasediment-hosted, lode-gold quartz vein deposits hosted in the province's Cambro-Ordovician Meguma Supergroup, which underlies much of mainland Nova Scotia. Small in size, the district recorded a modest total historical Au production of 7,943 oz. Au from 13,778 tons milled, for an overall grade of 1.73 oz. Au/ton. Discovered in 1868, there wasn't much development or mining until the 1890s. Most mining took place between 1900 and 1904, after which there was only sporadic Au production until 1916. Since then, the site has been essentially abandoned.

The district lies on the east-west Tangier-Harrigan Cove Anticline, which is also host to several other gold deposits, such as the Tangier Au District, the Moose Head mine and the Ecum Secum Au District. At Harrigan Cove, the main antiform, termed the North Anticline, is a west-plunging, broad, open fold. A smaller, secondary fold occurs along the North Anticline's southern limb, however, and is named the South Anticline. This is a much tighter fold structure and is host to most of the main historically producing veins of the district. These veins occur as thick, bedding-concordant saddle veins along the crest of the anticline, and as thinner veins extending down from them along the southern limb of the fold. Similar to many Meguma Supergroup Au districts, most of the auriferous quartz veins occur within slate and metasiltstone units interbedded with thick beds of metawacke and quartzite. For example, the Boak Shaft (Fig. 1) pierces a series of nine saddles along its 30 m depth. Most of the mining at Harrigan Cove was shallow, in the order of 30 to 40 m depth, with the deepest workings only extending to 60 m.

Over the years there have been several concerted exploration efforts at Harrigan Cove by a host of companies and individuals, including Cominco in 1937, Munroe Archibald in the 1940s, Harry Ryan in the 1950s, Milmore Syndicate 1973, Quebec Uranium 1974, Harrigan Mining Associates 1979-1981, AquaGold Resources 1986-1987, Stay Gold Inc. 1995-1997, Gammon Lake Resources 1997, Annapolis Properties Corporation 2008-2009, Acadian Mining Corp. 2013 and Stay Gold Inc. again from 2012-2015. All of these exploration efforts found indications of gold and drill intersections that range from interesting to very promising. The continual return of exploration activity alone attests to the enticing potential this property shows.

I find the lack of exploration at one key area of the property to be particularly perplexing, however, this being the area immediately west of the Boak workings where there is a prominent, 60 m high drumlin.

Historically, at most of the Meguma Au districts where thick drift conditions were encountered, mining was dismissed as the mining techniques of the day would not allow it. These areas were ignored, even though the miners knew that the vein zones likely extended under them. Harrigan Cove is just one such example, but what is most surprising to me is that there has been very little modern exploration to determine if the vein packages present in the Boak workings continue under the drumlin (Fig 1). There has been some limited mining and exploration drilling to the west of the drumlin in the Eel Brook area, which showed modest results, but none to test under the drumlin itself. It's highly unlikely that the promising auriferous vein packages occurring south of the Boak Shaft end abruptly toward the west. At least some, if not all, of the area that lies under the thick drumlin surely contains a strike extension of these veins, just waiting for someone to find them.

G. A. O'Reilly

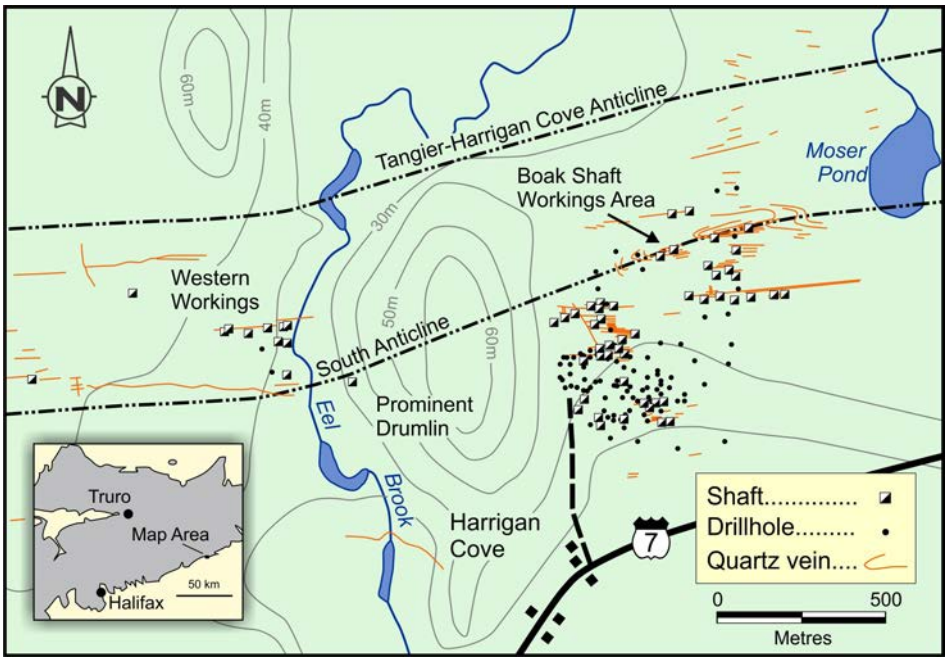

***Figure 1**. The Harrigan Cove Gold District, showing major quartz veins, historical shafts and exploration drillholes.*

Gavin Kennedy Receives Founder's Award from Nova Scotia Ground Water Association

Geoscience and Mines Branch staff member Gavin Kennedy was given the 2017 W.E. "Buster" Brown Founder's Award by the Nova Scotia Ground Water Association (http://www.nsgwa.ca/) at the association's AGM in May 2018. The award is given annually to a groundwater professional who shows excellence and dedication to groundwater in Nova Scotia.

Gavin Kennedy is a Senior Hydrogeologist with the Nova Scotia Department of Natural Resources. He holds a B.Sc. in environmental science from McMaster University and an M.Sc. in earth sciences from the University of Waterloo. For more than 10 years at DNR, Gavin has been leading scientific investigations on Nova Scotia's groundwater resources and providing scientific advice on managing the province's groundwater. He has published extensively on both groundwater quality and availability issues. His research topics have included methane, arsenic, uranium, manganese, drought impacts, groundwater recharge, surficial aquifers, saltwater intrusion, wetland hydrogeology, water-use demographics, and climate change effects on groundwater.

At DNR, Gavin has been a leader in the development of a relational, centralized groundwater database, the publication of groundwater data in various formats, the development of numerous thematic groundwater maps to support risk-based decision making, and the characterization of groundwater quantity and quality in the province.

In addition to working in the Hydrogeology Program at DNR, Gavin has worked as a consulting hydrogeologist and has been an active volunteer in the water industry, both as past president of Geoscientists Nova Scotia and as a volunteer with Water For People and the International Association of Hydrogeologists-Canadian National Chapter. He is widely respected for his technical excellence, resourcefulness, as well as his collaborative and adaptable approach to managing groundwater resources.

John Drage

Gavin Kennedy and the W. E. Brown Founder's Award.

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

August 17-19, 2018

Nova Scotia Gem and Mineral Show and Sale, Lion's Arena, 2163 Western Ave., Parrsboro, NS. For more information please visit the web site: http://fundygeological.novascotia.ca.

October 31-November 3, 2018

Mineral Resources Review 2018, Delta St. John's Hotel and Conference Centre, 120 New Gower Street, St. John's, NL. For more information please visit the web site: http://www.nr.gov.nl.ca/nr/mines/mineral.html.

November 1-3, 2018

Atlantic Universities Geoscience Conference, Dalhousie University, Halifax, NS. For more information please visit the web page: https://augc2018.weebly.com.

November 4-6, 2018

New Brunswick Exploration, Mining, and Petroleum 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.