

INTRODUCTORY SUMMARY

by C.A. Kaszycki

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In 1998, geological programming in Manitoba, along with other government initiatives, continued to focus on stimulating socio-economic development by fostering a positive business climate for investment in mining and exploration within the province. The Department of Energy and Mines' mining investment strategy summarizes a series of objectives designed to help the Department fulfill its vision of making Manitoba the best place in Canada to invest in the minerals industry. This year, specific outcomes include: the introduction of more favourable taxation policies; renewal of the Mineral Exploration Assistance Program (MEAP) for an additional three years; continuation of the Prospector's Assistance Program; implementation of a new Specialty Minerals Incentive Program, to help foster development in the industrial minerals sector; progress toward the development of a partnership protocol between aboriginal groups and the minerals industry; and active participation and industry consultation in the review of candidate sites for the Endangered Spaces Program.

Key to the Departmental investment strategy is the provision of current and relevant geoscience information that supports the minerals industry and contributes toward sustainable development and wise land management. To meet this objective, increased funding levels for the Geological Services Branch (GSB) were sustained in 1998 at \$3.78 million.

GEOSCIENCE PROGRAM

The 1998 geoscience program reflects a balance among providing support to the traditional mining camps, stimulating new exploration and development opportunities in the frontier areas and supporting land use and development priorities in southern Manitoba. The program is reviewed annually by the Mineral Exploration Liaison Committee (MELC) composed of members of the Mining Association of Manitoba, the Manitoba Prospectors and Developers Association and the Manitoba-Saskatchewan Prospectors and Developers Association, as well as representation from the University of Manitoba Geology Department and the Geological Survey of Canada. The committee meets at least once annually, to review progress toward meeting key long term program objectives and to discuss new program directions and collaborative opportunities.

Collaborative initiatives continue to be a key element in the delivery of Manitoba's geoscience program. These projects draw on the collective expertise and resources of various government, university and industry organizations. They provide opportunities for technology transfer and intellectual cross-fertilization, and augment the geoscience database for the province. The major collaborative initiatives currently underway are summarized below.

GSB's geoscience program is designed with a regional emphasis, focusing on those areas most in need of new and/or updated geological information. Programs are generally designed on a five year cycle. This allows for a rotation in areas of specific focus, while maintaining continuous improvement of geological information within a 20 to 30 year timeframe, that generally reflects advances in technological development and scientific thought.

Major activities carried out under the "field program" are:

- development of compilation maps and regional syntheses (1:50 000 scale or smaller), to provide up-to-date regional geological syntheses, for both the major mining districts of Manitoba and the frontier areas of the province; and to provide geological background information and mineral resource assessments in support of land use planning and sustainable development, including the network of Protected Areas.
- thematic studies (1:20 000 scale or greater), to address specific geological and land use problems; to support mineral deposit studies and compilation series mapping; and to identify new methods of assessing and defining mineral potential for a variety of traditional and non-traditional mineral deposit types.

- specialized geochemical and geophysical projects, to provide regional compilations of geochemical and geophysical data to assist industry in the identification of exploration targets or prospective areas.
- maintenance of a mineral deposits inventory, to provide a systematic inventory of metallic mineral, industrial mineral and aggregate deposits.

FLIN FLON/SNOW LAKE

Current and planned projects in the Flin Flon Belt are aimed at building on the new concepts and interpretations resulting from the NATMAP Shield Margin Project. The final NATMAP 1:100 000 scale compilation maps were released in hardcopy on November 1, 1998. The fully integrated digital maps and data sets will be released on CD-ROM in early 1999.

A major long term objective for the Flin Flon Belt is the completion of a set of new 1:50 000 scale compilation maps that will display more detailed information than the current NATMAP 1:100 000 compilation. To support this new compilation, a variety of more detailed thematic projects are currently underway. These include:

- new 1:20 000 scale mapping in the most productive portions of the Flin Flon Belt. The importance of arc extension and rifting in localizing VMS deposits has been documented in the Flin Flon and Snow Lake areas and similar environments have been identified in the Aimée-Naosap lakes area through a combination of stratigraphic mapping and geochemistry. New 1:20 000 scale mapping in the Snow Lake and Squall Lake areas has provided the stratigraphic and structural framework for assessing the geological setting of gold mineralization in this area.
- a variety of more detailed studies focused on known areas of mineralization to identify new methods of assessing mineral potential. These include: 1) rhyolite geochemistry, to define the origin and geochemistry of barren and ore-related rhyolites associated with VMS deposits; 2) detailed mapping (1:10 000 to <1:5 000) at Snow Lake and Flin Flon that focuses on bringing new concepts in stratigraphy, structure and geochemistry to define the genesis of specific mineral deposits.

Partnership Programs

| Region | Program | Participants |
|--------------------------------------|--------------|------------------------------|
| Flin Flon/Snow Lake | NATMAP | GSC, SEM, Univs. |
| Thompson Nickel Belt | CAMIRO | Industry, GSC, Univs., NSERC |
| N. Superior Province and SE Manitoba | NATMAP | GSC, OGS, Univs. |
| Southern and Central MB | NATMAP | GSC, Univs. |
| | Hydrogeology | GSC, MWRB, U of M |
| | Lk Winnipeg | GSC, AGC, MB Hydro |
| | Red River | GSC, IJC Climate Change |

GSC - Geological Survey of Canada;
SEM - Saskatchewan Energy and Mines;
NSERC - National Science and Engineering Research Council;
OGS - Ontario Geological Survey;
MWRB - Manitoba Water Resources Branch;
U of M - University of Manitoba;
AGC - Atlantic Geoscience Centre;
IJC - International Joint Commission on Boundary Waters

- initiation of a new archival sample collection of all current and past producing mineral deposits in the Flin Flon Belt. Work commenced this summer on the collection of an archival sample suite from the Photo Lake Mine. Polished slabs, thin sections, and descriptive data have been produced and will be maintained at the core viewing facility at the former Centennial mines site near Bakers Narrows.

LYNN LAKE/LEAF RAPIDS

Long term objectives for the Lynn Lake/Leaf Rapids region focus on upgrading existing databases and maps to modern standards. To this end, all of the Lynn Lake Project 1:50 000 maps and adjoining Barrington Lake maps are in the process of being digitized and rendered in colour. These maps will form the base for new regional geochemical, geochronological and thematic mapping projects. The maps will be updated and interrogated in light of new data, with the possibility of some follow-up mapping to solve specific problems.

This winter, existing sample sets collected during regional 1:50 000 mapping will be reanalyzed to provide precise trace and rare earth element analyses of metavolcanic rocks from Laurie Lake, Lynn Lake and Barrington Lake. This will allow subdivision of the greenstone belt according to tectonic affinity and will help to focus exploration for VMS deposits into more productive (juvenile arc) assemblages.

This summer, preliminary geological investigations focused on the importance of structure on the distribution of Au within the Farley Lake and Burnt Timber deposits. New field observations in a recently burned area suggest that the Johnson Shear Zone extends further to the west than was previously recognized. Detailed structural investigations have been proposed for several well exposed parts of the shear zone, and will be of critical importance in future exploration for Au within the region.

THOMPSON NICKEL BELT

The geology, metallogeny and tectonic evolution of the Thompson Nickel Belt (TNB) is the subject of a four year investigation being administered by the Canadian Mining Industry Research Organization (CAMIRO). The TNB project began in 1997 and will extend until 2001. The study will integrate existing mining company data and government records with a wide range of new data sets, using ArcInfo GIS software as a platform for analyzing the database.

In concert with the CAMIRO project, work continued on a new 1:50 000 scale compilation map series for the TNB. During the winter months of 1997/98, a manuscript lithologic map for the northernmost part of the exposed TNB was completed, as part of an Memorandum of Understanding (MOU) between INCO and GSB. This summer, field work and drill core examination commenced in the southwestern portion of the belt, between Gormley Lake and Halfway Lake, in cooperation with Falconbridge Ltd. The map manuscript for this area will be compiled during the winter and spring of 1998/99. A petrographic study of the Ospwagan Group carried out in conjunction with this project, has been expanded to include surrounding Churchill and Superior lithologies, in order to compare the Ospwagan Group metasedimentary rocks with reworked Archean gneisses and Paleoproterozoic metasedimentary gneisses.

Specific projects carried out in support of the CAMIRO initiative include:

- regional mapping at 1:50 000 and 1:20 000 scales, including: 1) 1:20 000 scale mapping in the Setting Lake area, to define lithological, structural and regional tectonic relationships along the western boundary of the TNB; and 2) 1:50 000 scale structural mapping and geochronological investigations in the Natawahunan Lake area, to resolve the tectonic and metamorphic history of the region as it relates to the tectonic evolution of the Churchill-Superior Boundary Zone.
- thematic studies focused on the petrogenetic and metallogenic significance of mafic-ultramafic dykes and volcanic sequences in the TNB, including: 1) detailed stratigraphic studies of the mafic and ultramafic flows on Ospwagan Lake, to place constraints on the temporal and genetic evolution of "Ospwagan Group volcanic sequences" as related to Ni sulphide mineralization in the TNB; and 2) detailed study of mafic intrusions to characterize the relative timing and age of mafic intrusions in the Thompson area.

SOUTHEAST MANITOBA

Activity in southeastern Manitoba is focused on compilation, digitization and upgrading of existing mapping as contributions to the Western Superior LITHOPROBE and the Western Superior NATMAP initiatives. These compilations will cross the provincial border and present a unified geological interpretation for the region. As part of this exercise, a suite of samples of volcanic and intrusive rocks from the Bidou Lake Subgroup of the Rice Lake Belt were collected this summer. Trace and rare earth element analyses of these rocks will permit geochemical characterization of the volcanic sequences. Geological reconnaissance carried out as part of the sampling program identified some important elements of the geological history of the belt that remain to be resolved, although the overall quality of previous mapping in the Rice Lake Belt is excellent. Regional mapping in the Wallace Lake area (1:20 000 scale) is currently being supported by Western Superior NATMAP and LITHOPROBE and forms part of an M. Sc. thesis carried out at McGill University.

Thematic subprojects will contribute new detailed mapping, geochronology and geochemistry. Specifically, preliminary investigations regarding the PGE-copper-nickel potential of mafic-ultramafic intrusions in the Bird River Greenstone Belt suggest that reef-type platinum group element (PGE) mineralization was locally developed. In comparison with other reef-type PGE occurrences, mineralization observed at the Chrome property displays only moderate levels of PGE enrichment; however the large amount of PGE-enriched sulphides is notable and warrants additional investigation.

NORTHERN SUPERIOR PROVINCE

Manitoba's Northern Superior Initiative is now in the 3rd year of a 5 year program. The overall objectives of this initiative are two-fold: 1) to identify regional exploration targets through new regional geochemical surveys and compilations of geophysical data derived from assessment files; and 2) to provide the geological framework for mineral exploration through regional mapping and thematic studies.

The regional multimedia geochemical sampling program continued this year in the Knife Lake, Webber Lake, Goose Lake and Aswapiswanan Lake areas. Geochemical and mineralogical analysis of these samples will continue to build a multielement, multimedia geochemical database to assist in the identification of potential exploration targets. Results of the 1997 field program were released in September, 1998. Release of the 1996 results in May 1997 has already resulted in the announcement of a discovery of significant mineralization in the Carrot River area, by Levelland Energy and Resources.

Compilation of geophysical data for the Superior Province continued this year. The second and final report of this series is scheduled for release in early 1999.

Regional (1:20 000 scale) bedrock mapping projects continued in the Knee Lake, Island Lake and Edmund Lake/Little Stull Lake areas, to better constrain the geological setting of base and precious metal mineralization. Results of 1998 mapping in the Knee Lake area include:

- construction of a regional stratigraphy for the Hayes River Group (HRG) metavolcanic rocks and identification of a previously unrecognized unconformity between the HRG and younger metasedimentary rocks on central Knee Lake;
- definition of two generations of folds and multiple generations of faults on central and northern Knee Lake;
- detailed structural interpretation of the southern Knee Lake shear zone.

In the Island Lake area, this summer's field program has resulted in a better understanding of the stratigraphy and structure of the belt, including elucidation of the geometry and kinematics of 3 major shear zones. Two gold mineralization events were recognized, both related to shear zones.

Results of new mapping and geochronological and geochemical investigations in the Edmund Lake/Little Stull Lake area include:

- description of a broad south-southeast trending alteration zone that cuts HRG basalts and gabbros southwest of the Au occurrences on Little Stull Lake;
- structural analysis of the "Wolf Bay" shear zone; and
- geochronological and geochemical interpretation of supracrustal and flanking intrusive rocks in the Edmund Lake area.

Thematic studies in the northern Superior Province include: 1) detailed stratigraphic mapping of the Pipestone Lake anorthosite complex (PLAC) to provide constraints on petrogenesis and associated Ti-V-Fe oxide mineralization; and 2) geochemical and chronological investigations of Proterozoic dykes from the eastern portion of the Carrot River Greenstone Belt, to elucidate the timing of emplacement with respect to the two distinct magmatic episodes associated with the "Molson dyke swarm".

SOUTHERN AND CENTRAL MANITOBA

The branch continues to promote exploration and development opportunities for non-traditional mineral deposits, such as the potential for carbonate-hosted mineralization associated with reactivation of the Superior Boundary Zone. To this end, a compilation of anomalous structures within the Phanerozoic sequence and associated basement structures is currently underway and will be published in early 1999. A geochemical database summarizing geochemical characteristics and anomalous trace element concentrations in Mesozoic black shales was released in September, 1998.

The Manitoba Stratigraphic Map Series has been updated with the completion of 6 new stratigraphic maps for the Lower Paleozoic section, including one for Precambrian basement. Twenty-four historic stratigraphic maps have been digitized and will also be re-released. These maps will be packaged on CD-ROM and released in digital format along with the Manitoba Stratigraphic Database, which contains non-confidential subsurface well data for the province.

The branch is also involved in activities in the southern part of the province that are focused primarily on land use issues in support of sustainable development. This summer, assessment of aggregate resources was focused on "Wildlife Management Areas" that are under consideration for protection to "Endangered Spaces Standards", which will prohibit aggregate extraction. In addition, an open file report summarizing mineral resource potential in Phanerozoic rocks in the northern part of the Greater Winnipeg area (Capital Region Study) will be released in early 1999. This report and a similar report for the southern part of the region to be completed next year, will form the basis for assessing mineral potential as part of municipal planning for the Greater Winnipeg Region.

GSB is also involved in several large collaborative initiatives in the southern part of the province. The Winnipeg region NATMAP project, now in its second year of a 4 year program, is focused on 3-D mapping emphasizing engineering and environmental geology and surficial mapping.

A multiagency study of regional hydrogeology and hydrogeochemistry of the Red River Valley/Interlake region is now in its second year. This program is aimed at providing an enhanced understanding of the dynamics of groundwater systems in the Red River Valley, to protect existing resources, to provide a framework for evaluating sustainability of groundwater resources in areas of proposed economic development, and to co-ordinate management of these valuable resources across the international boundary.

The branch is also participating in a multiagency initiative to study the history, evolution, geomorphology and stratigraphy of the Red River, in an effort to define the historical frequency of large magnitude flood events. A better understanding of the relative impact of long term climatic and geologic controls on flooding will help to identify the risk of recurrence of extremely large flood events.

GEOSCIENCE INFORMATION SERVICES

Manitoba Energy and Mines is shifting the focus of map and report production to encompass new technologies. Reports will include, where possible, comprehensive databases and digital maps as a CD-ROM supplement. The September, 1998 release of the 1997 Operation Superior Multimedia Geochemical Survey was the first of this style of publication. Data is included in a variety of formats, and packaging includes "freeware" viewer software as required.

The focus of the 1:250 000 scale bedrock compilation map series will temporarily shift from the production of new maps to the conversion of existing hardcopy maps into a seamless digital compilation. This seamless database will then be used for the planned revision of the 1:1 000 000 provincial compilation targeted for the year 2000.

The Department is also actively participating in the Canadian Geoscience Knowledge Network Initiative, championed by the Geological Survey of Canada. The first phase of this initiative is the development of a Canadian Geoscience Publications Directory, an Internet-based georeferenced bibliography that will provide graphical access to metadata describing all Canadian geoscience publications in mapped format. Energy and Mines has completed compilation and georeferencing of all maps and report available from the Department, and access to this data through the NRCan's web site is anticipated in the near future.

Manitoba Energy and Mines has also recently acquired the ArcView Internet Map Server. This software package will allow clients to access and query mapped information via the Internet. When online, it will provide access to claims and assessment file information, geological maps, mineral occurrence data and our georeferenced publications directory.

Finally, I would like to acknowledge the excellent work carried out by all staff of the Geological Services Branch. Their dedication and enthusiasm in support of geoscience initiatives within the province are key to making Manitoba the best place in Canada to invest in mining and exploration. Congratulations on a job well done.

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