

# The Geological Record

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## Prospectors' X-ray Fluorescence (XRF) Analyzer in Stellarton

As noted in the spring 2016 issue of *The Geological Record*, funding was provided through the 2015-16 Nova Scotia Mineral Incentive Program to allow the Nova Scotia Prospectors Association (NSPA) to purchase a Niton XL3t 950 GOLDD+ Mining XRF with Soils and Mining Modes. The XRF is stored at the Drill Core Library in Stellarton. Only NSPA members will be eligible to use the analyzer, and it is mandatory to take an XRF training course (unless you have a valid, up-to-date XRF training course already). New training courses will be held as the demand increases for using the device. To help clients use the XRF, Alex MacKay was contracted to produce user-friendly videos and a step-by-step manual to cover the basic use of the machine. These videos are available on the computer connected to the XRF machine.

A new jaw crusher was acquired by the NSPA in September 2016 and is also stored at the Drill Core Library for use by all registered members of the association. With the addition of the XRF and the jaw crusher to the Core Library, and free access to over 700 000 m of core, plus numerous rock, soil and till samples collected by DNR over the last 60 years, there are opportunities at the Core Library to discover new mineral occurrences and, who knows, maybe a mine!

Mick O'Neill



*The DNR Core Library in Stellarton is home to a new X-ray Fluorescence device, shown above, which allows prospectors to obtain immediate geochemical analyses.*

## New Bedrock Geology Compilation of Cape Breton Island

Pre-Carboniferous rocks in Cape Breton Island host a variety of significant metallic and industrial mineral occurrences. For this reason the Geological Survey of Canada, through the 1984-89 Canada-Nova Scotia Mineral Development Agreement and the 1990-92 Canada-Nova Scotia Cooperation Agreement, commissioned two major mapping projects on the island. The projects were overseen by Drs. Sandra Barr, Robert Raeside (Acadia University) and Rebecca Jamieson (Dalhousie University). One area encompassed the northern and eastern Cape Breton Highlands and the other area was in southeastern Cape Breton Island. Although mapping and data collection were conducted at a scale of 1:10 000, the final maps were produced at a scale of 1:100 000. Given the complexity of the geology, these oversimplified geological maps do not adequately display the economic potential or geological hazards of the area. This means that opportunities for

mineral industry growth and community economic development may be overlooked.

Much of the original database that was eliminated from the 1:100 000 maps was digitally captured at 1:10 000 scale during the early 2000s, but this wealth of unpublished high-quality data was at risk of being lost if the original mappers were to retire or 'move-on' to other projects. In addition, several additional detailed mapping projects have been completed throughout Cape Breton Island where there were gaps in the geoscience knowledge base and much of these data have also been digitally compiled in FieldLog and integrated with the other datasets.

In 2010, DNR agreed to compile and integrate the 30 years of data into a series of 1:50 000-scale geological maps of the island. At the same time, the opportunity was taken to include a compilation of geological information for Carboniferous and younger strata. The digital data had to be converted

from FieldLog into an ArcGIS database, new line work and polygons created, geological unit descriptions updated, and the whole project reviewed.

Accompanying the maps are a 1:220 000-scale overview map of the entire island and a detailed legend with over 350 units from the member to terrane level. It is anticipated that these maps will be released to the public early in 2017. By capturing all the details from both older and younger rocks, these maps provide new insights about the geology of the island. The maps will enable enhanced focus on mineral assets and land use, and will be valuable tools for communities seeking to better understand the origin and geological evolution of mineral deposits in Cape Breton Island. In a broader context, they will suggest how Cape Breton Island fits into the northern Appalachian orogen, where equivalent units that host significant mineral deposits exist.

*Sandra Barr, Chris White and Angie Barras*

## Mining Consultation Table

Twice a year, DNR, Nova Scotia Environment (NSE) and the Office of Aboriginal Affairs (OAA) meet with the Assembly of Nova Scotia Mi'kmaq Chiefs (KMKNO) to provide updates on mineral exploration, development and reclamation activity in the province and to discuss issues of concern. Pictured here are the participants of the October 26, 2016, meeting, which was held in Membertou. From left to right: Helen MacLeod (Supervisor Environmental Assessment Branch, NSE), Dr. Donald James (Ex. Dir., Geoscience and Mines, DNR), Beata Dera (Director of Consultation, OAA), Melissa Nevin (Consultation Researcher, KMKNO), Twila Gaudet (Consultation Liaison, KMKNO), Chief Terrance Paul (Mining Lead, KMKNO), Priscilla Beadle (Working Group Administrator, KMKNO), David Mitchell (Consultation Advisor, OAA), Eric MacLeod (Inspector Specialist, NSE), and Diane Webber (Industry Liaison Geologist, DNR). Photo by Patrick Whiteway (Manager of Mineral Development and Policy, DNR).





## John F. Jones, the Grandfather of Groundwater in Nova Scotia

When the science of groundwater hydrogeology was still in its infancy in Canada, John Jones was hired by Deputy Minister Dr. J. P. Nowlan of the Nova Scotia Department of Mines as the first practicing groundwater specialist in eastern Canada.

The Nova Scotia Department of Mines established its 'Groundwater Section' in 1963. As chief of this new section, John's mandate was to provide an overview of the groundwater resources of Nova Scotia and an understanding of the relationships between groundwater and other water resources. As a result of his prior work with Dr. Robert Farvolden in Alberta, John knew the methods, equipment, personnel, and budget required to carry out this task. The field methods, equipment, and training required were much the same as those used for mineral and petroleum exploration, geological mapping, and natural resource evaluation, but the focus on groundwater as a resource was new. John not only had his staff assess day-to-day individual problems, but also look at the "big picture" by undertaking regional groundwater resource evaluations on the mainland and offshore on Sable Island. Information from the Sable Island groundwater survey is now supporting the development of Canada's newest national park.

John's hands-on approach to learning, through both practical application of university teaching and learning from well contractors, provided excellent training for his staff. Staff of the Groundwater Section included both men and women, long before equal representation was in vogue.

During the 1960s the Well Drilling Act was passed, requiring all drillers to register with the province, and to submit a well log for all wells constructed as a source of water. John led the way in convincing the drilling contractors of the benefits of well logs and keeping good records.

John's specialty in hydrogeology was Quaternary glacial deposits, and

initially he focused on mapping and evaluating these deposits in the Annapolis-Cornwallis valley and Truro areas. He soon recognized the aquifer potential in sedimentary bedrock units also. As part of the United Nations International Hydrological Decade program during the late 1960s and early 1970s, four research watersheds were established, along with the basis for a province-wide groundwater observation well network. The observation well network is still being operated today and it provided valuable information about aquifer water levels during the recent drought that Nova Scotia experienced in the summer of 2016.

The Groundwater Section also assessed the location and rates of groundwater withdrawals to better understand long-term sustainability of the resource and its ability to support future withdrawals for agricultural, industrial, municipal, geothermal and other water uses throughout the province. To meet these objectives, various activities were implemented, such as exploratory drilling, application of geophysics and air photo interpretation, water sampling and analyses, pumping tests, preparation of reports and publications, education and awareness, teaching, and organizing conferences and workshops. The Geology Department at Dalhousie University recognized the value of groundwater studies, and John was the first to introduce a hydrogeology course there, which he taught during the 1960s and 70s. He also established a course in hydrogeology at the Technical University of Nova Scotia.

In 1973, the Groundwater Section was transferred to the newly established Nova Scotia Department of Environment (NSE), which focused on protection, inspection, enforcement, and environmental assessments. John became Director of the Water Planning and Management Branch and served in that capacity until he retired. One of many important roles played by the branch was managing groundwater use

through water withdrawal permits for uses greater than 23 000 L per day. Such permits require detailed assessment, monitoring, and reporting to ensure sustainable use without interference to other nearby users. Regulatory authority for managing groundwater remains with NSE. In 2007, however, DNR and NSE signed a Memorandum of Understanding on groundwater research and DNR began a new program that focuses on providing scientific advice to support the management and protection of groundwater resources.

John Jones was a mentor to many hydrogeologists who are still practicing today. He also led the Atlantic Provinces in developing the science of hydrogeology and raising the interest and importance of groundwater as a vital resource. During the latter part of his career he was the Senior Policy Advisor to the Deputy Minister of the Nova Scotia Department of Environment. Although the word 'sustainability' wasn't used then as it is now, by the time John retired in 1991 the practice in Nova Scotia was to manage groundwater with sustainability of the resource in mind. He was a visionary and the right person for the right job at the right time! Mr. Jones died in November 2016.

*Prepared by former students and colleagues who appreciate what he did for us, as well as for the people of Nova Scotia, January 2017.*



*John F. Jones (B. Sc., M. Sc., P. Eng.) enjoying retirement. Photo taken in 2004.*

## Donkin Update

Coal production was planned to start in February 2017 at the Donkin mine in Cape Breton County. Under approvals for the initial 'test mining' phase, Kameron Coal Management Limited can extract up to 500 000 tonnes in the first year of operation. Plans are to truck the initial 10 000 tonnes to one of Nova Scotia Power's coal-fired electrical generating plants for a test burn in order to provide performance data that will allow the two parties to finalize a thermal coal supply contract.

There are presently 52 people working at the site, seen in the photo below. A community liaison committee meets regularly and the Mi'kmaq are invited to attend those meetings. Kameron plans to apply to Nova Scotia Environment (NSE) to amend their existing Industrial Approval to include the operation of a coal wash plant on site, which will produce metallurgical-grade coal for export.



## Personnel Changes in the Geoscience and Mines Branch

Industry Liaison Geologist Diane Webber has taken on a new challenge. On January 3, 2017, Diane became the Acting Director of Organizational Strategy and Renewal with the Policy, Planning and Support Branch of DNR. The acting position is for six months, and during this time Diane will assume responsibility for a number of department-wide initiatives, including work process

improvement, outreach renewal, and the ongoing implementation of the department's Natural Resources Strategy.

During Diane's absence Geologist Garth DeMont has kindly agreed to assume many of her responsibilities. Garth will act as the first point of contact for mineral exploration companies. Garth will also oversee the planning and delivery of the department's mineral promotion activities, and assist with delivery of the Nova Scotia Mineral Incentive Program.



*Diane Webber*



*Garth DeMont*

*Robert Naylor*

## Nova Scotia's Most Influential Geologist, Sir William Dawson (1820-1899)

Born John William Dawson to a Scottish bookseller and his family in Pictou, Nova Scotia, William was the benefactor of learned acquaintances early in his life, and later at university in Edinburgh, who helped guide his geological path in life. He met Sir Charles Lyell early in his adulthood and impressed the older Lyell with his insights into the geological correlations between the Carboniferous and Permian sequences of Atlantic Canada and those in Europe. Lyell and Dawson had an abiding loyalty and friendship throughout their lives, and Lyell remained a deep influence on Dawson's thinking.

Dawson authored what to many is still considered the best work of its kind on the geology of Atlantic Canada, *Acadian Geology*, first published in 1855 and updated continuously until shortly before his death. He consulted actively with colleagues in Britain and the United States, and drew parallels between the fossil and geological records on both sides of the Atlantic. His observations were summarized in his acceptance speech as President of the British Academy of Sciences, published by the Geological Society of London in 1888: *On the Eozoic and Palaeozoic rocks of the Atlantic coast of Canada, in comparison with those of western Europe and of the interior of America*. The correlations and comparisons that he drew make all the more sense to us now with the hindsight of plate tectonic theory.

A deeply religious man, Dawson is often wrongly labelled a creationist because of his reticence in accepting that humans evolved from primates, as proposed by Darwin. He was a proponent of 'deep time', but also recognized stasis in the fossil record that would not be addressed by evolutionary theory until well into the Twentieth Century. His proposition that the fossil record extended much farther back into deep time than anyone was willing to accept hinged on his identification of stromatolite-like structures that he named

*Eozoon canadense*. His identification has since been repudiated as inorganic structures, but ironically, stromatolites are now widely accepted as the earliest record of fossil life.

A lasting legacy of Dawson's work is his lifelong investigation of the cliffs at Joggins, now a UNESCO World Heritage Site. In 1852, he and Sir Charles Lyell discovered tetrapod remains in the standing Coal Age tree fossils at Joggins, their work being described by Darwin in his *Origin of Species*. Dawson considered his ground-breaking work on Devonian plants both his opus and his greatest disappointment, as his treatise was refused publication by the Royal Society after the society's rare admittance into their ranks of a 'colonial.' Undaunted, Dawson

persevered, working more closely with his less class-conscious colleagues in the United States. Dawson was recognized early on by his peers south of the 49<sup>th</sup> parallel, becoming president of the American Association for the Advancement of Science in 1857. Twenty-nine years later, the British Association followed suit and elected him president, the first time that the positions would be held by the same individual. Dawson was instrumental in forming the Royal Society of Canada, was knighted in 1884, and for 38 years held the position of Principal at McGill University in Montreal, where he is widely credited with its rise to an international school of learning.

*John Calder, with input from the Dictionary of Canadian Biography.*



Sir John William Dawson



## Former DNR Summer Student Shines at AUGC

Taylor Chew worked as a summer student for DNR in 2014 under the supervision of Ron Mills, but during the 2015 field season he was enticed by DeBeers to look for diamonds in northern Canada. After a very rewarding experience, Taylor returned to us during the 2016 field season to work on granite-related mineral occurrences in the New Ross area under the direction of Dr. Geoff Baldwin. In his spare time Taylor also worked on his B.Sc. Honours thesis at Acadia University.

During the October 2016 Atlantic Universities Geoscience Conference (AUGC), hosted by the Fletcher Geology Club at Acadia University, Taylor was part of a four-person team representing Acadia at the 'Jeopardy-style Challenge Bowl,' hosted by the Canadian Society of Exploration Geophysics. Taylor's team won over participants from UNB, St. Francis Xavier, Saint Mary's, and Memorial universities, and two from his team won an all-expense-paid trip to Calgary in the spring of 2017 to participate in the national championship.

In addition, Taylor presented the initial results from his Honours thesis entitled "Geological setting of Au-Cu-Ni-Pb occurrences in the Second Gold Brook area, southwestern Cape Breton Highlands, Nova Scotia." At the evening Awards Banquet, Taylor was presented with the Frank S. Shea Memorial Award for best economic geology presentation. It should be noted that his thesis project was partially funded by a DNR Mineral Incentive Program University Grant to his supervisor Dr. Sandra Barr (Acadia University). Although we would like to take credit for Taylor's success at the AUGC conference, those who know him recognize his keen observational skills, and tremendous work ethic, which will continue to make him a great geologist. We all should keep an eye on his future endeavours.

Chris White

## Reclamation Proceeds at CGC Windsor

CGC's gypsum quarries in the Windsor area are on care-and-maintenance while the company awaits suitable market conditions to recommence operations. During this period, the company is committed to annually conducting reclamation work and increasing its reclamation security. In 2016, reclamation work commenced in the area pictured below, which is located in the Miller's Creek quarry, to make the slopes safe, stable and revegetated. According to the reclamation plan that was accepted by DNR and Nova Scotia Environment, annual reclamation work is planned in disturbed areas that have not been naturally revegetated and where there are no gypsum reserves that can be mined in the future, should demand for gypsum improve.

Patrick Whiteway





## Touquoy Update

This mill, being constructed at the Touquoy site, 110 km northeast of Halifax, is scheduled to begin processing gold ore from the Touquoy open pit mine in September 2017. Financed by Atlantic Mining NS Corp. (wholly owned by Atlantic Gold Corporation), the mill is capable of treating 5,550 tonnes of ore per day. The process of recovering 87,000-92,000 ounces of gold per year will include three-stage crushing (to about 9 mm in size), grinding (to 80% passing -150 microns), classification (hydro-cyclone), gravity concentration of underflow (coarse) and thickening of overflow (fines), followed by cyanidation and adsorption onto activated carbon in a carbon-in-leach circuit. Loaded carbon will be screened and transferred to an elution (sodium cyanide) circuit. The mill also includes facilities for carbon regeneration, cyanide destruction (INCO SO<sub>2</sub>/air process to reduce cyanide from 170 ppm down to 3 ppm), electro-winning, drying, an induction furnace (bullion), and effluent treatment (ferric sulphate to precipitate arsenic and remnant cyanide complexes). Photo courtesy of Atlantic Gold Corporation.



## George MacPherson Joins DNR as Director of Mineral Management

George MacPherson joined the Geoscience and Mines Branch in November as Director of Mineral Management. George earned a Mineral Technology Diploma from the College of Cape Breton in 1980 and later acquired a Bachelor of Science Degree in Mine Engineering from South Dakota School of Mines and Technology. His mining experience includes 20 years of exposure to hard rock mining operations at the Bathurst Mining camp in New Brunswick and an additional 11 years of narrow vein and bulk mining at various underground mining operations in Northern Ontario. He has also worked in the soft rock mining industry at the Potash Corporation of Saskatchewan-Sussex Mine for the past three years and most recently for the New Brunswick Government in their Mines and Energy Branch.

I am very pleased to welcome George to DNR and back to Nova Scotia.

*Donald James*



## Remembering Roland Anthony

As a geologist assigned to work with prospectors it is my job to treat all prospectors equally: to deliver the same degree of respect and service to all. I have always endeavoured to do so. Nonetheless, some capture my interest and become great friends. Roland Anthony was such a prospector.

Growing up in a large family during WWII, Rollie learned to be resourceful, a skill all good prospectors exhibit. He was larger than life, with big hands and a spirit and personality to match. Rollie prospected for placer gold from the Adirondacks of New England to the Blue Ridge and Piedmonts in Georgia and Alabama, and from the Californian Sierra Nevadas north to the Yukon and Alaska. With a gruff voice and a booming laugh that would temper steel at the punch line of a joke while holding a stiff rum, one might think Roland a rough and tumble customer, and he was tough. Wet-suited in a hookah diving outfit with a regulator in his mouth while dredge-feeding a sluice in often near-freezing water, he was one of the brawniest prospectors I knew, and he became a bit of a legend with the locals. But he was also a father and family man. Rollie studied theology at Acadia, went on to earn a B. A. at Gordon Christian College in Massachusetts, and spent part of his life rescuing souls and assisting the down and out on the streets of Boston, Quincy, Charlestown and Roxbury. In reality, Rollie was a man with a huge heart who believed deeply in a commitment to his fellow man. He would ultimately know more about how to find placer gold than most who came before or after him.

Rollie returned to Hants County, became trained in electronics, and took over a family business. He loved the forest, however, and his life was intertwined with the twigs and leaves, the game trails, and the rivers that run through Hants County, where he pursued gold with a passion. He would disappear alone for days, living off fish from the rivers and fiddleheads growing in the shade, cooking and washing in a gold pan. In spite of his knowledge and skill, it was never about the gold, for he never sold any. For Rollie Anthony, prospecting was an affair of the heart, a path to that place of enchantment he loved so dearly. Rollie died in October 2016. How can anyone not miss him?

Ron Mills



Roland Anthony in 2000 on Eagle Summit above Fairbanks, en route to the Circle Mining District, Alaska. Photo courtesy of Carol Blakeney.

## Special Notes

### 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](mailto:DNR.Library.List@novascotia.ca).

### Geoscience and Mines Branch Report of Activities 2015

Report ME 2016-001 was released on the branch web site in November, and is available free of charge online: <http://novascotia.ca/natr/meb/pdf/16re01.asp>.

## Dates to Remember

### February 10-11, 2017

Atlantic Geoscience Society 2017 Colloquium and Annual General Meeting, Fredericton Inn, Fredericton, NB. For more information please visit the web site: <http://ags.earthsciences.dal.ca/ags.php>.

### March 5-8, 2017

Prospectors and Developers Association of Canada International Convention, Trade Show and Investors Exchange, Metro Toronto Convention Centre, Toronto, ON. For more information please visit the web site: <http://www.pdac.ca/convention>.

### April 21, 2017

Mining Association of Nova Scotia Annual General Meeting, Inn on the Lake, Fall River, NS. For more information please visit the web site: <http://tmans.ca/events>.

### May 14-18, 2017

Geological Association of Canada - Mineralogical Association of Canada GAC-MAC 2017 Meeting and Convention, Queen's University, Kingston, ON. For more information please visit the web site: <http://www.kingstongacmac.ca/en/2017-gacmac/>.