

Annual review by C.O. Böhm

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Summary

In 2015, the Manitoba Geological Survey (MGS) conducted a broad range of partnered and collaborative geoscience projects to enhance and update the geoscience knowledge base of the province. Main geoscience priorities included

- Precambrian mapping projects in the northern Superior province east of Thompson, where there is high mineral potential for a variety of commodities; in the Flin Flon and Lynn Lake belts, currently the main focus areas of mineral exploration; and in the Southern Indian Lake area, to expand bedrock mapping into a frontier area with conceptual volcanogenic massive sulphide (VMS), gold and diamond prospectivity;
- remote-sensing mapping of lineaments in support of hydrocarbon-potential studies in the Hudson Bay Lowland, as part of Phase 2 of the Geological Survey of Canada's Geo-mapping for Energy and Minerals program (GEM-2; 2013–2020);
- potash and gypsum studies in southwestern Manitoba, along with continuing studies of shallow gas-bearing Cretaceous formations;
- advancement of the digital three-dimensional (3-D) model of Phanerozoic stratigraphy in Manitoba south of 55°N—a key geoscience framework for hydrogeological, petroleum and socio-economic assessments; and
- Quaternary geoscience studies in southwestern and north-central Manitoba, in support of drift-exploration and aggregate-resource assessments.

In addition to providing geoscience knowledge, MGS geoscience programming promotes resource development, informed land-management planning, Aboriginal engagement and mineral education to the public.

Roles of the Manitoba Geological Survey

Through its broad-based geoscience program, the MGS strives to provide authoritative geoscientific information to clients in industry, government, First Nations and the general public. Public geoscience provided by governments is widely recognized as one of the key determinants of a favourable investment climate for exploration and development. Geoscience provides fundamental information to attract exploration investment by identifying areas of favourable mineral and hydrocarbon potential, and enhances the investment climate by improving both the efficiency (reduced cost) and effectiveness (reduced risk) of exploration.

By reducing costs and risk, public geoscience not only improves returns on private investment but also increases revenues accruing to governments in the form of royalties and taxes.

As has been the case since 2008, benefits from public geoscience, which typically accrue in the medium to long term, can be adversely affected by global commodity cycles and related low natural-resource prices. Additional factors that continue to negatively affect mineral exploration and development in Manitoba and elsewhere in Canada are uncertainties concerning environmental regulations, protected areas, disputed land claims and community-development agreements. Despite these challenges, Manitoba returned in 2014 to the top 10 of ranked mining jurisdictions worldwide, mainly due to excellence in its investment attractiveness, minerals policy and mineral potential. Importantly, Manitoba was ranked 7th worldwide in 2014 for its geological database by the Fraser Institute Annual Survey of Mining Companies 2014, based on criteria such as the quality and scale of maps, and ease of access to information). Manitoba's geological database, constructed during the past several decades and readily accessible through our online GIS Map Gallery, represents the principal, living product of the MGS's core program.

Mining is the primary driver of northern Manitoba's economy and, along with hydroelectric developments, represents the most viable option for sustainable economic development in the future. In order to meet the challenge of the next upswing in the global economy, the MGS is continuing to invest in knowledge infrastructure for the future of Manitoba's resource industries. Of particular importance in 2015 was the hiring of four new field geologists (two Precambrian, one sedimentary, one Quaternary), representing an instrumental step toward maintaining a modern geological survey that combines strengths in traditional fields with new expertise and vision (Figure 1).

Manitoba's vast frontier areas with limited infrastructure, and underexplored mineral and hydrocarbon resource potential, are where basic geoscience information can be particularly vital in stimulating exploration and development activities. Particularly in the north, public geoscience should be viewed as a direct investment toward future economic sustainability. Readily accessible government geoscience has become increasingly important for communities; First Nations, in particular, seek geoscience information relevant for land-use planning and understanding resource potential of traditional lands. The MGS continues to provide geoscience information



Figure 1: New MGS sedimentary geologist Kathryn Lapenskie examining Cretaceous shale at Vermillion River, southwest of Dauphin.

to First Nations through compilation of existing maps and data, or new geological mapping in their traditional territories.

Government geoscience has additional relevance to the public through such aspects as the environment, health and safety (e.g., water, radon), natural-hazard prevention, infrastructure development and education. The MGS's new *Manitoba Rocks!* mineral-education program is second to none and ever expanding.

Resource-potential assessments and evaluations of protected-areas proposals have increasingly become an integral part of the MGS program. In 2014, Manitoba Mineral Resources and Manitoba Conservation and Water Stewardship established the Mineral Potential Assessment Committee (MPAC), with a mandate to assess the mineral potential of areas proposed for protection and to make recommendations for new protocols, guidelines and best practices for developments in parks and protected areas. Mineral-potential assessments are done by the MGS through compilation and evaluation of existing geoscience data. In areas where such data are inadequate, MPAC may recommend MGS geoscience projects involving additional mapping and/or analytical surveys.

Collaborations and partnerships

The primary and long-term role of the MGS is to update, improve and expand Manitoba's geological knowledge base. The broad range and scope of the MGS geoscience program benefits greatly from collaborations with industry, university and government partners. The minerals and petroleum industries are the principal users of geoscience information generated by the MGS, and programs are therefore developed and designed to have maximum impact for these sectors. The MGS currently has research partnerships with a number of mineral-exploration companies and with Manitoba Hydro. University collaborations bring access to expertise and analytical techniques that complement those of the MGS and facilitate the training of future geoscience professionals, which in 2015 included three postdoctoral researchers, five Ph.D. candidates, two M.Sc. candidates and three B.Sc. thesis projects from across Canada and the United States.

The MGS has been collaborating with the Geological Survey of Canada (GSC) since the inception of two current, federal collaborative geoscience programs: Geo-mapping for Energy and Minerals (GEM) and the Targeted Geoscience Initiative (TGI). These programs have provided high-level opportunities for Manitoba to bring not only federal funding and geoscience activities into Manitoba, but also to maintain the integrity of the Canadian geoscience network.

The federal GEM program, designed to unlock the mineral and energy potential of, and promote responsible land development in, Canada's North, was launched as a five-year (2008–2013) geological mapping program administered by Natural Resources Canada and in collaboration with provinces and territories, and has been renewed for seven additional years (GEM-2; 2013–2020). Manitoba program collaborators include the GSC, Ontario Geological Survey, Canada-Nunavut Geoscience Office, University of Manitoba, The Manitoba Museum, and Laurentian University. Building on results of the first GEM Energy program (Hudson Bay and Foxe Basins Project), the role of MGS in the current Hudson-Ungava Project under GEM-2 is to integrate the onshore Paleozoic succession in Manitoba into a regional framework and to advance assessment of its hydrocarbon source-rock potential. Results from this project feed directly into long-term resource-development plans and strategies for Manitoba's far northeastern region.

Phase 4 of TGI, designed to improve capabilities of exploring for mineral deposits at depth in Canada, ended in March 2015. Partnered TGI-4 projects in Manitoba comprised several highly successful projects in the Flin Flon–Snow Lake and Bird River belts. In May 2015, the federal government announced a continuation of the TGI program (TGI-5; 2015–2020), with project and activity negotiations between the federal and provincial governments to follow in the fall and winter of 2015–2016.

2015 Manitoba Geological Survey Geoscience Program Overview

Precambrian Geoscience Section

In 2015, the MGS renewed bedrock mapping at Knee Lake, which lies in the centre of the largest contiguous greenstone belt in the northwestern Superior province (Anderson et al., GS-1, this volume). Together with recent MGS mapping of Oxford Lake, the new mapping at Knee Lake is building toward a more complete understanding of the stratigraphy, tectonic evolution and economic potential of a large and geologically diverse region that includes some of the most prospective yet underexplored greenstone belts in the Superior province.

Bedrock mapping in the Archean Pikwitonei domain, situated at the northwestern margin of the Superior province, focused on Cauchon Lake in 2015 (Couëslan and Guevara, GS-2, this volume), where variably retrogressed granulite-facies rocks were remapped with emphasis on interpretation of protoliths and better understanding the polyphase tectonothermal evolution of the region. The new mapping at Cauchon Lake reveals the presence of significant volumes of supracrustal rocks, similar to those in adjacent lower grade domains. High-grade metamorphic terranes have traditionally been underexplored, in part due to the challenge of recognizing supracrustal rocks, which tend to hold the greatest economic potential. The fact that several world-class mineral deposits are hosted in granulite-facies rocks, together with evidence that high-grade metamorphism can be responsible for the localized concentration of metals to form economic mineral deposits, warrants a new assessment of the mineral potential of the Pikwitonei domain.

In the Flin Flon–Snow Lake belt, the MGS examined recent and historical drillcore of Paleoproterozoic bedrock from the southern portion of the Reed Lake area and the sub-Phanerozoic area immediately to the south (Gagné, GS-3, this volume). This project builds on current bedrock mapping to update the geology of the Reed Lake area. With the recent discovery of the Reed volcanogenic massive sulphide (VMS) deposit, industry is showing growing interest in gaining more detailed knowledge of the sub-Phanerozoic geology south of Reed Lake, which requires data acquired from drillcore and geophysical surveys. Results to date from this project indicate a greater complexity and diversity than previously identified in arc or arc-rift volcanic rocks hosting VMS deposits in the Reed Lake area (Reed, Spruce Point, Fourmile Island and Dickstone deposits). Moreover, the widespread presence of moderate to intense alteration and sulphide mineralization appears to characterize all volcanic-arc assemblages in the sub-Phanerozoic basement of the Reed Lake area, emphasizing both the prospectivity of this area and the need for more robust exploration methodologies to identify key favourable horizons.

The MGS also renewed bedrock mapping in the Lynn Lake belt to further define its geological and geodynamic evolution, and to identify the controlling factors that produced its wide variety of mineral deposits (Yang and Beaumont-Smith, GS-4, this volume). A new belt-wide compilation map produced by the MGS provides a critical foundation to identify areas for new mapping and sampling. Collaborative field investigations with the MGS, Carlisle Goldfields Ltd. and researchers from the University of New Brunswick target key geoscientific questions and areas most relevant for current mineral exploration in the belt. The focus in 2015 was on detailed mapping in the Keewatin River area, which includes the MacLellan Au-Ag and Lynn Lake Ni-Cu-Co deposits (Figure 2).

As part of an ongoing MGS initiative to systematically characterize granitoid rocks, the most abundant but commonly least-studied rocks in the Precambrian shield, Paleoproterozoic granitoid rocks in the Lynn Lake region were mapped and sampled in 2015 at reconnaissance scale (Yang and Beaumont-Smith, GS-5, this volume). The aim of this work is to identify and catalogue the various types of granitoid rocks and to investigate their petrogenesis, geodynamic settings and mineralization potential. The project is designed around a GIS-based database to capture the field relationships, petrography, litho geochemistry and geochronology of granitoid rocks throughout Manitoba, and their relationships to various types of mineralization. Preliminary results on granitoid intrusions in the Lynn Lake region indicate that peraluminous S-type



Figure 2: MGS geologist Eric Yang on gossanous picrite outcrop at the MacLellan mine.

(muscovite±garnet) granite plutons, with potential for rare-metal and/or Sn-W mineralization, are emplaced predominantly along major tectonic boundaries, whereas I-type (amphibole±biotite) granitoid rocks, with potential for porphyry Cu, Au and Mo mineralization, occur across the region.

Bedrock mapping in the northern part of Southern Indian Lake in 2015 (Martins, GS-6, this volume) builds on previous MGS mapping that was focused on Paleoproterozoic supracrustal rocks in the Southern Indian domain. New geochronological and isotopic analyses of samples collected in 2015 will be used to further delineate the extent of crustal contamination by older (late Archean to early Paleoproterozoic) basement, as was documented in the southern and central parts of Southern Indian Lake. Together with isotopic evidence of buried Archean microcontinental fragments extending beneath part of the Chipewyan/Wathaman batholith, results to date indicate the possibility of a favourable foundation for diamondiferous lithosphere in the region. In addition to diamonds, the region has good potential for VMS deposits similar to those in the Lynn Lake–Leaf Rapids domain. Moreover, fieldwork in 2015 identified a second occurrence of Au mineralization associated with granitic pegmatite intrusions at Southern Indian Lake, suggesting there may be previously unrecognized potential for intrusion-related Au deposits.

In addition to the Precambrian geoscience projects reported in this volume, MGS geologists are involved in a number of collaborative research projects: volcanological, structural and metamorphic reconstructions of the Snow Lake VMS district (Laurentian University and Mount Royal College); stratigraphy and structural geology of the New Britannia mine horizon at Snow Lake (Laurentian University); structural geology and geochronology of intrusion-hosted Au deposits in the Rice Lake belt (University of Waterloo); and metamorphism and tectonothermal evolution of the Flin Flon belt (University of Calgary) and the Pikwitonei granulite domain (Virginia Tech; Figure 3). The MGS is providing in-kind and logistical support for each of these initiatives.

Several geoscience pages of the Manitoba Mineral Resources website are being updated or replaced with new ones, including pages focused on rare metals and industrial minerals. Already available is a new ‘Mineral Commodities in Manitoba’ page with up-to-date commodity brochures on Cu-Zn, Au, Ni and rare metals in Manitoba (<http://www.gov.mb.ca/iem/geo/commodity/index.html>).

Sedimentary Geoscience Section

Phanerozoic stratigraphy and resources

Results from the collaborative, multiyear, GEM-2 Hudson-Ungava Project provide the foundation for



Figure 3: MGS geologist Chris Couëslan and Virginia Tech postdoctoral research fellow Besim Dragovic taking a saw-cut sample at Armstrong Lake.

hydrocarbon exploration and land-use planning of the Hudson Bay Lowland region between Churchill and Ontario. In 2015, the MGS contributed to the program by mapping lineaments in the area covered by Paleozoic rocks in the Hudson Bay Lowland using remote-sensing methods (Nicolas and Clayton, GS-7, this volume). The objective of the project is to demarcate preglacial linear features, such as fractures, faults or arches, in the Precambrian and/or Phanerozoic bedrock. Identification of regional-scale bedrock structures contributes to understanding the paleostresses that may have affected fluid and hydrocarbon migration during basin evolution.

In southwestern Manitoba, the MGS, in partnership with the Manitoba Potash Corporation, conducted research on potash deposits in the Devonian Prairie Evaporite (Nicolas, GS-8, this volume). Stratigraphic studies and resource estimates indicate that the potash deposits in Manitoba are less extensive than most deposits in Saskatchewan but may be of sufficient size and grade to be economically extracted using conventional underground-mining methods.

Gypsum has been mined and quarried in Manitoba since the beginning of the 19th century and remains an important industrial mineral. The most recent MGS report on gypsum in Manitoba was published more than 50 years ago. Lapenskie and Bamburak (GS-9, this volume) initiated a project to review past gypsum production and provide a comprehensive, modern update on the geology of Manitoba gypsum. In 2015, the focus has been on the composition, stratigraphy and thickness of gypsum in the Upper Amaranth Member of the Amaranth Formation in the Harcus area west of Lake Manitoba, the only locality in Manitoba where gypsum is actively quarried today.

In addition to the activities reported in this volume, MGS geologists in the Sedimentary Geoscience Section are actively involved in several other projects: geochronology of bentonite beds in the Manitoba escarpment to assist

in constraining stratigraphic correlations; collaborations with the University of Manitoba on the stratigraphy of the Favel Formation in the Riding Mountain area and stratigraphy and petroleum potential the Devonian Duperow Formation in southwestern Manitoba; geochemistry and gas potential of the Upper Cretaceous strata in southwestern Manitoba (University of Calgary); and onshore correlation of the Ordovician carbonate sequences in the Manitoba and Ontario portions of the Hudson Bay Basin (Laurentian University).

Samples continue to be collected under the multiyear Shallow Unconventional Shale Gas Project from new sites along the Manitoba escarpment and from drillcore of the Cretaceous section in the Russell area. Excellent recovery of drillcore through this section is unique in Manitoba, and samples from the core will be used in geochemical profiling of the Cretaceous sequence in Manitoba. During this year's fieldwork, the MGS discovered an exquisitely preserved *Cimolichthys* fish fossil from the Late Cretaceous Favel Formation (Figure 4), which is on temporary display at the Canadian Fossil Discovery Centre in Morden.

The MGS is participating with the GSC and the Canada-Israel Research and Development Foundation of the Government of Canada in a study of in situ extraction of hydrocarbons from oil shale, by providing outcrop samples of Cretaceous oil shale from different parts of the Manitoba escarpment, with all geochemistry results being shared with the MGS.

The MGS has continued to provide year-round technical expertise to energy clients by responding to inquiries made directly to the geologist and through contact at meetings and geoscientific conferences in relation to the exploration and development of oil and gas in Manitoba. The MGS has participated regularly



Figure 4: *Cimolichthys* fish fossil in shale from the Keld Member, Favel Formation, discovered by MGS Chief Geologist Michelle Nicolas at Wilson River, southwest of Dauphin.

in regional technical groups to discuss current energy-related issues (e.g., shale gas, hydraulic fracturing) and has helped develop strategies to better educate the public on the energy industry and its practices.

Quaternary geology

The MGS Quaternary geoscience program is designed to provide the surficial geology framework to inform mineral exploration, resource development of glacial deposits (e.g., aggregate) and land-use management in the province. Successful mineral exploration and prospecting in Manitoba's drift-covered northern regions require a thorough understanding of surficial geology. Geochemical and indicator-mineral analysis of till, combined with analysis of the orientation, timing and nature of ice-flow phases, can provide tools to more accurately locate exploration targets. In addition, Quaternary geological information continues to play an important role in infrastructure development, through mapping of sand-and-gravel aggregate deposits.

In 2015, the MGS undertook surficial-geology mapping, stratigraphic logging of Quaternary sections and till sampling for geochemical, lithological and indicator-mineral analyses in the Arden area of southwestern Manitoba, where no detailed surficial-geology information is available (Hodder and Trommelen, GS-10, this volume). In addition to supporting drift prospecting, the new surficial-geology map and analytical results will aid infrastructure and agricultural planning, highlight prospective aggregate resources and contribute to the hydrogeology framework—all critical parameters for future resource development in the area.

Taking advantage of logistical synergies with an ongoing MGS bedrock-mapping project, surficial-geology studies in the northern part of Southern Indian Lake focused on mapping of paleo-ice-flow indicators, logging of Quaternary sections and collection of till samples (Hodder, GS-11, this volume). As the Southern Indian Lake area has a complex ice-flow history, with influence from both the Keewatin and Labrador sectors of the Laurentide Ice Sheet, the new paleo-ice-flow indicator data are critical for effective drift prospecting in this region. Combined with till-geochemical results used to determine source areas of anomalous till compositions, the data on glacial-transport direction provide a necessary drift-exploration framework.

A multiyear program of Quaternary geological mapping in the Gillam area, initiated in 2013, continued in 2015 in collaboration with the University of Waterloo (Kelley et al., GS-12, this volume). The team conducted Quaternary geology studies in the Stephens Lake area and along the Nelson River, downstream from Gillam, to further detail the type and distribution of surficial materials in the region, with special emphasis on aggregate-resource assessment in support of local hydro and infrastructure

projects. Of particular interest for drift prospecting and from a glacial-history point of view is the collection of till property, stratigraphy and clast-fabric data from ten new stratigraphic sections along the Nelson River (Figure 5).



Figure 5: New MGS Quaternary geologist Tyler Hodder working on a stratigraphic section at Angling River near its mouth with the Nelson River.

Regionally, the Quaternary stratigraphy and ice-flow history along the Hayes, Pennycutaway, Nelson and Gods rivers is being compiled and reinterpreted from previously unpublished, archived MGS field notes to assemble the glacial history in the Hudson Bay Lowland in Manitoba.

Three-dimensional mapping

The MGS has made steady progress toward a 3-D geological model of the Phanerozoic succession in southern Manitoba. To this end, province-wide cross-sections at 5 km spacing from the American border to 55°N have been produced and are available for download on the GIS Map Gallery. Recently, a redesigned 3-D mapping webpage highlighting Manitoba's models, inputs, construction and output derivative products, such as the new bedrock surface, was added to the Mineral Resources website (<http://www.gov.mb.ca/iem/geo/3dmodel/index.html>).

Manitoba's 3-D geological model, cross-sections and derived products use standardized nomenclature for Phanerozoic geology in the province, making for easy use and cross-referencing. The model and its products continue to contribute to a variety of geoscience knowledge bases relevant to Phanerozoic stratigraphy, hydrocarbon, groundwater and industrial-mineral resource development, and geological education.

Geoscience Information Services

The Geoscience Information Services section of the MGS is responsible for maintenance and expansion

of the geological content of the Internet-based GIS Map Gallery and its associated databases and information layers. Furthermore, the section supplies the organization with cartographic, GIS, CAD and database-management services, and provides the government with digital data for the Spatial Data Initiative (SDI), a single province-wide portal to access all digital data produced by Manitoba agencies.

Section staff continued compilation of the sub-Phanerozoic Precambrian geology south of the Flin Flon–Snow Lake belt, in an area that extends south from the exposed Precambrian shield to latitude 54°N and east from approximately longitude 101°W to the extension of the Thompson nickel belt (approximately 7000 km²). As a basis for subsurface modelling, an integrated database was generated that contains all nonconfidential data from assessment files, including whole-rock geochemical data acquired by industry and the MGS from exploration drillholes. Nonconfidential, high-resolution geophysical surveys from industry and the GSC provide the base for a new subsurface-geology compilation map in preparation.

Expansion and maintenance of the GIS Map Gallery have continued and include major redesign plans to move the portal to a more versatile and user-friendly format.

Digital compilation of bedrock geology in the Lynn Lake area is proceeding, with the geology from eight NTS sheets mapped between 1976 and 1982 compiled at 1:50 000 scale, edge-matched and converted digitally to a common legend. The compilation includes geophysical grids, digital elevation models, mineral occurrences and geochronological data. Outputs for this project will include an updated set of 1:50 000 bedrock-geology maps and a multitheme map presentation in the GIS Map Gallery.

A new *Geological Highway Map of Manitoba*, based on revised 1:250 000 and 1:1 000 000 scale geological compilations, is an MGS priority project that remains in progress. The base compilation maps are currently being refined in conjunction with extensive work on the structuring of a new common legend. In addition, a system to collect and manage media files for the multimedia content of the new map is being populated.

The Roadside Geology of Manitoba project, a collection of virtual 'GeoTour' videos on YouTube™, continued in 2015 with the addition of 15 site videos. The main objective of the videos is to provide a descriptive legacy of unique geological and geomorphological localities (geolocalities) that are generally road accessible (Bamburak and Pacey, GS-13, this volume).

Community liaison

The MGS community-liaison program is designed to provide geoscience and mineral-resource information, primarily to First Nation communities. The program aims to encourage a respectful, balanced, communicative

approach that bridges the perspectives of Manitoba's First Nations, government and the mineral-resource sector. The program consists of classroom and field components during which MGS geologists demonstrate and explain basic geological-mapping techniques, including mineral and rock identification, note taking and sampling methods. First Nation communities also have an opportunity to work within the liaison program by being directly involved in the inception, development and completion of a community mapping project in their traditional land-use area. The program focused in 2015 on developing transformative methodologies to promote collaboration with Manitoba's First Nation communities.

Client Services and Outreach

Publications

A complete list of MGS publications, including reports, maps and data released since the *Report of Activities 2014* is contained in the back of this volume.

The MGS continues to release the majority of its publications in hard copy (print and/or CD-ROM or DVD) for purchase through Publication Sales. All MGS publications are available in electronic format for free download from the Manitoba Mineral Resources website.

Outreach

Investing in the future of all Manitobans, the MGS *Manitoba Rocks!* outreach and mineral education/awareness program aims to inspire new generations to think 'geosciences' and to consider the wealth of learning opportunities as well as the tremendous untapped resource potential of Manitoba's vital minerals sector. The MGS 2015 community-based outreach program took geoscience to a new level and reached more young Manitobans, educators and the public with the exciting development of a new DIG IT! mineral-card collection, featuring more than 40 minerals and rocks found in Manitoba. DIG IT! is being actively distributed to science teachers, schools, museums and beyond.

In 2015, *Manitoba Rocks!*, in co-operation with the Canadian Geoscience Educators Network and Mining Matters (Prospectors and Developers Association of Canada; PDAC), has been developing a pilot 'Geoscience Literacy and Learning Challenge' aimed at engaging all levels of Girl Guides program attendees, from Sparks, Brownies and Pathfinders to Rangers and adults. The program will incorporate Manitoba geology and history and the supporting Earth science concepts of EarthScienceLiteracy.org; *Manitoba Rocks!* is targeting a spring 2016 launch with Girl Guides Canada–Manitoba Chapter.

The *Manitoba Rocks!* website has received a steady stream of visitors and traffic since its launch in October 2013, leading to numerous (and continuing) requests

from schools around the province for mineral-education information and presentations. The program connects in the classroom and through an information display at northern-community school events, reaching more than 2000 elementary and high-school students at Frontier School Division's 'Norway House Career Day' and the University College of the North's 'Thompson/The Pas Try-a-Trade & Career Expo'. The program has also engaged with new community organizations, such as the Northern Association of Community Councils, at their general meeting and trade show.

Teachers' information kits have been distributed to the Science Teachers Association of Manitoba professional development workshops since 2013, as well as to the Northern Manitoba Mining Academy's teacher tours. Geo-backpacks for kids were also provided for mineral-related activities in 2015 at the Snow Lake Mining Museum, the Canadian Fossil Discovery Centre in Morden, Stonewall Quarry Park and Oak Hammock Marsh's annual Archaeology, Rocks & Minerals weekend in September.

The *Manitoba Rocks!* school program is back by popular demand at the 2015 Manitoba Mining and Minerals Convention, in partnership with the Mineral Society of Manitoba, Mining Matters (PDAC) and the Canadian Fossil Discovery Centre, to engage more than 250 students in Grades 4 to 7 in hands-on and fun learning about our province's valuable mineral resources.

Midland Sample and Core Library

The Midland Sample and Core Library, administered by the MGS, provides a wide range of services to Manitoba Mineral Resources staff, the petroleum and mining industries, other branches of government and academia. For the MGS, the Midland facilities directly support geoscience projects through sample preparation, processing, storage and archiving. Core storage and viewing have become invaluable services for industry; the core-viewing area at Midland continues to be booked almost year round, with most users being from the petroleum industry. The staff at Midland are continually reorganizing and optimizing the storage and viewing areas, as well as identifying lower priority materials for storage at offsite facilities. Outside of Winnipeg, MGS drillcore-storage facilities are located in The Pas, Flin Flon, Thompson and Lynn Lake.

Acknowledgments

Four long-term staff have retired from the MGS since November 2014: Lori Janower (Librarian, Mineral Resources Library) in January after 18 years of government service; Tom Heine (Regional Geologist, Flin Flon) in April after 23 years of service; Paul Gilbert (Precambrian Geologist) in May after a record 42 years of service; and Glenn Conley (Database Geologist) in

August after 28 years of service with the MGS. Their contributions, expert technical knowledge, genuine helpfulness and camaraderie have been most appreciated and will be missed.

The careful work of all MGS staff (Figure 6), including geologists, cartographers, lab technicians, expeditors, Client Services staff and administration,

went into the production of the *Report of Activities 2015*. B. Davie and his team from RnD Technical provided top-notch professional technical-editing services, while L. Chackowsky and B. Lenton oversaw drafting of all illustrations and C. Steffano managed report production and publication layout.



Figure 6: Manitoba Geological Survey staff, October 2015. From left to right: Maureen McFarlane, Christian Böhm, Garry Courchene, Colin Epp (back row), Sharon Lee (front row), Marc Rinne, Eric Anderson, Diana Savage, Vio Varga, Shirley Holgate, Jim Bamburak, Susan Michaels, Tania Martins (front row), Candace Regan (back row), Greg Keller, Bonnie Lenton, Mark Pacey, Len Chackowsky, Craig Steffano, Neill Brandson, Eric Yang, Michelle Nicolas, Scott Anderson, Kathryn Lapenskie, Tyler Hodder, Simon Gagné, Paul Lenton, Chris Couëslan, and Peter Leskiw. Not included in photo are: Gerry Bengier, Donna Dault, Michelle Gauthier, Kelly Heglin, Paige Klowak, Mitch Lenton, Ashley McKenzie, Linda Murphy, Linda Rogoski and Mark Timcoe.