

The Geological Record

Volume 4, No. 4

Fall 2017

In This Issue

Atlantic Gold Corporation Officially
Opens Moose River Gold Mine

Joan Kaizer and John Donahue Retire
from Registry of Mineral and Petroleum
Titles

Dufferin Update

Director of Geological Services Rob
Naylor Retires

Fifty-first Nova Scotia Gem and Mineral
Show

DNR Firefighter Makes a Geological
Discovery

From the Mineral Inventory Files

DNR Publishes Data on Mine
Reclamation Securities

Big Meadow Bog Restoration Project

China: an Immense Mineral Market
Opportunity for Nova Scotia

Brian Fisher Named New Director of the
Geological Services Division

Sinkholes in Nova Scotia

Special Note/Dates to Remember

**Comments or questions? Please
contact:**

Doug MacDonald
Editor, *The Geological Record*
Nova Scotia Department of Natural
Resources
P.O. Box 698, Halifax
Nova Scotia, Canada B3J 2T9
Phone 902-424-2510
Douglas.R.MacDonald@novascotia.ca

Atlantic Gold Corporation Officially Opens Moose River Gold Mine

October 11 marked a milestone for Atlantic Gold Corporation, the Moose River Consolidated (MRC) Gold Mine, and the Province of Nova Scotia. Atlantic Gold officially opened the mine with a ribbon-cutting ceremony in front of a large crowd of dignitaries, company executives and staff, and invited guests. There were many highlights during the event, but none shone more brightly than the 160-ounce gold bar (see photo below) on display, representing the first gold pour for the MRC mine.

The mine opening comes after only thirteen months of construction, which has proceeded on time and on budget. When the MRC Gold Mine reaches full production, targeted for the first quarter of 2018, the workforce at the site will reach close to 200 full-time employees. The company plans to produce 87,000 ounces of gold per year for a minimum of 8.5 years.

The Geoscience and Mines Branch of DNR congratulates Atlantic Gold Corporation on the opening of the mine, and on helping to re-establish gold mining in Nova Scotia.

Diane Webber



Atlantic Gold Corporation Chairman and Chief Executive Director Steven Dean (second from the right) was in the province on October 11, 2017, to celebrate the official opening of the Touquoy gold mine at Moose River Gold Mines, N.S. He is accompanied here by two RCMP officers, Chief Terrance Paul, Mining Lead, Assembly of Nova Scotia Mi'kmaq Chiefs (centre, with gold bar) and Maryse Bélanger, Chief Operating Officer for Atlantic Gold (second from the left). Photo courtesy of Atlantic Gold Corporation.

Joan Kaizer and John Donahue Retire from Registry of Mineral and Petroleum Titles

Joan Kaizer and John Donahue have both recently retired from the department's Registry of Mineral and Petroleum Titles. Joan's last working day was in July and John's was in September. Joan worked with the registry for more than 32 years, experiencing countless changes in technology and work procedures to provide service to clients. John had accrued more than 16 years of government service when he retired.

Although we are excited for them as they each start a new adventure, their absence is felt in the registry by staff and clients alike. They take with them the gratitude of colleagues and clients for their knowledge, wonderful sense of humor, and exceptional client services.

Danielle Nicholson



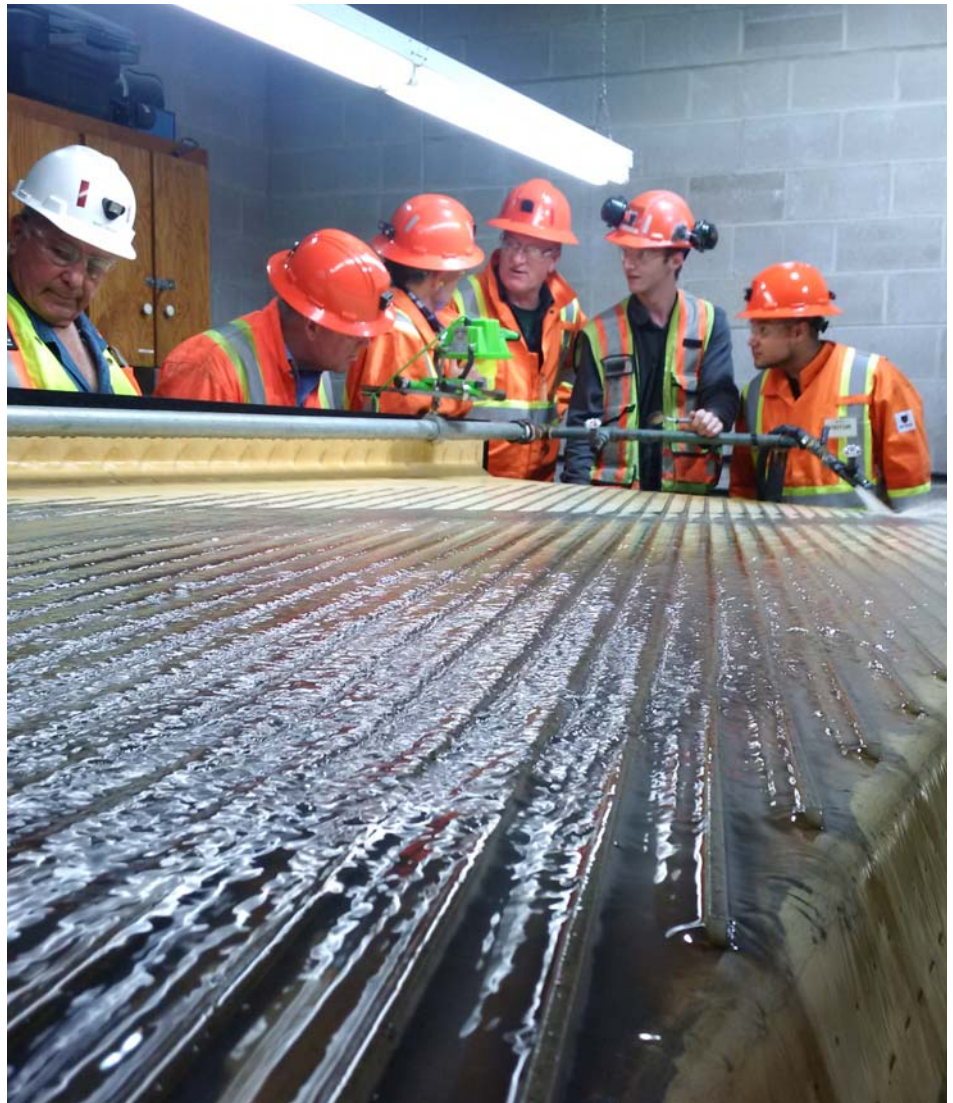
Lori Blackburn (L) visits with John Donahue (C) and Joan Kaizer (R) on Joan's last day of work in July 2017.

Dufferin Update

Resource Capital Gold Corporation of Vancouver continues to ramp up production at the Dufferin mine near Port Dufferin, Halifax County, N.S. The company reports that 3235 tonnes of ore were processed in the gravity separation mill in September at a recovered grade of 8.0 g gold per tonne. The mill has a capacity to process 300 tonnes per day. The company is incrementally increasing its reclamation security and will continue to do so until April 2018. At that point, the province will hold sufficient funds to reclaim the site in accordance with the reclamation plan.

In the photo below (L to R) Mike Gross, Chief Operating Officer, Maritime Dufferin Gold Corporation; Dr. Donald James, Executive Director, Geoscience and Mines Branch, DNR; George MacPherson, Director Mineral Management, DNR; Patrick Whiteway, Manager Mineral Development and Policy, DNR; Mill Operator, Maritime Dufferin Gold Corporation; and Isaias Peraza, DNR Engineering Summer Student, observe gold concentrates from the Holman-Wilfley shaking table at the Dufferin gold mine in July 2017.

Patrick Whiteway



Director of Geological Services Rob Naylor Retires

One thing is certain, if you persist at something long enough, your workplace, your world, and even you will change. Many of those changes come from outside: no more second-hand smoke in your cubicle, no more diamond drillers, personal computers on every desk, digital mapping, no more Rapidographs or even a drafting section. Over 35 years in the Nova Scotia civil service, Rob Naylor witnessed all these changes and more, including the changing name of our department: from Mines, to Mines and Energy, to Natural Resources.

Rob is a field geologist, first and foremost, and a fine one. He is at home in the bush: his high-school passion was to tend his trap lines after class – and maybe sometimes during. After working with industry in uranium exploration, Rob joined the department in 1982. For the next decade, Rob served as a Coal Geologist, working in all of the major coalfields on mapping programs, drilling programs, re-interpreting the Pictou Coalfield in the Stellarton Basin, solving the riddle of oil shale deposits, working to help predict the underground mine geology of collieries operated by Cape Breton Development Corporation (Devco), and to define new surface coal mine resources in the Stellarton Basin and Springhill coalfields, many of which went on to be successfully mined. I know of no other geologist in this department who can lay claim to a similar record.

It came as a surprise to me when Rob confided that he was applying for the position of Director in 2010, but it really shouldn't have. Rob loves to solve problems, and even more, to strategize – it should come as no surprise that chess is a favourite game. He applied that same strategic sense with his U12 Girls soccer teams at Halifax County United, who won virtually every competition and Provincial Championship during his long career as their coach.

Rob changed the look and substance of the Geological Services Division, and I contend is responsible in large part for our very existence. When wholesale programs were being shut down due to budget cuts, Rob strengthened our position proactively by diversifying — making us more vital to more people. He head-hunted top hydrogeologists, and drew up Memoranda of Understanding (MOUs) with Environment to bring groundwater studies back to DNR. When positions were frozen or cut elsewhere, he fought successfully to hire new geologists, hydrogeologists, and GIS specialists. As Chair of the Committee of Provincial and Territorial Geologists, and Co-chair of the National Geological Surveys Committee, he shared his vision with Canada's other geological surveys, and was respected from coast to coast to coast. He



Rob Naylor retired in May 2017. Rob's parting gift was an onyx chess set.

believed in celebrating the good work of staff and always had our back. He was a force to be reckoned with, and he had a vision for us. Rob chose to work in management to make a difference, and he did.

John Calder

Fifty-first Nova Scotia Gem and Mineral Show

The Fundy Geological Museum in Parrsboro ran another successful Gem and Mineral Show in August 2017. A record breaking 4000 + people attended the event, the 51st year for the show. A team from DNR's Geoscience and Mines Branch operated a booth for the weekend event, but this year two of the booth's fixtures were missing: Diane Webber and Ron Mills had other work assignments this summer. Their absence was noticed by several attendees, but a new team composed of DNR geologists Amy Tizzard and Garth DeMont, and summer

students Jon Shute, Chrystal Smith and Mary Besaw, engaged the participants very effectively.

The DNR booth design was much like the time-tested model run by Ron and Diane. Only a couple of changes were made to the displays. The specimen displays were larger, and a television screen and laptop were added to display an educational PowerPoint show. The largest and most spectacular mineral specimens we could find in the DNR offices were displayed in the booth. The museum-quality specimens

attracted a lot of attention. In fact, the booth was often so full of people that the television screen was blocked from view. The PowerPoint presentation attracted attention from a few people, but most visitors were interested in asking questions about the mineral specimens.

Thanks to the assistance of Amy and the summer students, who did a wonderful job interacting with the booth visitors, the DNR booth was a great contributor to a successful event.

Garth DeMont

DNR Firefighter Makes a Geological Discovery

Fighting forest fires is challenging work, but fighting a forest fire and then discovering what could be one of the most interesting trace fossil sites in Nova Scotia, now that's impressive!

In June 2016, a small forest fire was detected in a remote area of Lunenburg County. The fire crew (Jacob Penney, Corey Conrad and Elaine Mosher) was transported via helicopter to the site to establish a fire line with water pump and hoses. Following eight hours of fire-fighting activity, the crew began to gather up the fire hose and begin the arduous task of carrying out the gear. Fire fighters maintain a high standard of physical fitness, but at the end of a day like this one, exhaustion begins to erode both physical and mental capacity, and that is what makes this story remarkable.

While lifting heavy sections of hose back to the chopper and climbing over steep outcrops of Meguma sandstone, Corey Conrad looked down and noticed that burning of the duff layer had revealed significant features in the rock. Corey quickly flagged the area and used his smart phone to take photos prior to flying back to Lunenburg. Once the crew returned to the Lunenburg office, Corey showed his photos to Area Manager Sandra Johnston, who advised Corey to: "send them to Ian Lawyer—he loves fossils!" So the story came to me.

As soon as I received a text with the photos I was aware of the possible significance of this discovery and began to plan a trip to the site. In November 2016, Corey Conrad, Jacob Penney and I flew to the site, scoured the area, collected some loose samples, and took several photos. While Corey and Jacob were clearing off some of the root mass they revealed a new and most unusual looking feature (see photo). This feature appears to be the remains of a creature that had a round base, a stalk, and long fine tentacles, perhaps resembling something like a sea anemone. Following the visit to the site, I contacted Senior Geologist John Calder and asked him to come to Lunenburg, meet with Corey Conrad and look at some of the photos and samples. John was also impressed,

and we decided to plan for a new expedition.

In October 2017, I returned to the site with Corey Conrad, John Calder and Sandra Johnston. We uncovered new features, collected measurements and took more photographs. These features could be similar to those first identified by J. W. Dawson in 1890, which he identified as Lower Cambrian trace fossils that he named *Astropolithon hindii*. In 1979, R. Pickerill and R. Harris interpreted such

features as dewatering structures rather than fossils.

Regardless of whether these are rare trace fossils or well preserved sedimentary structures from the 500 million year old Lower Cambrian Green Harbour Formation of the Meguma Supergroup, finding them after spending a day fighting forest fires is one of the province's great stories of discovery!

*Ian Lawyer, Resource Manager
DNR Regional Services Branch*



DNR Firefighter Corey Conrad points out one of the possible trace fossils in outcrop. Note that fossils are protected and researchers require a Heritage Research Permit.

From the Mineral Inventory Files

The Sibley Mountain Slate Quarry

An obscure, but nonetheless significant slate quarry once operated along the west bank of McLean Brook, which drains the western flank of Sibley Mountain, Colchester County (Fig. 1). The quarry dates from the late 1770s, so it's likely one of the oldest known mine sites in the province; only the early Acadian coal mines at Joggins (for Fort Beausejour and Port Royal) and Port Morein (for Louisbourg) are known to be older.

The quarry was built on land owned by John Olemixon, a close friend of John Wentworth, who prior to his appointment as Lieutenant Governor of Nova Scotia in 1791, served as Surveyor General of the Kings Woods for Nova Scotia. Wentworth commissioned Olemixon to build a slate quarry on his land to provide shingles and flagstone for buildings in Halifax. Olemixon brought in experienced quarry manager Jonathan Bulgin and quarrymen from England to construct a quarry along McLeans Brook, which at that time was raw wilderness. A two-storey manager's house and workers' cabins were built, and the quarry produced shingles that were taken by ox cart over a very rough road to Fort Ellis

on the Stewiacke River. From there they were taken by barge and schooner to Halifax and overseas to England.

Sibley Mountain is underlain by the Glen Brook Formation, uppermost formation of the Cambro-Ordovician Halifax Group (Fig. 1). The Glen Brook Formation consists of interbedded, greyish metasiltstone and slate, which typically has little or no sulphide content and is well suited to making shingles and flagstone. Currently, Scotia Stone Limited produces its fine stone products from the same Glen Brook Formation rocks at East Gore, roughly 30 km west of Sibley Mountain. Production continued from the Sibley quarry until the early 1860s when the operation closed, in large part because the quarry lost all its workers to higher paying positions in the province's newly discovered and developing gold mines.

Today the site is heavily overgrown but several interesting features remain. Most prominent is a 2-3 m high, 30 m long slate retaining wall that follows the west bank of the brook. The wall has partially

collapsed in recent years. The quarry itself is higher on the bank and has a narrow, gorge-like entrance, which opens into a 10 m wide and 40 m long quarry. Foundations, waste piles and a few open cuts surround the quarry. About 250 m to the northwest is the substantial fireplace and foundation of Mr. Bulgin's two-storey house (Fig. 2).

A visit to the quarry site is an interesting trek back in time. It's easy to imagine the rough conditions and hardships that workers endured living and working in what was such a remote area. The remnants of the fireplace in particular evoke a feeling of awe. If you do venture into the location the sights are impressive, but please show respect and be aware that this site has a municipal historical designation.

G. A. O'Reilly

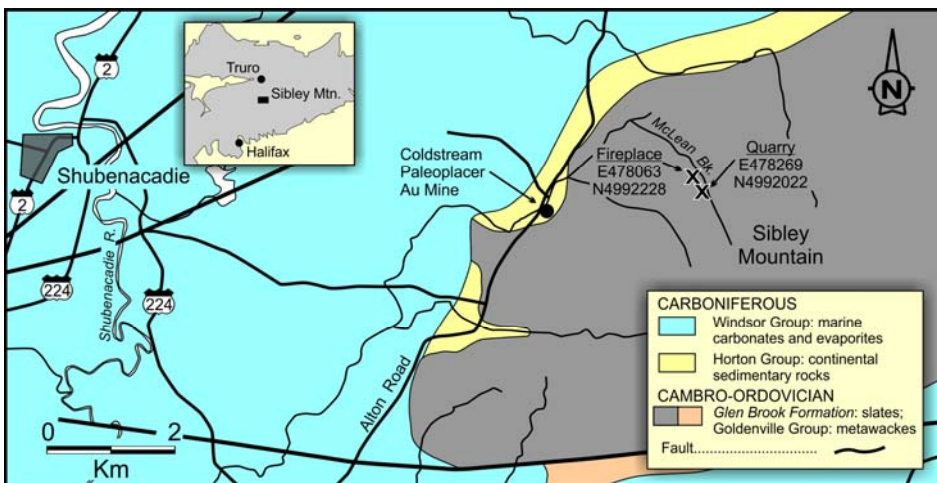


Figure 1. Geology of the Sibley Mountain area, southern Colchester County, showing the location (and NAD83 UTM coordinates) of the Sibley Mountain slate quarry and the fireplace of the manager's house.



Figure 2. Remnants of the fireplace of the two-storey manager's house at the Sibley Mountain slate quarry; rock hammer for scale.

DNR Publishes Data on Mine Reclamation Securities

The Nova Scotia Department of Natural Resources (DNR) has posted reclamation security details for some of Nova Scotia's producing mine sites. The information may be accessed at the URL <http://bit.ly/2zxZtffE>.

DNR is committed to working with the Nova Scotia mining industry to adopt the best Canadian practices with respect to mine reclamation securities. Robust, fair, and transparent mine reclamation security policies and practices will improve public confidence in legislation, regulatory agencies, project approval processes, and the mining industry in general. In addition, having mine sites adequately secured will help to protect taxpayers from bearing the costs of mine site remediation, provide assurance for investors, and promote the Canadian mineral industry as being 'best in class' with respect to sustainability.

An independent study prepared by Ernst and Young for British Columbia on mine reclamation financial security policy issues (<http://bit.ly/2gQB25m>; February 2017) highlighted transparency in reporting and communication as key issues to be addressed by Canadian jurisdictions.

At the Federal/Provincial/Territorial Energy and Mines Ministers Conference in Winnipeg in 2016, former Natural Resources Minister (Hon.) Lloyd Hines proposed a national transparency reporting initiative to his counterparts, consistent with British Columbia's leadership. Aligned with that initiative, and following reclamation security transparency reporting practices in British Columbia (see 2015 Annual Report of the Chief Inspector of Mines, British Columbia Ministry of Energy and Mines, e.g., <http://bit.ly/2kzpbZl>, p. 36-39), DNR has now published information on the reclamation securities held for some of the producing mines in Nova Scotia.

George MacPherson and Patrick Whiteway

Big Meadow Bog Restoration Project

In the summer of 2013, staff from DNR's Geoscience and Mines Branch began providing hydrogeological expertise to a wetland restoration project at Big Meadow Bog on Brier Island. The key objective of the project is to protect the Eastern Mountain Avens, a globally endangered plant found in only two places in the world: the White Mountains of New Hampshire and the coastal peatlands of Digby Neck, Nova Scotia. The species has undergone population decline in Nova Scotia due to habitat loss and degradation. In particular, its habitat at Big Meadow Bog has been threatened by the construction of a drainage ditch in the 1950s, which has caused the bog to become drier.

The Geoscience and Mines Branch's role in the project has been to help develop an understanding of the bog's hydrology, with the long-term goal of restoring the hydrology to pre-ditching conditions in order to rehabilitate the bog. The branch has installed a groundwater monitoring network comprising over 40 wells to monitor both baseline and post-restoration groundwater levels and chemistry. A report on the hydrological monitoring at the bog can be viewed here: http://novascotia.ca/natr/meb/data/pubs/15ofr05/ofr_me_2015-005.pdf.

Restoration work at Big Meadow Bog began with a pilot testing program in 2016 and is being carried out by East Coast Aquatics of Bridgetown, Nova Scotia. The main restoration program was completed in September 2017. The work involved blocking the ditches in the bog to restore the pre-ditching water levels. The ditch blocks were constructed with saturated peat and were placed in the ditches at intervals of about 10 m to 50 m. Aerial video footage of the restoration work was undertaken courtesy of Mike Dembeck and can be viewed here: <https://vimeo.com/235160812>.

The network of groundwater monitoring wells at the bog will continue to be monitored to track post-restoration changes to water levels. The monitoring is being carried out by Dalhousie University M.Sc. student Audrey Hiscock under the direction of Dr. Rob Jamieson. The Big Meadow Bog project is a multi-disciplinary effort involving partners from DNR (Geological Services Division and Wildlife Division), Nature Conservancy of Canada, Mersey Tobeatic Research Institute, Environment & Climate Change Canada, Acadia University, St. Francis Xavier University and Dalhousie University. The project is being led by Dr. Nick Hill of the Fern Hill Institute for Plant Conservation with financial support from Environment & Climate Change Canada's National Wetland Conservation Fund. The Geoscience and Mines Branch's involvement in this work supports the Natural Resources Strategy to conduct earth science research that helps to understand and protect Nova Scotia's biodiversity.

John Drage and Gavin Kennedy



Dr. Nick Hill (L) addresses a group during the Canadian Land Reclamation Association field tour of Big Meadow Bog in October 2017.

China: an Immense Mineral Market Opportunity for Nova Scotia

China's growing middle class has an enormous appetite for consumer products. The province recently established an interdepartmental committee to investigate and pursue market opportunities in China, and DNR's Geoscience and Mines Branch is playing an active role.

Natural Resources Canada has worked with some provinces, including Nova Scotia, to organize China missions in 2016 and 2017. A Chinese investment group followed up with a request for more information on the province's mineral resources after the 2016 China tour. To support the work of the interdepartmental China team, the author gave a presentation in July 2017 on Nova Scotia's mineral resources to a Chinese delegation visiting Nova Scotia from Suzhou. The author and Geoscience and

Mines Branch Executive Director Donald James worked with colleagues at Nova Scotia Business Incorporated and Nova Scotia Department of Intergovernmental Affairs to prepare a document addressing questions asked by this investment group, and to expand on the mineral resource information provided in the China tour's 2016 Nova Scotia Mines Brochure. The document was well received by the Chinese investment group and we are waiting to hear if they will come to Nova Scotia for a site tour.

The 2017 Canadian team, which included Donald James, attended the Canadian Mineral Investment Forum in Beijing on September 21, and the China Mining Conference in Tianjin, September 23-25. The team also met

with their counterparts in the China Geological Survey, to build on the relationship established in previous visits to China.

Many of the consumer products in high demand in China, and the massive volumes of goods manufactured in China for export, contain mineral products, some of which are available for development in Nova Scotia. Nova Scotia's existing and proposed port facilities lie on global shipping routes, so Nova Scotia is in a good strategic position to export mineral commodities to China. It takes a long time and a great deal of effort to establish a good working relationship with Chinese investors, but the scale of the market opportunity justifies the effort.

Garth DeMont

Brian Fisher Named New Director of the Geological Services Division

Brian Fisher was named as the successful candidate for the position of Director, Geological Services Division of DNR, in October 2017. Prior to this appointment, Brian served as Manager of Geoscience Information Services and Environmental Geology for the Geoscience and Mines Branch since 2011.

Brian began his geoscience career with a B.Sc. from Dalhousie/Kings in 1979. He returned for a combined honours degree in geology and economics in 1985. In 1990 he received a Diploma in Geographic Information Systems from the Nova Scotia College of Geographic Sciences. Brian then worked on mineral exploration programs for Falconbridge Ltd., Hecla Mining Canada Ltd., and many other Canadian and international companies.

In 1995 Brian began working for DNR, first as a Geologist/GIS Specialist, and eventually as Senior Geologist and Digital Information Services Supervisor. Brian was the trained and experienced GIS professional who built the department's digital information capabilities into the leading source of digital geoscience information for the Government of Nova Scotia. In his 22

years of government service, Brian has authored or co-authored over 300 reports, maps and digital products.

As Manager of Geoscience Information Services and Environmental Geology, Brian assumed a steadily increasing leadership role in the division,

including overseeing the division budget and producing budget forecasts and financial documents.

Please join me in welcoming Brian Fisher to his new role with the Geoscience and Mines Branch.

Donald James



Brian Fisher (front row, second from left) stands with colleagues on a field trip to the Annapolis Valley in 2014.

Sinkholes in Nova Scotia

Sinkhole development in karst terrane can cause extensive damage to buildings, roads and other infrastructure. The primary geohazard in karst areas is sudden catastrophic subsidence due to the collapse of cavities in the bedrock created by the dissolution of soluble evaporite or carbonate rocks. Sinkholes can be a serious geohazard in some areas of the province and caution should be exercised in potential karst areas when constructing buildings or roads.

Most natural sinkholes in Nova Scotia develop in areas where gypsum occurs near the ground surface (see photo below). The geological boundary between the gypsum- and salt-bearing Windsor Group and the underlying sandstone and shale of the Horton Group or older basement rocks is particularly prone to sinkhole development. Sinkholes are also known to occur in older carbonate rocks, such as those of the George River Group in Cape Breton Island.

The current map of potential karst areas in Nova Scotia can be viewed at the following link, where potential karst areas are shown in light blue: <https://fletcher.novascotia.ca/DNRViewer/?viewer=MRLU&layerTheme=&scale=1000000&layers=2%20FbrWy2FLqK639q67b¢er=465578.7805046468%2C4992640.748868011>.

The Geoscience and Mines Branch is developing a new provincial karst risk map. The work has involved the compilation of the best available geology maps, compilation of karst occurrence data, review of lidar data, and field verification of sinkhole occurrences. The resulting karst occurrence database contains approximately 1,000 records of known locations with karst topography, sinkholes and karst springs. A new interactive karst risk map is expected to be published by spring 2018.

For more information about karst and sinkholes in Nova Scotia, please visit: <https://novascotia.ca/natr/meb/hazard-assessment/sinkholes.asp>.

John Drage



Gypsum outcrop displaying karst topography in the Cheverie area, Hants County.

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

January 22-25, 2018

Association for Mineral Exploration (AME) Roundup 2018, Canada Place, Vancouver, BC. For more information please visit the web site: <http://roundup.amebc.ca/>.

February 2 and 3, 2018

Atlantic Geoscience Society 44th Colloquium, Holiday Inn, Truro, NS. For more information please visit the web site: <http://ags.earthsciences.dal.ca/ags2018/index.html>.

March 4-7, 2018

Prospectors and Developers Association of Canada (PDAC) 2018 Convention, Metro Toronto Convention Centre, Toronto, ON. For more information please visit the web site: <http://pdac.ca/convention>.

June 16-21, 2018

Resources for Future Generations (RFG) 2018, a premier conference on energy, minerals, water and the Earth, Vancouver Convention Centre, Vancouver, BC. For more information, please visit the web site: rfg2018.org.