



Provincial Geologists Journal

**Journal des
géologues
provinciaux**

2003 – VOLUME 21

Published annually by the Committee of Provincial Geologists
Publication annuelle du Comité des géologues provinciaux

Editor - Brian Grant

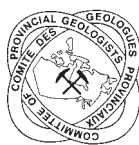


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Committee of Provincial Geologists Chairperson's Report 2003

The Committee of Provincial Geologists (CPG) comprises representatives of the 12 (9 provinces and 3 territorial) government geological survey organizations across Canada. The Committee was established in 1976 as a forum that would encourage and promote actions by governments in support of mineral exploration and development, and provide liaison with the Geological Survey of Canada (GSC), universities, industry to resolve issues and initiate cooperative programs, and act on behalf of Mines Ministers.

The CPG maintains a close relationship with the GSC through meetings of the National Geological Surveys Committee (NGSC), which comprises the members of CPG and senior representatives of the GSC. The meetings of both committees ensure that government geoscience activities across Canada are carried out in a collaborative and coordinated manner, thereby maximizing their utility for all users of geoscience information.

2003 Meetings

CPG and NGSC met twice 2003, in conjunction with the March annual meeting of the Prospectors and Developers Association of Canada and with the annual conference of Energy and Mines Ministers, held in September. Key issues discussed at these meetings are highlighted in the following paragraphs.

TARGETED GEOSCIENCE INITIATIVE, PHASE 2

The federal government announced in its 2003 budget that the Targeted Geoscience Initiative (TGI), which had operated from 2000 to 2003 with \$15 million in new funding, would be extended for 2 years, with an additional \$10 million in funding. Phase 2 of TGI is focused on geoscience activities to stimulate energy exploration. By mid-year, 17 projects had been approved and started: all are collabo-



Committee of Provincial Geologists during field trip in the fall of 2003.



Photo taken during the NGSC taken on our field trip in the fall of 2003.

rations of the GSC with provincial and territorial geological surveys and/or industry. Every province and territory has at least one project in TGI 2.

GSC ISSUES-DRIVEN PROGRAM

The change within the GSC, begun in 2002, from a program based largely on geoscience disciplines to one based on issues and priorities of the federal government continues to present challenges and opportunities to cooperation between the provinces and territories and the GSC. An important challenge to CPG and NGSC is to find commonalities among the different political and fiscal regimes in which member agencies operate that will permit each survey to participate in collaborative initiatives while still meeting its own priorities. Recent initiative by NGSC, such as the development and renewal of the Intergovernmental Geoscience Accord and the development of the Cooperative Geological Mapping Strategies, indicate that these challenges will be met. Many of the opportunities for collaboration in the near future are being identified through current joint initiatives. Most important of those in 2003 are the Cooperative Geological Mapping Strategies and the Canadian Geoscience Knowledge Network.

COOPERATIVE GEOLOGICAL MAPPING STRATEGIES

Mines Ministers agreed to a proposed Cooperative Geological Mapping Strategies Across Canada (CGMS) at their 2000 conference. The document calls for increased funding by governments for geoscience mapping. The ability of governments to meet this requirement has, to date, been mixed. The federal government provided new funding for the first phase of the Targeted Geoscience Initiative, which operated from 2000 to 2003, and renewed that funding for a 2-year second phase of TGI. Several provinces and territories have also received additional funding for geoscience activities.

During 2003, the GSC accelerated its planning for the federal component of the CGMS, as part of its issues-driven Consolidating Canada's Geoscience Knowledge program. This initiative by the GSC included definition of federal priorities for geoscience mapping and extensive communication with the provincial and territorial surveys to look for areas of overlapping priorities that could be met through projects done in collaboration. Considerable progress was made during the year toward definition of an operational framework for a national CGMS. Regional workshops across Canada, involving federal, provincial and territorial agencies responsible for geoscience related to minerals, energy and public

good, are planned for 2004 to continue this work.

CANADIAN GEOSCIENCE KNOWLEDGE NETWORK

The Canadian Geoscience Knowledge Network (CGKN) is an initiative of the NGSC to make the information holdings of Canada's government geoscience surveys discoverable through a single portal on the Internet. Work is continuing to integrate key jurisdictional holdings into distributed, national, seamless databases. A primary objective of the initiative is to develop and implement a national, Internet-based, data catalogue with comprehensive search capabilities.

A highlight of CGKN activities in 2003 was a national workshop, held in Toronto in conjunction with the March meetings of CPG and NGSC. The workshop comprised sessions to resolve technical issues and to discuss policy issues related to the CGKN. The latter sessions brought managerial and technical personnel together to develop a common understanding of the goals and limitations of the CGKN initiative. The workshop was very productive in resolving technical issues, and will be repeated in 2004.

OTHER ACTIVITIES

Provincial Geologists Medal

The Provincial Geologists Medal for 2003 was awarded to Dr. Peter Barnett of the Ontario Geological Survey at the Energy and Mines Ministers' Con-

ference in Halifax. The medal citation is provided elsewhere in this volume.

Liaison Activities

Gary Delaney of Saskatchewan Energy and Mines represented the Committee on the federal Minister's National Advisory Board on the Earth Sciences. Mike Cherry and Ric Syme represented provincial and territorial interests on steering committees for the GSC's issues-driven Consolidating Canada's Geoscience Knowledge and Northern Resource Development programs, respectively. The Committee benefitted from the participation in its meetings by Dr. Bill Shilts, Chief, Illinois State Geological Survey. Dr. Shilts provided liaison between the Committee of Provincial Geologists and the Association of American State Geologists.

Provincial Geologists Journal

The Committee of Provincial Geologists gratefully acknowledges the dedication of Brian Grant and Dave Lefebure of the British Columbia Geological Survey to the production of this and preceding volumes of the Provincial Geologists Journal.

Mike E Cherry
Chairperson
Committee of Provincial Geologists

2003 Provincial Geologists' Medal

CITATION

PETER JAMES BARNETT

Ontario Geological Survey Ontario Ministry of Northern Development and Mines

Peter Barnett stands as an outstanding example of a Survey geologist; an acknowledged expert in his field, a geological mapper of international repute and a researcher who has advanced scientific boundaries to the benefit of both his profession and society. For over twenty-five years Peter has honed his craft as a Quaternary field geologist with the Ontario Geological Survey. His works add significantly to the knowledge base in fields as diverse as environmental and economic geology, remote sensing and archeology.

Peter's national and international recognition as a pre-eminent expert on the Quaternary geology is solidly founded upon years of fieldwork in a variety of environments and terrains. His exceptional skills of observation and interpretation allow him an unparalleled ability to generate multi-faceted geologic models that permit an understanding of complex settings. The applied aspects of his work are far-ranging and numerous. His recognition of tunnel valleys in south-central Ontario has significantly refined exploration strategies for municipal groundwater supplies and defined sources of mineral aggregate. Beyond this, his work on surficial stratigraphy and material properties has played a major role in land management issues as evidenced by utilization of his work in the assessment of landfill sites, shore bluff erosion studies and migration of toxic runoff. Peter's comprehensive knowledge of Ontario is clearly evident by his authorship of the seminal text entitled "*Quaternary Geology of Ontario*".

Peter's quest for knowledge and a fuller understanding of the earth's surface has led to his involvement in numerous productive research collaborations and partnerships. Unfailingly these were designed to investigate innovative concepts and methodologies. Collaboration with Geological Survey of Canada scientists on the Oak Ridges Moraine has resulted in a body of work that has dramatically advanced the understanding of the structure and formation of this majestic, resource-rich feature. In partnerships with the Canada Centre for Remote Sensing and academic researchers, Peter has developed applied mapping applications employing a variety of remote imaging tools, including RADARSAT

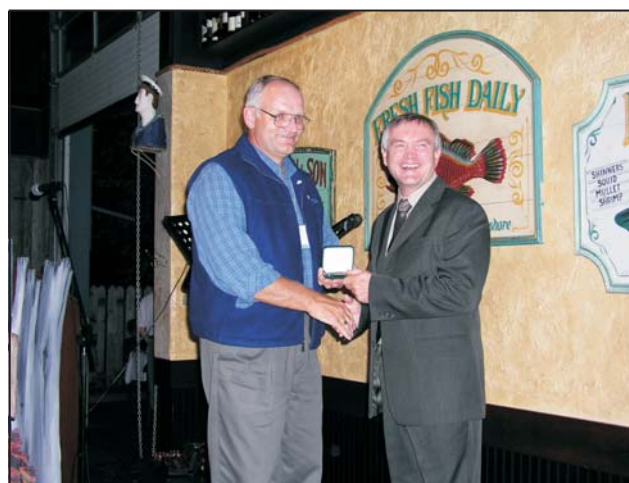
and hyperspectral technologies. His expertise in this field led to his appointment to the national RADARSAT Product Development Committee. Peter's involvement with a multidisciplinary investigation of the controversial Sheguiandah archeological site on Manitoulin Island, refined the date of human occupation and impacted the debate on the populating of North America.

Sharing and transferring of geoscientific knowledge is a quest endlessly pursued by Peter. This has taken many forms with notable examples being the organization of countless fieldtrips, mentoring of junior staff and education of the public. His commitment to the earth sciences extends well beyond his duties as a Survey geologist. Dedicating countless hours as a professor, he has enriched the lives of many students by bringing his passion for geology to the classroom. Such commitment has been rewarded by the success of numerous students whose careers he influenced and enriched.

On the basis of an exceptional portfolio of quality products, insightful research in a variety of fields, conducted both on his own and in numerous collaborations with academic and government agencies, his unflagging dedication to sharing his knowledge and adding meaningfully to environmental and development issues, Peter James Barnett is exceedingly deserving of the 2003 Provincial Geologists Medal.

BIOGRAPHICAL NOTE

Peter Barnett was born in St. Catharines, Ontario and spent his youth in the Niagara Peninsula region. An unbridled interest in the outdoors and the



OGS Peter Barnett receives CPG Medal for 2003

earth sciences grew to an encompassing life-long obsession with geology that has only grown stronger with time. Energized by fieldwork, Peter maintains a level of enthusiasm for science that inspires those with whom he comes in contact. Unassuming yet determined, he brings to his profession the unfettered belief that an understanding of the earth's structure and processes are paramount to the wise use and management of our environment and resources.

Peter studied at Brock University, where he received his honours B.Sc. in geology in 1972. Following this he undertook post-graduate studies at the University of Waterloo under the mentorship of Dr. Paul Karrow. His M.Sc., received in 1975, involved a detailed investigation of the regional stratigraphy and geochemical properties of Quaternary sediments in south-central Ontario. Peter joined the Engineering and Terrain Section of the Ontario Geological Survey (OGS) in 1975. His early work saw him completing a series of 1:50,000 scale surficial mapping projects and complementary reports for several areas in southwestern Ontario. This work was augmented by collaborative studies with the Ontario Centre for Remote Sensing to use airborne thermography to locate buried mineral aggregates.

Peter returned to the University of Waterloo to undertake a Ph.D., which was awarded in 1987. During his time at Waterloo, Peter received the W.B. Pearson award for outstanding creative research. His thesis research focused on mapping along the north shore of Lake Erie and resulted in the development of new depositional models for Quaternary deposits, specifically glaciolacustrine sediments, as well as a detailed glacial history for the area. This work would later play an important role in subsequent litigation involving erosion rates of the Lake Erie shore bluffs.

Continuing his career with the OGS, Peter undertook mapping and related geoscience investigations in several areas of Ontario. Mapping and drift studies over the Precambrian Grenville Province in the Bancroft area in the early 1980s resulted in the establishment of a framework for the interpretation of surficial data for environmental studies. Subsequent mapping in the Ottawa River Valley gave rise to a series of products and new geological models with implications to public health and safety and material properties. In the late 1980s to mid-1990s, Peter's mapping was concentrated in south-central Ontario in an area ranging from Lake Simcoe to Lake

PROVINCIAL GEOLOGISTS MEDAL 2003



Obverse and reverse images of the 2003 Provincial Geologists Medal.

Ontario. The regional stratigraphy and concepts related to tunnel valley formation that he established, as a result of 1:50,000 and 1:20,000 scale mapping, were revolutionary. Work with researchers from the Geological Survey of Canada during the 1990s resulted in a new understanding of the construction of the Oak Ridges Moraine that has profound implications on groundwater management and the volume and location of industrial mineral resources.

Coincident with this mapping and research, Peter authored the "*Quaternary Geology of Ontario*", a summary of the glacial activity, materials and ice age evolution of the province that is unsurpassed in its scope and comprehension. To complement this work he led the assembly and production of a series of 1:1 million scale maps illustrating the Quaternary Geology of Ontario. The four-map set, while being useful and functional, possesses a beauty that makes it a work of art.

Recently, Peter has continued to combine surficial mapping with applied research. His work in the Sudbury region has resulted in the production of a range of user-friendly products developed both on his own and in co-operation with others. From these efforts has emerged a regional GIS-based urban geological data set, a thematic "hillshade" Quaternary map and GIS-assisted methodologies for effective sampling in remote settings. Currently, Peter is involved in a multi-year partnership with the Canada Centre for Remote Sensing focused on mapping the far north of Ontario. It is the aim of this work to integrate traditional mapping with remotely sensed imagery and thus determine terrain characteristics affecting the harvesting of timber and reforestation.

GEOSCIENCE ORGANIZATION CHARTS - 2003

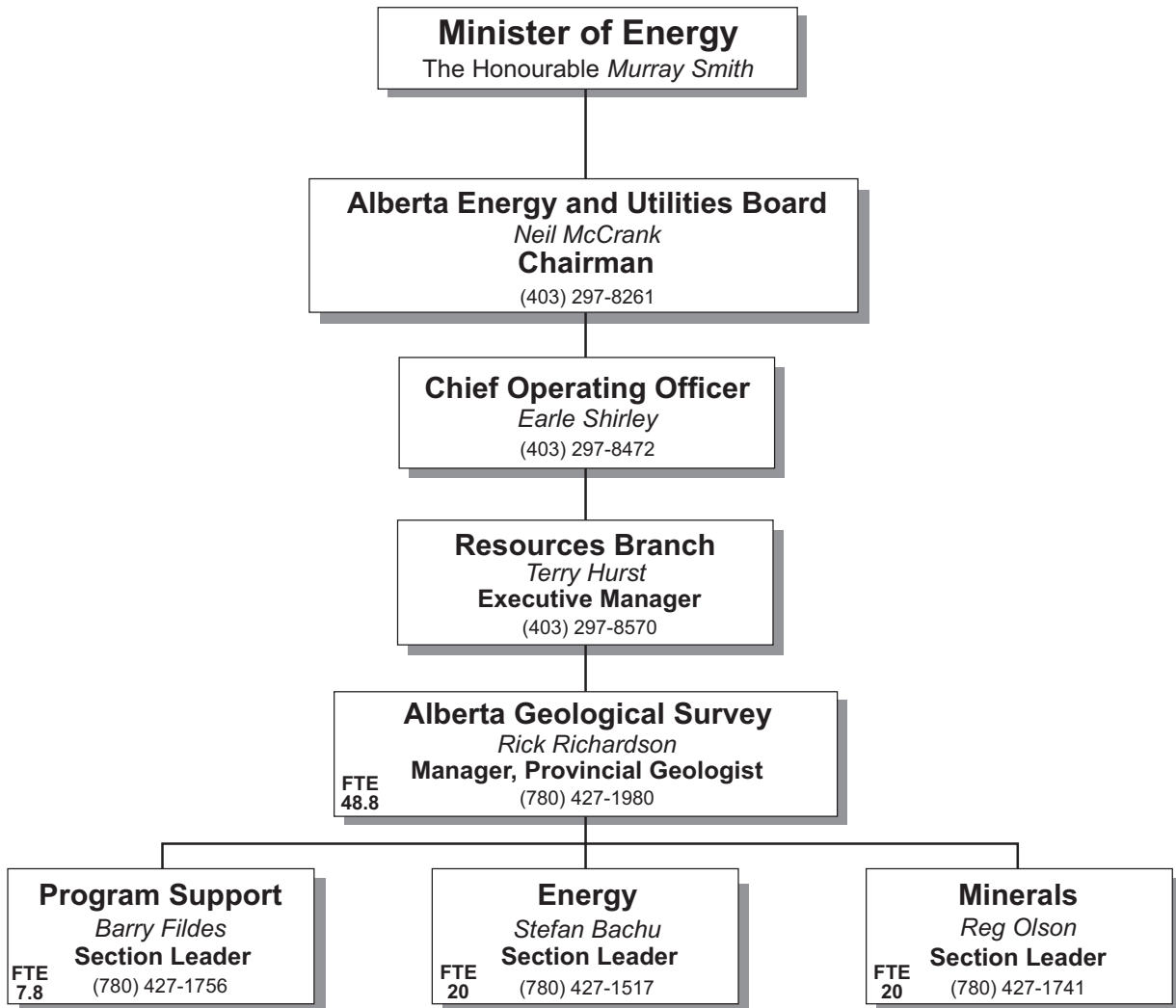
Each Provincial and Territorial government in Canada has developed its own organization structure for conducting geoscientific survey and research work. Some provinces have what is formally called a 'Geological Survey', but in most jurisdictions the main elements of the geological survey function are embraced in one or more Branches or Divisions of provincial Mines/Energy/Natural Resources departments. The following organization charts are set out to help clarify access to geoscience services for potential clients. The charts contain reference to the lines of reporting for the various units in each hierarchy, the staffing associated with each separate jurisdiction, and the names and telephone numbers of key individuals in each system.

Fall 2003



Alberta Geological Survey

Organizational Chart 2003

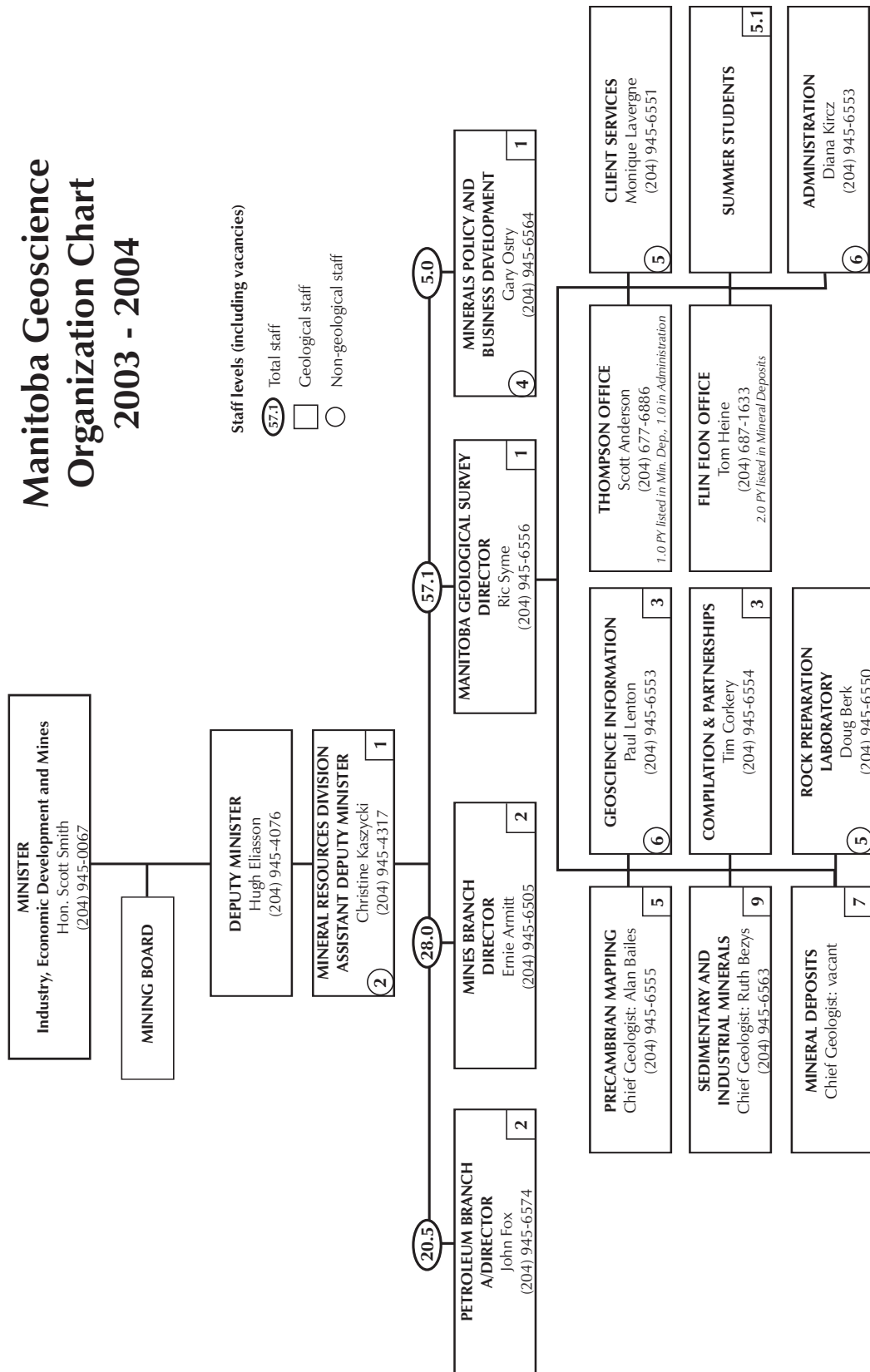


Provincial Geologists Journal



Manitoba Geoscience Organization Chart 2003

Manitoba Geoscience Organization Chart 2003 - 2004

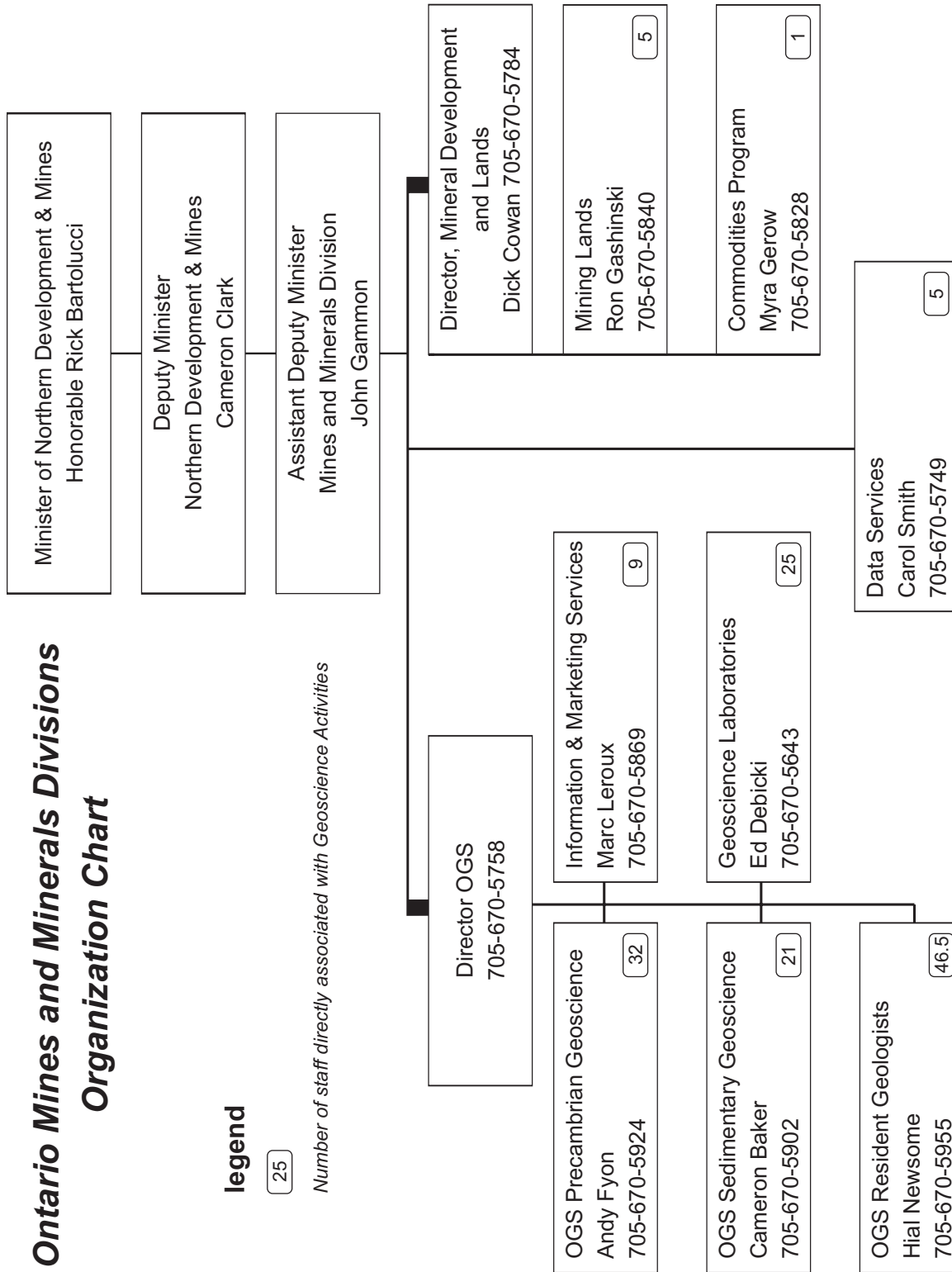


Ontario Mines and Minerals Divisions Organization Chart

Legend

25

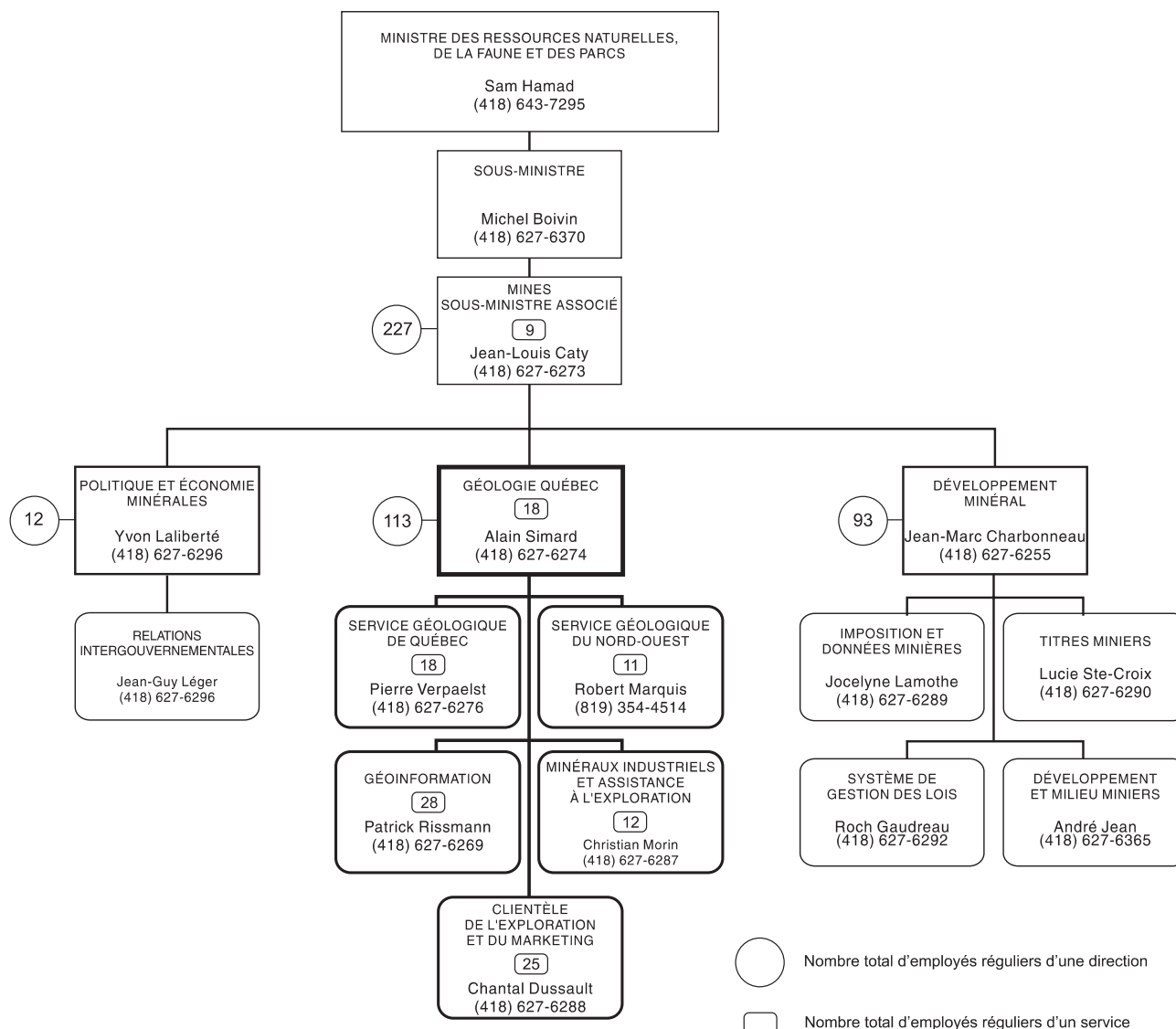
Number of staff directly associated with Geoscience Activities



Quebec Geoscience Organization Chart 2003

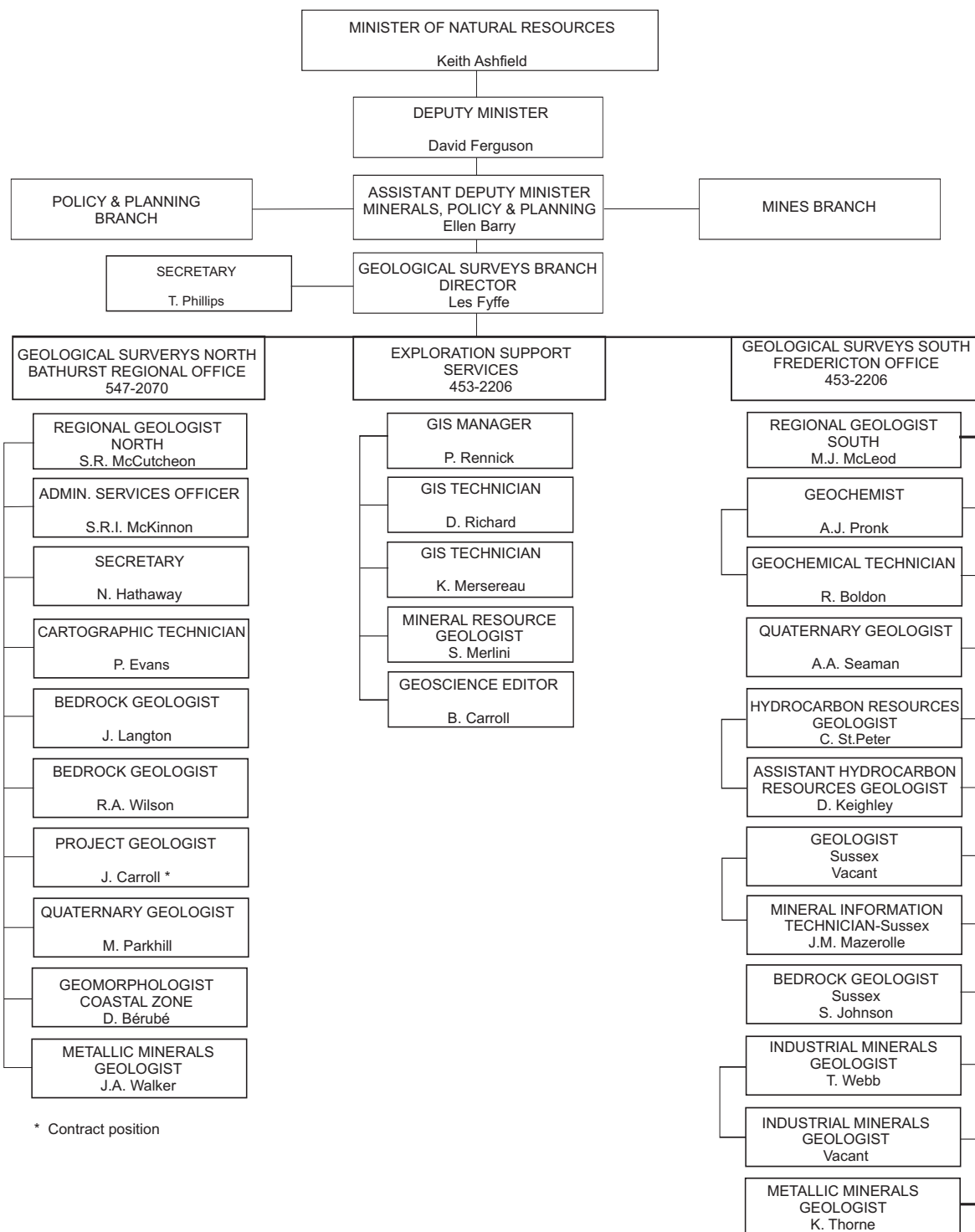
Ressources
naturelles,
Faune et Parcs

Québec

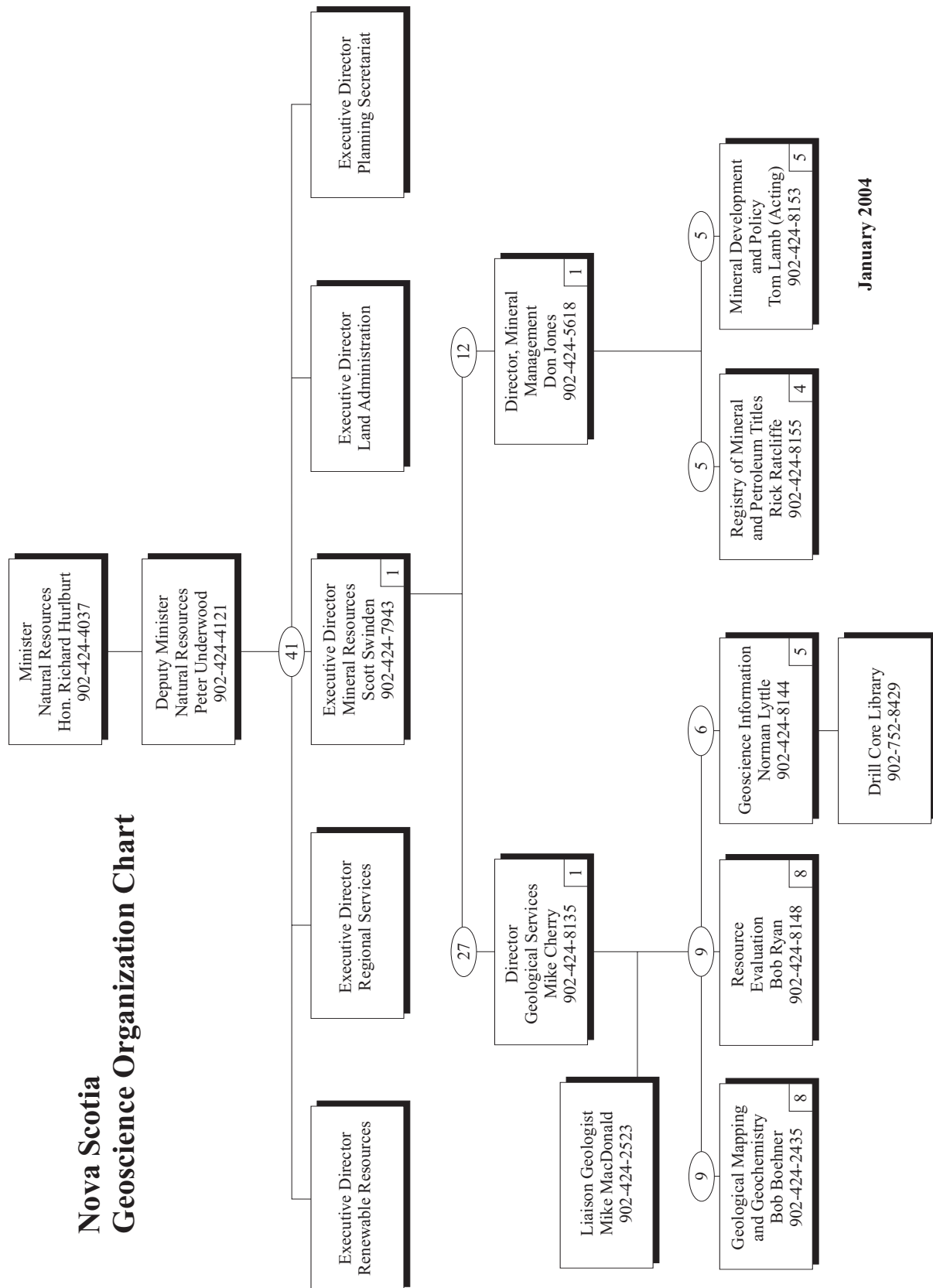


New Brunswick Geoscience Organization Chart 2003

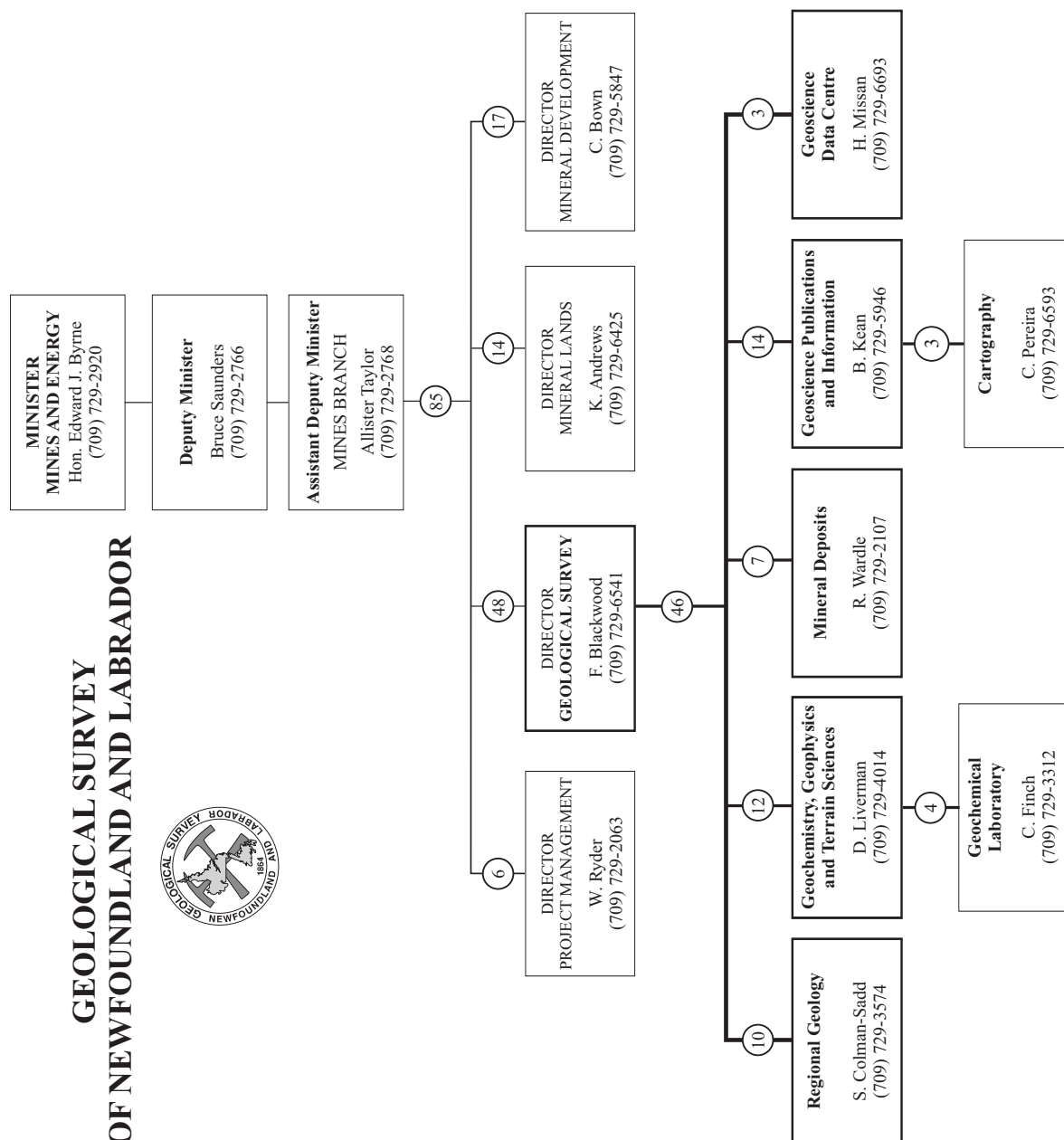
NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES Organizational Chart 2003

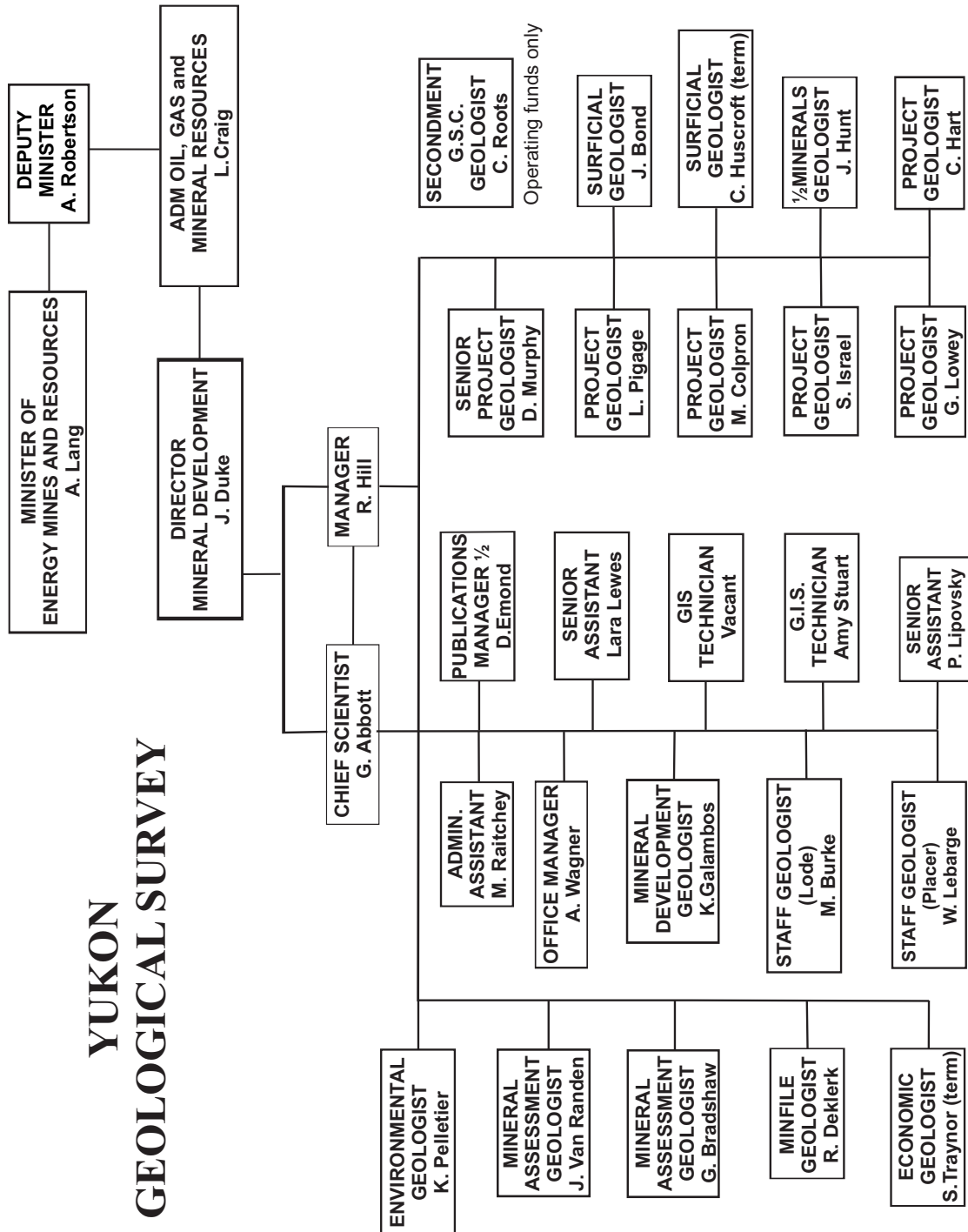


Nova Scotia Geoscience Organization Chart

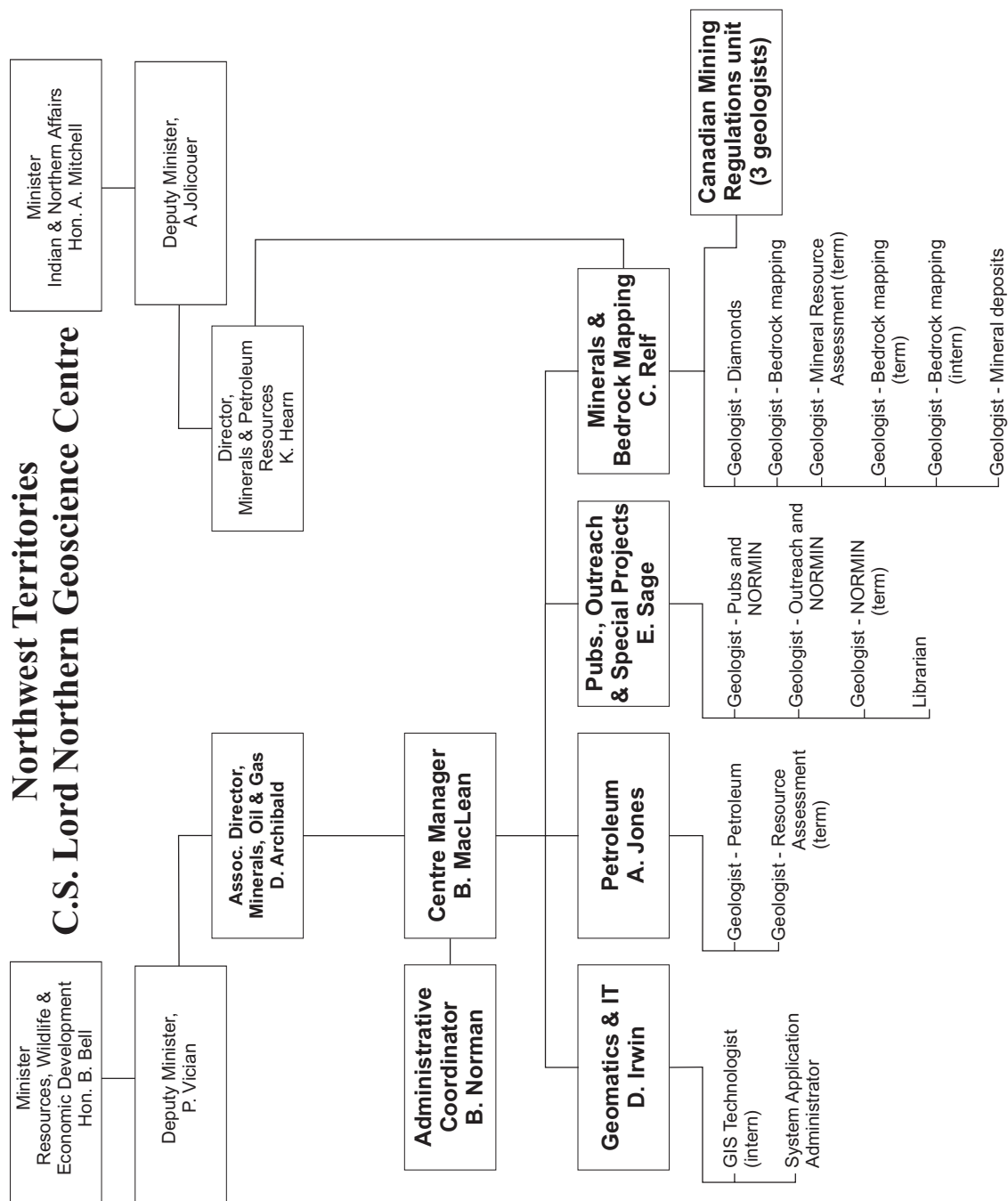


Newfoundland & Labrador Geoscience Organization Chart 2003



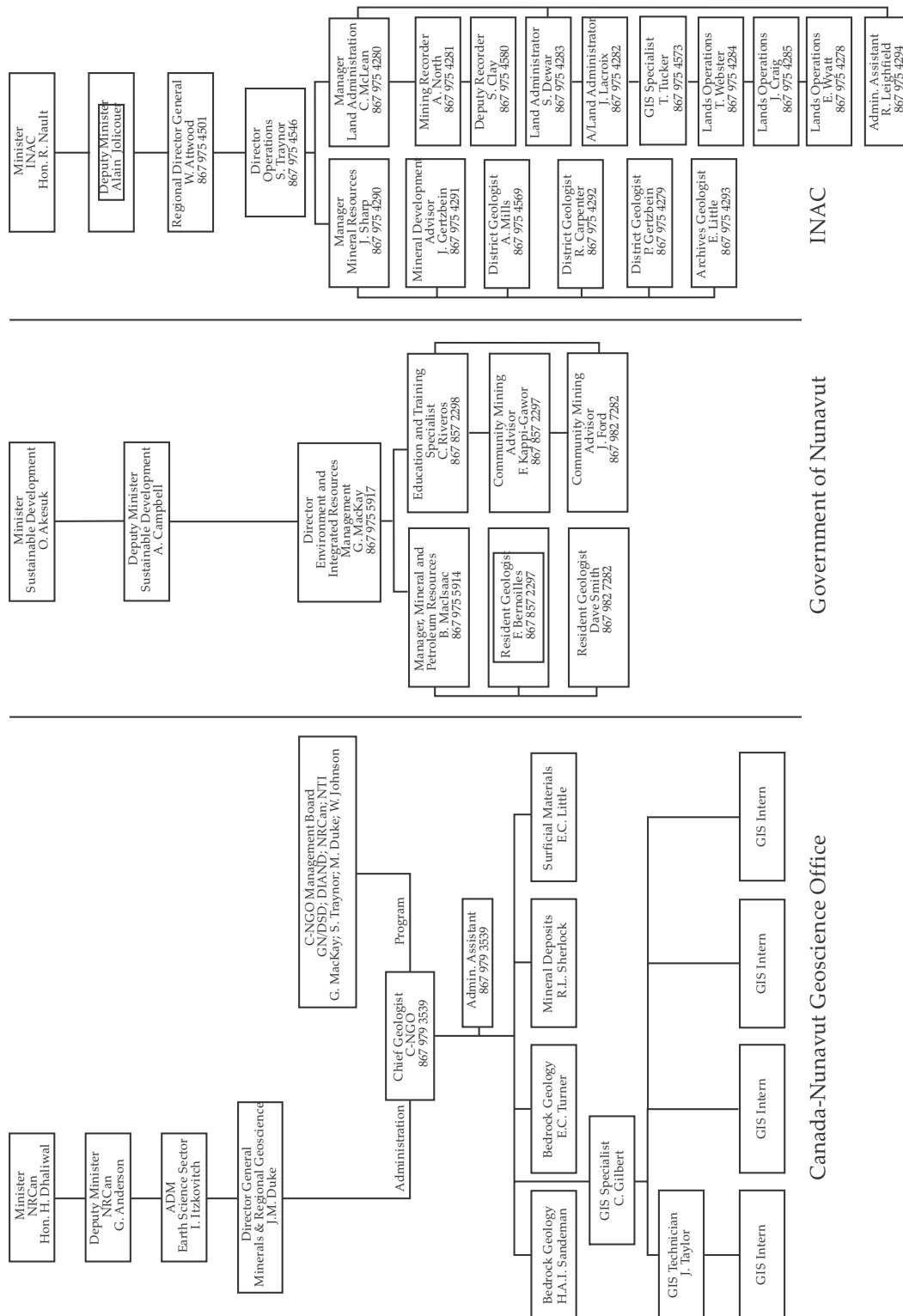


Northwest Territories Geoscience Organization Chart 2003



Nunavut Geoscience Organization Chart 2003

Government Geoscience in Nunavut



**PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES
2002-2003 FINAL & 2003-2004 PRELIMINARY**

Provincial / Territorial Geological Survey Expenditures 2002 – 2003

Provincial/Territorial Geological Survey Expenditures 2002-2003

Province/Territory	Survey Expenditures**	% of Canada Total	2003 Provincial Mineral Production*	Survey Expenditures as percentage of			
				Provincial Mineral Production	Area Prov/Terr km ²	Survey Expenditures \$ per km ²	Population Oct-02
BRITISH COLUMBIA	\$2,975,001	4.74%	\$2,860,427,293	0.104%	944,735	\$3.15	4,141,272
ALBERTA	\$5,975,179	9.52%	\$1,168,853,606 +	0.511%	661,848	\$9.03	3,113,586
SASKATCHEWAN	\$3,931,787	6.26%	\$574,454,344	0.684%	651,036	\$6.04	1,011,808
MANITOBA	\$4,520,600	7.20%	\$871,179,901	0.519%	647,797	\$6.98	1,150,848
ONTARIO	14,584,200	23.23%	\$5,543,217,518	0.263%	1,076,395	\$13.55	12,068,301
QUEBEC	\$13,192,700	21.01%	\$3,651,268,471	0.361%	1,542,056	\$8.56	7,455,208
NEW BRUNSWICK	\$2,434,966	3.88%	\$688,953,139	0.353%	72,908	\$33.40	756,652
NOVA SCOTIA	\$1,993,410	3.18%	\$260,932,819	0.764%	55,284	\$36.06	944,765
PRINCE EDWARD ISLAND	\$0	0.00%	\$3,349,623	0.000%	5,660	\$0.00	139,913
NEWFOUNDLAND & LABRADOR	\$3,517,444	5.60%	\$936,577,631	0.376%	405,212	\$8.68	531,595
YUKON	\$4,140,494	6.60%	\$36,535,413	11.333%	482,443	\$8.58	29,924
NORTHWEST TERRITORIES	\$3,002,000	4.78%	\$1,800,997,214	0.167%	1,346,106	\$2.23	41,403
NUNAVUT	\$2,514,000	4.00%	\$29,940,371	8.397%	2,093,190	\$1.20	28,715
Canada Totals:	\$62,781,781	100.00%	\$18,426,687,343	0.341%	9,984,670	\$6.29	31,413,990
							\$2.00

* Source: NRCan: Preliminary Estimate of the Mineral Production of Canada, by Province, 2003. Oil & Gas related production figures for 2003 not available.

Provincial mineral production figures include metals, non-metals, structural materials and coal.

+ Alberta figures do not include natural gas, natural gas by-products and crude oil for 2003

** Except for BC & Alberta, does not include expenditures on Oil&Gas or Industry Grant Programs (e.g. Prospectors Assistance) see Table 2 for details on grants
Expenditures column includes a total of A-base funds and other funds available directly to the geological surveys.

Note: Direct comparisons between jurisdictions are difficult due to the variety of budget/program components and methods of reporting data.

Industry Grant Programs – 2003 – 2004 Estimates

Provincial/Territorial Industry Grant Programs 2002-2003 Final

Province/Territory	Prospectors Assistance	Mineral Exploration Assistance		Total
BRITISH COLUMBIA	n/a	n/a		\$0
ALBERTA	n/a	n/a		n/a
SASKATCHEWAN	n/a	n/a		n/a
MANITOBA	\$59,300	\$2,175,000		\$2,234,300
ONTARIO	n/a	3,500,000	+	\$3,500,000
QUEBEC	\$2,487,000	\$5,054,400		\$7,541,400
NEW BRUNSWICK	\$250,000	380,000		\$630,000
NOVA SCOTIA	\$0	\$0		\$0
NEWFOUNDLAND & LABRADOR	\$294,672.00	\$1,935,328.00		\$2,230,000
YUKON	813,603	\$0	*	\$813,603
NORTHWEST TERRITORIES	85,500	\$0		\$85,500
NUNAVUT	\$150,000	\$0		\$150,000.0
Totals:	\$4,140,075	\$13,044,728		\$17,184,803

* Yukon Target Evaluations

+ includes Operation Treasure Hunt and Ontario Mineral Exploration Technologies Program

Provincial Geological Survey Expenditures 2003-2004 Preliminary Estimates

Province/Territory	Survey Expenditures	% of Total	Industry Grant Programs	Totals
BRITISH COLUMBIA	\$2,933,973	4.83%	\$0	\$2,933,973
ALBERTA	\$5,701,135	9.38%	\$0	\$5,701,135
SASKATCHEWAN	\$4,155,560	6.84%	\$0	\$4,155,560
MANITOBA	\$5,312,800	8.74%	\$2,234,300	\$7,547,100
ONTARIO	11,100,000	18.26%	2,500,000.00	\$13,600,000
QUEBEC	\$12,250,000	20.16%	\$650,000	\$12,900,000
NEW BRUNSWICK	\$2,447,200	4.03%	\$3,238,000	\$5,685,200
NOVA SCOTIA	\$1,938,700	3.19%	\$0	\$1,938,700
NEWFOUNDLAND & LABRADOR	\$3,571,200	5.88%	\$2,230,000	\$5,801,200
YUKON	\$4,150,000	6.83%	\$763,000	\$4,913,000
NORTHWEST TERRITORIES	\$4,587,421	7.55%	\$308,000	\$4,895,421
NUNAVUT	\$2,630,000	4.33%	\$150,000	\$2,780,000
Canadian Total:	\$60,777,989	100.00%	\$12,073,300	\$72,851,289

Province: British Columbia 2002 – 2003

Province: British Columbia 2002-2003

Minerals Activities									
Bedrock geological surveys	GSB	3	4		366,892	85,000		451,892	
Geochemical surveys	GSB	1	1		80,937	24,000		104,937	
Surficial geology surveys/Hazards	GSB	1	1		86,723	10,000		96,723	
Mineral deposit studies	GSB	5	3		307,059	30,000		337,059	
Industrial mineral studies	GSB	2	1		86,723	10,000		96,723	
Mineral Inventory (Minifle)	GSB	1	1.25		79,569	50,000		129,569	
Vancouver Regional Office	GSB	1	3		198,482	22,000		220,482	
Regional Geologists (2001 figures)	MB	5	5		309,043	50,767		359,810	
	Sub total	19	19.25	0	1,515,428	281,767		1,797,195	
Energy Activities									
NEBC - Unconventional	RDCB	2	1		88,452	163,466		251,918	
Interior Basins - oil and gas	RDCB	3	1		88,452	205,240		293,692	
Coalbed methane	RDCB	4	2		167,660	363,084		530,744	
CO2 sequestration/AcidGas	RDCB	2	1		88,452	68,853		157,305	
Coal	RDCB	2	1		88,452	30,000		118,452	
	Sub total	13	6	0	521,468	830,643		1,352,111	
Other Activities									
Map Compilations	GSB	1	2		164,766	7,000		171,766	
MapPlace	GSB	2	2		170,552	28,500		199,052	
Assessment Reports	GSB	1	1.25		97,705	60,000		157,705	
Management	GSB	3	2.75		251,074	50,500		301,574	
Administrative Support	GSB	4	3		141,512			141,512	
Energy related Administrative Support	RDCB	4	1		45,797	10,000		55,797	
Office Overhead (Victoria, Vancouver)	GSB	-				239,000		239,000	
	Sub total	15	12	0	871,406	395,000		1,266,406	
Miscellaneous									
Publications/Website	GSB	1	0.75		42,623	15,000		57,623	
UBC Grant	GSB	-				5,000		5,000	
	Sub total	1	0.75	0	42,623	20,000	\$	62,623	
Total Ministry Geoscience-related Budget		48	38	0	\$2,950,925	\$1,527,410		\$4,478,335	
Total GSB Base Budget (Minerals)		31	30	0	\$2,074,617	\$636,000		\$2,710,617	
Total RDCB Base Budget (Energy)		17	7	0	\$567,265	\$840,643		\$1,407,908	
Total MB Base Budget (Minerals)		5	5		309,043	50,767		359,810	

Funding Agency Abbreviations:

*GSB - Geological Survey Branch; MB - Mines Branch; RDCB - Resource Development and Geoscience Branch.

Province: Alberta 2002 – 2003

Province: Alberta 2002-2003

Agency	Funding	Projects	Person Years		Salaries (\$)		Operating Expenditures	Total (\$)	
			Perm.	Casual	Perm.	Casual			
Mineral Activities									
Bedrock Geology	EUB	EUB	2	3	1.0	\$ 274,878.00	\$ 17,835.00	\$ 142,857.00	\$ 435,570.00
Surficial Geology	EUB	EUB	3	4	1.2	\$ 342,906.00	\$ 26,972.00	\$ 142,072.00	\$ 511,950.00
Geochemistry	EUB	EUB	1	1	0.5	\$ 89,931.00	\$ 9,362.00	\$ 51,639.00	\$ 150,932.00
Geophysical Survey	EUB	EUB	1	2	1.3	\$ 208,584.00	\$ 59,193.00	\$ 75,039.00	\$ 342,816.00
Industrial Minerals	EUB	EUB	1	3	0.5	\$ 256,211.00	\$ 8,126.00	\$ 23,558.00	\$ 287,895.00
Core Repositories	EUB	EUB	1	1	-	\$ 48,306.00	\$ -	\$ 5,570.00	\$ 53,876.00
Laboratories	EUB	EUB	1	1	0.5	\$ 76,800.00	\$ 4,000.00	\$ 5,570.00	\$ 86,370.00
Energy Activities									
Coal / Coalbed Methane	EUB	1	3	6	0.8	\$ 525,765.00	\$ 17,331.00	\$ 158,273.00	\$ 701,369.00
Oilsands	EUB	EUB	1	1	-	\$ 114,498.00	\$ -	\$ 10,000.00	\$ 124,498.00
CO2 Sequestration	EUB	1	1	4	2.0	\$ 366,137.00	\$ 88,601.00	\$ 180,308.00	\$ 635,046.00
Hydrogeology	EUB	2	2	5	2.2	\$ 457,526.00	\$ 46,252.00	\$ 114,045.00	\$ 617,823.00
Other Activities									
Geoscience Information System	EUB	EUB	3	7	1.0	\$ 398,661.00	\$ 27,125.00	\$ 92,950.00	\$ 518,736.00
Chief's Office / Facilities	EUB	EUB	3	3.8	1.0	\$ 338,269.00	\$ 26,663.00	\$ 630,916.00	\$ 995,848.00
Miscellaneous									
Library	EUB	EUB	1	1	-	\$ 57,229.00	\$ -	\$ 47,430.00	\$ 104,659.00
Publication / Data Sales	EUB	EUB	2	5	1.0	\$ 358,172.00	\$ 32,072.00	\$ 17,547.00	\$ 407,791.00
Totals				47.8	13.0	\$ 3,913,873.00	\$ 363,532.00	\$ 1,697,774.00	\$ 5,975,179.00
1 = EUB/ARC/ASRA									
= EUB / AERI									

1 = EUB/ARC/ASRA

2 = EUB / AERI

Province: Saskatchewan 2002 – 2003

Province: Saskatchewan 2002-2003

	# Projects	Positions (person-years)		Salaries		Operational \$	Total \$
		Permanent	Non-permanent	Permanent	Non-permanent		
Mineral Activities							
Bedrock Geology Surveys	6	5.6	3.8	403,300	152,200	227,417	782,917
Surficial Geology Surveys	2	1	0.3	76,600	8,800	18,500	103,900
Mineral Investigations	3	1.5	0	109,000	-	25,380	134,380
Mineral Deposit Inventory	1	0.5	0.3	29,300	-	-	29,300
Industrial Mineral Studies	2	2	0.3	116,800	8,200	14,263	139,263
District Geologists	n/a	1.5	0	103,700	-	-	103,700
Core Depositories	1	0.25	0.3	19,200	9,000	10,400	38,600
Mineral Resource Assessment	1	1	0	68,300	-	11,200	79,500
Geophysical Surveys	1	-	-	-	-	400,000	400,000
Energy Activities							
Oil/gas data files	n/a	8.5	4.8	338,600	170,800	7,124	516,524
Core Depositories	1	4	4.5	134,900	122,300	25,629	282,829
Subsurface analysis	6	6.6	0	420,900	-	111,700	532,600
Other Activities							
Chief's Office/Administration	n/a	2.5	0.6	174,700	19,600	140,000	334,300
Miscellaneous							
Publications	n/a	1	1	58,000	27,754	49,000	134,754
Information/Assessment Files	n/a	1.9	0	97,700	-	-	97,700
Other - GIS/Computerization	n/a	3	1.35	150,900	45,700	24,920	221,520
Grand Total	24	40.85	17.25	\$ 2,301,900	\$ 564,354	\$ 1,065,533	\$ 3,931,787

Province: Manitoba 2002 – 2003

Province: MANITOBA 2002-2003

PROGRAMS	Survey agency	Funding agency	No. of projects or facilities	Person years		Salaries		Operating	TOTAL
				Permanent	Non-permanent	Permanent	Casual		
MINERAL ACTIVITIES									
Bedrock Geology Surveys	MCS	MB	44	12:00	2:17	\$767,100	\$79,200	\$216,500	\$1,062,800
Geochemical Surveys	MCS	MB	8	1:00	0:25	\$116,600	\$24,200	\$94,600	\$235,400
Surficial Geology Surveys	MCS	MB	5	3:00	0:24	\$182,100	\$11,100	\$16,700	\$209,900
Geophysical Surveys	MCS	MB	2	1:00	0:00	\$71,700	-	\$100	\$71,800
Mineral Investigations (Field)	MCS	MB	17	3:00	0:27	\$231,200	\$21,500	\$57,400	\$310,100
Mineral Deposit Analysis/Inventory	MCS	MB	3	-	-	-	-	\$30,900	\$30,900
Industrial Minerals	MCS	MB	5	1:00	0:12	\$62,500	-	\$4,700	\$67,200
District Geologists	MCS	MB	4	4:00	-	\$247,300	-	\$27,100	\$274,400
Core Repositories	MCS	MB	7	0:00	0:06	-	\$2,800	\$30,600	\$33,400
ENERGY ACTIVITIES									
Coal/Peat	-	-	-	-	-	-	-	-	-
Oil & Gas	-	-	-	-	-	-	-	-	-
Core Repositories	-	-	-	-	-	-	-	-	-
Subsurface Analysis	-	-	-	-	-	-	-	-	-
OTHER ACTIVITIES									
Environment/Land Use	MCS	MB	4	1:00	-	\$63,700	\$0	\$1,100	\$64,800
Hydrology	MCS	MB	-	-	-	-	-	-	-
Laboratories	MCS	MB	3	4:00	0:42	\$161,000	\$16,000	\$25,000	\$202,000
Miscellaneous Activities	MCS	MB	12	8:00	0:00	\$432,200	-	\$256,200	\$688,400
Chiefs Office/Administration	MCS	MB	15	8:00	0:26	\$475,700	\$14,100	\$638,700	\$1,128,500
MISCELLANEOUS									
Library	-	-	-	1:26	0:16	\$49,700	\$4,400	\$16,600	\$70,700
Publications	-	-	-	0:26	-	\$18,300	-	\$52,000	\$70,300
Information/Assessment Files	-	-	-	-	-	-	-	-	-
Research Grants	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
TOTALS									
	-	-	0	49:00	8:07	\$ 2,879,100	\$ 173,300	\$ 1,468,200	\$ 4,520,600
MCS - Manitoba Geological Survey									

MGS - Manitoba Geological Survey

Province: Ontario 2002-2003

	Funding Agency	No of Projects or Facilities	Staff (person-years)		Salaries (incl Benefits)	Operating Expenditures	Totals
			Permanent	Contract			
Mineral Activities							
Bedrock Geology Surveys	MNDM	9	15.0	1.0	\$1,345,800	\$562,000	\$1,907,800
Geochemical Surveys	MNDM	3	2.0	2.0	272,400	152,000	\$424,400
Surficial Geology Surveys	MNDM	3	2.0	2.0	270,800	54,200	\$325,000
Mineral Investigations (field)	MNDM	4	4.0		344,700	44,600	\$389,300
Mineral Deposit Analysis and/or Inventory	MNDM	5	5.0	1.0	404,000	43,500	\$447,500
Industrial Minerals	MNDM	3	2.0		183,700	128,400	\$312,100
Resident & District Geologists	MNDM	10	42.5		2,507,800	587,400	\$3,095,200
Core Repositories	MNDM	5				28,000	\$28,000
Geophysical Surveys	MNDM	8	2.0		153,700	16,400	\$170,100
Other Activities							
Geoscience Assessment	MNDM		5.0		300,200	23,200	\$323,400
Environment/Land Use	MNDM		4.0		249,700	33,600	\$283,300
Laboratories	MNDM		17.0	8.0	1,360,000	640,000	\$2,000,000
Miscellaneous Details							
Library	MNDM		1.0		43,200	18,900	\$62,100
Publication Services	MNDM		8.0		443,200	182,900	\$626,100
Data Services	MNDM		5.0		371,500	318,400	\$689,900
Sub-Totals		50	114.5	14.0	\$8,250,700	\$2,833,500	\$11,084,200
Additional Initiatives							
Groundwater Studies	MNDM	5		3	362,400	\$637,600	\$1,000,000
Ontario Mineral Exploration Technologies	MNDM					\$2,500,000	\$2,500,000
MNDM - Ministry of Northern Development & Mines							
		55	117.5	16.0	\$8,613,100	\$5,971,100	\$14,584,200

Province: Quebec 2002 – 2003

Province : Québec 2002-2003

Programmes	Financement	Nb de projets	Employés		Salaires \$	Dépenses d'opération \$	Total \$
			Permanents (équivalent à temps complet)	Occasionnels			
Activités géominières							
Cartographie géologique	MRNFP	6	19.7	28.1	2,042,800	2,745,600	4,788,400
Levés/études géochimiques	MRNFP						
Levés/études géophysiques	MRNFP	1	0.3	0.6	41,800	25,300	67,100
Levés/études géologie de surface	MRNFP	1	0.5	0.1	34,700	29,800	64,500
Recherche en métallogénie (terrain) et gîtologie	MRNFP	14	11.7	5.7	998,600	435,300	1,433,900
Évaluation de potentiel minéral	MRNFP	3	1.6	0.0	101,100	8,600	109,700
Minéraux industriels	MRNFP	3	1.8	0.1	128,800	39,300	168,100
Bureaux régionaux	MRNFP		21.6	3.7	1,016,000	174,400	1,190,400
Promotion du potentiel minéral	MRNFP		11.0	2.1	666,200	340,600	1,006,800
Compilations géominières	MRNFP		8.8	12.7	968,800	22,900	991,700
Autres activités							
Administration/bureau du géologue en chef	MRNFP		25.1	17.5	1,715,500	1,156,000	2,871,500
Divers							
SIGÉOM-GIS; autres	MRNFP		4.5	0.2	266,600	234,000	500,600
Total		28	106.6	70.9	\$7,980,900	\$5,211,800	\$13,192,700

PROVINCE: NEW BRUNSWICK 2002-2003

	No. of Projects	Staff			Salaries	Operating	Total
		Perm.	Casual	Contract			
Minerals Activities							
Bedrock Geology	6	4.0	0.9		248,634	78,452	327,086
Surficial Geology and Till Geochemistry	4	5.0	0.9	1.0	268,905	52,975	321,880
Mineral Deposits	4	2.0	0.3	1.0	85,644	40,119	125,763
Industrial Minerals	4	2.0	0.6		78,059	9,863	87,922
Energy Activities							
Oil, Gas, Oil Shale	3	2.0	0.3	0.3	73,996	41,713	115,709
Other Activities							
Drill Core	2	1.0	1.5		105,855	22,992	128,847
Geophysics (Airborne)	4			1.0	51,084	149,586	200,670
GIS and Digital Technology	4	3.0	0.3		133,491	71,770	205,261
Miscellaneous Details							
Editorial	1	1.0			61,771	0	61,771
Director's Office	1	1.0			111,507	28,019	139,526
Regional Geologists (Administration)	2	6.0			307,001	99,633	406,633
Publications, Education (Mines Branch)	3	4.0			169,499	144,397	313,896
Total:	38	31.0	4.8	3.3	\$1,695,447	\$739,520	\$2,434,966

Province: Nova Scotia 2002 – 2003

Province: NOVA SCOTIA 2002-2003

	Survey Research Agency	Funding Agency	No. of Projects or Facilities	Employees*		Operating* Expenditures	Salaries*	Totals*
				Permanent	Casual			
Mineral Activities								
Bedrock Geology Surveys	GSD	DNR	5	5.5	0.50	\$34,000	\$360,850	\$394,850
Geochemical Surveys	GSD	DNR	2	1.0	0.25	\$10,000	\$68,230	\$78,230
Surficial Surveys	GSD	DNR	1	1.0	0.25	\$8,000	\$76,100	\$84,100
Geophysical Surveys								
Mineral Investigations (Field)	GSD	DNR	3	3.5	0.25	\$15,000	\$244,800	\$259,800
Mineral Deposit Analysis/Inventory	GSD	DNR	2	2.0	0.25	\$15,000	\$127,730	\$142,730
Industrial Minerals	GSD	DNR	2	2.0	0.25	\$25,000	\$128,720	\$153,720
District Geologists	RSB	DNR						
Core Repositories	GSD	DNR	1	1.0		\$10,000	\$69,000	\$79,000
Energy Activities								
Coal/Peat	GSD	DNR	2	1.0		\$15,000	\$68,230	\$83,230
Oil and Gas	PD							
Core Repositories	PD							
Subsurface Analysis	PD							
Other Activities								
Environmental / Land Use	MDD							
Hydrology	DOEL							
Laboratories								
Miscellaneous Activities - Mineral Promotion	GSD	DNR	n/a	1.0		\$20,000	\$76,100	\$96,100
Chief Geologist's Office/Administration	GSD	DNR	n/a	2.0		\$33,100	\$129,000	\$162,100
Miscellaneous Details								
Library	PS	DNR	n/a					
Publications	GSD	DNR	n/a	4.0		\$10,000	\$213,750	\$223,750
Public Awareness/Prospectors Training	GSD	DNR	n/a	1.0		\$5,000	\$60,480	\$65,480
Information/Assessment Files	MDD	DNR						
Research Grants								
Information Technology	GSD	DNR	n/a	2.0	0.25	\$41,600	\$128,720	\$170,320
Totals			18.0	27.00	2	\$241,700	\$1,751,710	\$1,993,410

* = FTEs and budget data provided for GSD only, salary data include permanent and casual employees

GSD = Geological Services Division

MDD = Mineral Management Division

RSB = Regional Services Branch

DNR = Department of Natural Resources

PD = Petroleum Directorate, Department of Energy

PS = Policy and Planning Secretariat

DOEL = Department of Environment and Labour

n/a = not applicable

Province: Newfoundland & Labrador 2002 – 2003

Province: Newfoundland & Labrador 2002-2003

	Agency	Agency	Facilities	SMY	SMY					
MINERAL ACTIVITIES										
Bedrock geology surveys	GSNL	NLDME	7	9	0.5	514,612	-	7,994	138,530	661,136
Geochemical surveys	GSNL	NLDME	3	3	0.5	179,384	-	8,965	75,547	263,896
Surficial geology surveys	GSNL	NLDME	3	3	-	181,561	-	-	114,118	295,679
Geophysical surveys	GSNL	NLDME	1	1	0.5	55,446	-	5,212	14	60,672
Mineral investigations (field)	GSNL	NLDME	4	4	0.25	190,551	-	3,996	84,444	278,991
Mineral deposit analysis and/or inventory	GSNL	NLDME	1	2	-	100,707	-	-	1,267	101,974
Industrial minerals	GSNL	NLDME	2	2	0.5	119,083	-	9,608	17,767	146,458
District geologists	-	-	-	-	-	-	-	-	-	-
Core repositories	MLD	NLDME	1	2	1.0	108,708	-	10,663	32,920	152,291
ENERGY ACTIVITIES										
Coal/Peat	-	-	-	-	-	-	-	-	-	-
Oil & Gas	EB	NLDME	2	24	-	1,179,239	-	410,700	378,961	1,968,900
Core Repositories	-	-	-	-	-	-	-	-	-	-
Subsurface Analysis	-	-	-	-	-	-	-	-	-	-
OTHER ACTIVITIES										
Environment/Land Use	MLD	NLDME	1	5	-	151,867	-	-	40,596	192,463
Hydrology	-	-	-	-	-	-	-	-	-	-
Laboratories	GSNL	NLDME	1	4	-	175,468	-	-	103,459	278,927
Miscellaneous Activities	-	-	-	-	-	-	-	-	-	-
Director's Office/Admin.	GSNL	NLDME	2	8	0.25	271,186	55,441	3,529	193,282	523,438
MISCELLANEOUS DETAILS										
Library	GSNL	NLDME	1	2*	0.25	55,446	-	1,515	7,743	64,704
Publications/Cartography	GSNL	NLDME	2	8	-	312,758	14213	-	105,530	432,501
Information/Assessment files	GSNL	NLDME	2	5	-	231,049	-	-	73,319	304,368
Research Grants	-	-	-	-	-	-	-	-	-	-
Information Technology	GSNL	NLDME	1	-	-	-	-	-	104,700	104,700
TOTALS			34	80.0	3.8	\$3,827,065	\$69,654	\$462,182	\$1,472,197	\$5,831,098

GSNL - Geological Survey of Newfoundland and Labrador

MLD - Mineral Lands Division

EB - Energy Branch

NLDME - Newfoundland Department of Mines and Energy

1 - includes long-term temporary staff

* - includes one employee sponsored by Opening Doors Program

TOTAL GEOLOGICAL SURVEY ACTIVITIES 2002-2003 (GSNL)(ACTUAL)

\$3,517,444

TOTAL GEOLOGICAL SURVEY ACTIVITIES 2003-2004 (GSNL) (ESTIMATED)

\$3,571,200

Territory: Yukon 2002 – 2003

Territory: Yukon 2002-2003

Activity	Research Agency	Funding Agency	# Projects	Positions (FTEs)		Salaries (\$)		Operational \$	Total (\$)
				Permanent	Non-permanent	Permanent	Non-permanent		
Mineral Activities									
Bedrock Geology Surveys			6	4	1	\$262,153	\$24,548	\$378,139	\$664,840
Surficial Geology Surveys			2	1.25	0	\$109,471	\$0	\$35,984	\$145,455
Geochemical Surveys			0	0	0	\$0	\$0	\$0	\$0
Geophysical Surveys			0	0	0	\$0	\$0	\$0	\$0
Mineral Deposit Studies			2	1	1	\$88,000	\$41,050	\$146,266	\$275,316
Placer Deposit Studies			2	2	0.5	\$167,496	\$18,178	\$70,057	\$255,731
Mineral Potential Assessments			10	0	3.5	\$0	\$310,241	\$210,842	\$521,083
Environmental Studies			4	1	0	\$90,000	\$0	\$84,900	\$174,900
Support for Graduate Theses and University Research			7	0	0.25	\$0	\$23,100	\$90,875	\$113,975
District Geologists	see below	see below	1	1	0	\$77,000	\$0	\$12,100	\$89,100
Mineral Deposit Databases			2	1	1	\$77,000	\$55,000	\$4,150	\$136,150
Energy Activities									
Oil & Gas Resource Assessments			-	-	-	-	-	-	-
Other Activities									
GIS Support, Drafting, Publishing, Website etc.			-	1.5	0.25	\$92,000	\$7,500	\$170,970	\$270,470
Administration (Manager & Chief Geologist Offices)			-	4	0	\$293,000	\$0	\$268,976	\$561,976
Miscellaneous									
Core Repositories			-	0	0.25	\$0	\$7,500	\$70,395	\$77,895
Geological Library			-	0	0.5	\$0	\$20,000	\$20,000	\$40,000
Prospectors Assistance (YMIP)			-	1	0	\$81,198	\$0	\$732,405	\$813,603
TOTALS				16.75	7.5	\$1,256,120	\$479,617	\$1,473,259	\$4,140,494
Funding Sources									
DIAND Salaries	\$566,000								
DIAND O&M	\$364,660								
DIAND Capital	\$680,000								
YTG Geological Surveys	\$905,148								
YTG Mineral Assessments	\$521,083								
YTG O&M	\$150,000								
YTG YMIP	\$813,603								
GSC - TGI	\$140,000								
	\$4,140,494								

Territory: Northwest Territories 2002 – 2003

Territory: Northwest Territories 2002-2003

	Funding sources	Number of projects	Personnel	Operations & Mgmt (CSL)	Salary
Mineral Activities					
Bedrock geology surveys	CSL	2	2.5	\$251,000	\$200,000
Geochemical surveys	n/a				
Surficial geology surveys	n/a				
Geophysical surveys	CSL				
Mineral investigations (field)	CSL	2	3	\$50,000	\$220,000
Mineral deposit analysis / inventory	CSL	2	2.5	\$78,000	\$190,000
Industrial minerals	n/a				
District geologists	DIAND		2	\$15,000	\$190,000
Core repositories	CLS				
Energy Activities					
Coal / Peat	n/a				
Oil & Gas	CSL	1	1	\$62,000	\$100,000
Core repositories	CSL				
Subsurface analysis		2	1.5	\$98,000	\$150,000
Other Activities					
Environmental / Land use	Land claims, PAS	3	2	\$54,000	\$190,000
Hydrology	n/a				
Laboratories	n/a				
Miscellaneous activities	n/a				
Chief Geologist's office / Admin.	CSL		2	\$263,000	\$190,000
Miscellaneous Details					
Library	CSL			\$20,000	\$30,000
Publications	CSL		0.5	\$4,000	
Information / Assessment files	CSL		4	\$209,000	\$340,000
Research grants	n/a				
IT Software licenses, etc.	CSL			\$98,000	
Sub-Totals:		12	21	\$1,202,000	\$1,800,000
Total:					\$3,002,000

Territory: Nunavut 2002 – 2003

Territory: Nunavut 2002-2003

	Funding Agency	Number of Projects	Positions (Term)	Salaries	Operating	Total
Mineral Activities						
Bedrock geological surveys	C-NGO	2	2.0	140,000	700,000	840,000
Geochemical surveys	GSC (TGI)	1	0.5	30,000	120,000	150,000
Surficial geological surveys	C-NGO	1	1.0	45,000	70,000	115,000
Geophysical surveys	n/a	n/a	n/a	0	0	0
Mineral investigations (field)	C NGO, DIAND,	3	2.0	130,000	150,000	280,000
Mineral deposit analysis/ inventory	n/a	n/a		0	0	0
Industrial Minerals	n/a	n/a		0	0	0
District Geologists	DIAND	3	3.0	180,000	75,000	255,000
Core depositories	n/a	n/a		0	0	0
Energy Activities						
Coal/ Peat	n/a	n/a	n/a	0	0	0
Oil & Gas	n/a	n/a	n/a	0	0	0
Core depositories	n/a	n/a	n/a	0	0	0
Subsurface analysis	n/a	n/a	n/a	0	0	0
Other Activities						
Environment/ Land Use	n/a	n/a	n/a	0	0	0
Hydrogeology	n/a	n/a	n/a	0	0	0
Laboratories	C NGO	7 (GIS)	2.0	90,000	30,000	120,000
Miscellaneous Activities	IHT, C NGO	1 (Outreach)	1.0	50,000	5,000	55,000
Chief Geologist's Office/ Admin.	C NGO	n/a	1.0	40,000	50,000	90,000
Miscellaneous Details						
Library	C NGO	n/a	n/a	0	5,000	5,000
Publications	C NGO	n/a	n/a	0	5,000	5,000
Information/ Assessment files	DIAND	n/a	1.5	90,000	55,000	145,000
Research Grants	n/a	n/a	n/a	0	0	0
Other (housing)	C NGO, DIAND	n/a	n/a	0	454,000	454,000
Total			14.0	\$795,000	\$1,719,000	\$2,514,000

* Geochemical surveys are included within both bedrock and surficial geological survey costs.

Geological Program Highlights 2003

British Columbia Program Highlights 2003

The Ministry of Energy and Mines delivers energy and minerals geoscience programs for the provincial government of British Columbia. The Resource Development and Geoscience Branch is responsible for gas, oil and coalbed gas projects. The Geological Survey and Development Branch, also known as the British Columbia Geological Survey, is

focused on issues related to coal and minerals geoscience, including industrial minerals. Both these Ministry groups carry out new field-based geoscience surveys as well as ensuring maintenance of the province's geoscience database and market and promote resource development opportunities.

ENERGY GEOSCIENCE RESOURCE DEVELOPMENT and GEOSCIENCE BRANCH 2002/2003 Fiscal and 2003 Field Season

In 2003, the Ministry revised its organizational structure and the New Ventures Branch was renamed the Resource Development and Geoscience Branch (RDGB) within the Oil and Gas Division. The branch strategy however, remained the same; to provide geoscience and project management expertise in support of new energy resource development and reduce risk for energy resource exploration within BC. This objective of the RDGB aligns with a Ministry goal to maintain and increase investment in energy and mineral resource development in the province by striving to, increase oil and gas production, activity and investment in BC oil and gas sector. These goals are being met by three RDGB Sections; Petroleum Resource Geology, Aggregate Geology and Resource Development.

PETROLEUM RESOURCE GEOLOGY

The Petroleum Resource Geology Section has the mandate to improve BC's geoscience knowledge base and to identify and quantify the underdeveloped or unrecognized petroleum resources of the province. The section initiated several significant projects in 2003 by expanding studies in Interior Basins and unconventional resources. In addition, the section is responsible for operating and maintaining the core facility in Ft. St. John.

Industry Promotion

The group as a whole participated in numerous conferences and technical symposiums throughout the year, including the North American Prospect Exchange in Houston Texas., the American Association of Petroleum Geologists Annual Meeting in Dallas Texas, the Canadian Society of Petroleum Geologists in Calgary and the Canadian Society for Unconventional Gas also in Calgary. Audiences included various stakeholder groups, industry and financial insti-

tutions. Messaging targeted the hydrocarbon exploration opportunities within the province.

Core Facility

The BC *Petroleum and Natural Gas Act* through the Drilling and Production Regulation outlines the requirements for oil and gas exploration companies to submit core and drill cuttings from any well drilled within the province. These rock samples are housed within a central warehouse Core Facility, located in Charlie Lake BC. This facility archives and provides public access to select and examine over 5400 petroleum well cores, hundreds of coalfield core and over 16 000 well drill cutting samples.

The facility and its collection are open to all interested parties. The facility offers year-round heated indoor viewing of samples and cores. There are 10 core examination tables. There is also an area with two examination tables that can be reserved by company staff to view and examine their 'confidential' core. There are 3 sample viewing booths set up to allow individuals to both view well drill cuttings through microscopes and correlate their interpretations to core examinations. To further assist individuals using the facilities, a conference room is available through a reservation system for presentation of core examinations, technical conferences, and educational presentations for oil and gas industry specialists, local college educational development and the general public.

The storage of cores & drill cuttings and the provision of facilities for their examination by the RDGB ensures oil and gas exploration companies, academic institutions, the general public and other natural resource oriented groups benefit via access to a hard data source that would otherwise be unobtainable or costly to obtain.

Interior Basins

The interior regions of British Columbia contain four major areas with conventional oil and gas exploration potential: the Bowser/Sustut Basin, the Nechako Basin, the Quesnel Trough and the Whitehorse Trough. These areas all have significant volumes of sedimentary rocks but remain virtually unexplored. The total resource potential of these basins is estimated at over 17 TCF of natural gas and 7 billion barrels of oil in place. Due to a limited exploration history and a lack of drilling there is very sparse subsurface geological and geophysical information and the risk level for exploration is high. As such, the Ministry, in collaboration with the Geological Survey of Canada initiated a four year, multi-million dollar geological survey in the Bowser/Sustut Basin and a multi-year study of subsurface data from the Nechako Basin to better refine the resource potential of these areas. The new data published from ongoing projects and industry promotional activities conducted by the Resource Development and Geoscience Branch have increased industry awareness and interest levels in exploring these basins.

BOWSER/SUSTUT

In collaboration with The Geological Survey of Canada, Senior Petroleum Geologist Fil Ferri, participated in mapping the western part of the McConnell Creek Sheet (an area of approximately 3300 km²), covering the eastern portion of the Bowser Basin and central part of the Sustut Basin. This effort concentrated on lithostratigraphic mapping, source rock analysis, reservoir characterization and petroleum system analysis. Results of the previous year (2002) efforts were presented to industry at a workshop in February 2003.

NECHAKO

In the Nechako Basin, Senior Petroleum Geologist, Fil Ferri, investigated the presence of suitable petroleum source rocks and published a paper entitled, *"Petroleum Source Rock Potential of Lower to Middle Jurassic Clastics, Intermontane Basins, British Columbia"*.

One week was spent examining possible source beds on the east side of the Nechako area, within the Quesnel Trough. Approximately 25 samples were collected in the McConnell Creek area and 12 samples were taken from the Quesnel Trough. Further sampling is planned in both regions during the 2004 field season.

Contractor Mel Best carried out and supplied preliminary interpretation for ground gravity and magnetic surveys in the southern Nechako basin.

The purpose of the survey was to illustrate how integrated potential field data can provide constraints on basin structure, sediment thickness and volcanic structures within the sedimentary section.

WHITEHORSE TROUGH

The RDGB sponsored graduate level studies through the University of Victoria in which Joe English investigated the level of organic maturation and source rock potential in the Atlin portion of the Whitehorse Trough as well as Kara Wight who focused on determining the nature of the Copper Island Fault, the relationship to other regional structures, and on documenting the structure and stratigraphy of adjacent strata of the Laberge Formation.

NEBC

Tight Gas

- ✧ Petrel Robertson Consulting Ltd., under contract from RDGB, undertook an assessment of "tight gas" production and exploration potential in British Columbia in early 2003. This report addresses several key areas: definition of tight gas, and overview of its history and recent development in BC;
- ✧ geology and reservoir characteristics of major tight gas units in BC; and,
- ✧ analysis of future exploration and development potential.

This project is a regional overview for the purpose of assessing tight gas potential and highlighting opportunities.

Deep Gas

The RDGB contracted Petrel Robertson to conduct an Exploration Assessment of Deep Devonian Gas Plays in NEBC as a means to define the basic fundamentals of deep gas in British Columbia. This initiative was aimed at identifying and mapping deep gas play concepts and trends as well as attempting to quantify the undiscovered resource potential of these deep horizons.

Conventional Oil & Gas

The RDGB sponsored the graduate level studies of Ayse Imbrahimbas through a grant to the University of Calgary to study Lower Triassic to Lower Cretaceous potential source rocks within a large area of northeastern British Columbia and northwestern Alberta (118°-124°W and 57°- 58°N). Hydrocarbon source rock parameters, including type and amount of kerogen, and thermal maturity of these formations, were assessed by analyzing 74 core samples from 23 wells using Rock-Eval/TOC pyrolysis.

Coalbed Gas

Coal and Coalbed Gas (CBG) Expert, Barry Ryan, undertook several studies relating to CBG in the province. His paper entitled "*Unique Aspects of British Columbia CBG Geology: Influences on Produceability*" was a discussion of aspects of CBG produceability in regard to the recent tectonic history of coalfields and how it may improve permeability and interrelate with coal properties. A second paper looked at the market potential of low volatile bituminous coal on the Willow Creek Property in NEBC. This study looked at the possible use of 7 Seam from the Willow Creek property in northeastern BC as a low-volatile component in a standard coke oven blend. A third study looked at the CBM potential of the Crowsnest Coalfield in southeast BC. This paper summarizes existing mapping data, coal quality and coal resource data. It also attempts to delineate the resource potential of the area.

Carbon Management/CO₂ Sequestration

CO₂ sequestration involves the capture and extraction of CO₂ from flue-gases or industrial streams, transportation of CO₂ and its disposal in an appropriate sink. There are several different methods for se-

questering CO₂ that provide potential options for BC.

In 2003, George Simandl and Danae Voormeij published a study to investigate stationary CO₂ point sources in BC and various different sequestration options available in BC. This study was advanced by an additional study focused on geological and mineral CO₂ sequestration options and their technical review. Barry Ryan and Dave Richardson also co-authored a study to examine the potential for CO₂ sequestration in various British Columbia coal seams.

RDGB has contributed to a research project, conducted by Dr. Greg Dipple at The University of British Columbia, to assess CO₂ sequestration potential of the Cassiar Mine Tailings. This research identified the content of amphibolitic minerals in the Cassiar mine tailings, determined if CO₂ is being sequestered during crust formation and determined source of sequestered CO₂ using carbon isotope fingerprinting. In addition, RDGB has been contributing to an ongoing acid gas injection study being conducted by Alberta Research Council (ARC) since 2001. This study covers a summary of BC acid gas injection operations.

MINERALS GEOSCIENCE BRITISH COLUMBIA GEOLOGICAL SURVEY

The British Columbia Geological Survey (BCGS) continues to provide new geoscience information to industry, government and the public, and to ensure ease of access to the important library of minerals-related geoscience information built up over the past century. A key program focus was the publication of this information in articles, maps, presentations and over the Internet to attract mineral exploration investment to the province and play a role in the discovery of new coal and mineral deposits.

The Survey's field programs (14 projects) were concentrated on attracting mineral exploration investment to under-explored frontier regions or areas with established mining infrastructure. Four bedrock-mapping projects in the Atlin, Eskay-Iskut, Toodoggone and Johanson Lake regions were completed with assistance from partners. Other field projects addressed a variety of aspects of provincial geology and mineral deposits, including platinum group elements in alkaline rocks and placer deposits, diamond and emerald potential of British Columbia, volcanogenic massive sulphide and porphyry deposits and new industrial mineral opportunities. The first detailed airborne geophysical surveys in six years were completed in the Toodoggone and Horsefly areas in northeast and central BC.

At the same time the British Columbia Geological Survey continued to improve its capability to deliver information to clients via the Internet. The total number of visits to the MapPlace, the primary tool for accessing British Columbia georeferenced mapping data, doubled to almost 2 million. New technologies adopted by the Survey made improved the convenience of accessing data access and provided new interactive tools enabling clients to increase data value.

BCGS staff in the Vancouver Mineral Development office continued to provide important client services to the large mineral exploration community based out of Vancouver, and point out investment opportunities arising from new mineral industry activities. Although in the Mines Operations Branch of the Ministry, the Regional Geologists contribute significantly to the province's mineral geoscience program by assisting clients, monitoring industry activity, and carrying out economic development initiatives. They are stationed in Cranbrook, Kamloops, Prince George, and Smithers. Unfortunately the Nanaimo office closed in early 2003.

The base funding allocation for the BCGS totaled \$2.2 million in fiscal year 2003-04. This



Figure 1. BC Geological Survey: Back Row - Dave Lefebure, Gib McArthur, Ian Webster, Laura de Groot, Pat Desjardins, Graham Nixon, Julie Hutchins, Larry Diakow, Nick Massey, Alan Wilcox, Larry Jones, Andrew Legun, Brian Grant, George Simandl, Jim Logan and Martin Stewart. Front Row: Ray Lett, Mitch Mihalynuk, Tom Schroeter, Dani Aldrick, JoAnne Nelson and Paul Schiarizza.

dropped from the previous year; therefore, the Survey responded by consolidating operations and focusing on its economic development mandate.

In 2003 the BCGS continued its private-public partnership program for delivery of selected geoscience programs. This program formalized more than 100 years of informal field assistance from the mineral industry. As with all other Survey work, all private-public partnership results are published in our traditional report and map series formats. Prior to release of any results to the public, industrial partners have access only to data from their claims. This partnership program enabled survey geoscientists to supplement limited government funding in order to carry out field projects and bring longer-term projects to a suitable conclusion. Guidelines for this program are available from the Survey website at:

www.em.gov.bc.ca/geology/

FIELD PROGRAM HIGHLIGHTS

Bedrock Mapping Projects

Bedrock mapping projects in northern British

Columbia near Atlin and in the Toodoggone River and Iskut River areas, were jointly planned, funded and delivered with the Geological Survey of Canada as part of the joint Targeted Geoscience Initiative. Pooling of resources and staff expertise permits delivery of integrated geoscience projects with a wider variety of products.

The Atlin project in northwestern British Columbia started in 2000 with a high-resolution, regional aeromagnetic survey, which was released the following year. Mitch Mihalynuk and his crew, including researchers from the University of Victoria, The University of British Columbia and Université Claude Bernard (France), completed bedrock mapping of two 1:50 000-scale map sheets in the southeastern project area (Figure 3). The map area is underlain mainly by oceanic crustal rocks and deep to shallow marine sedimentary rocks of the Cache Creek Terrane. Mitch (BCGS) and Dante Canil (University of Victoria) also carried out detailed work on the LaBerge wackes which have been proven to contain abundant high-pressure, high-temperature eclogitic minerals. Their research is expected to better define the conditions under which this group of sediments may have become rich in these minerals.



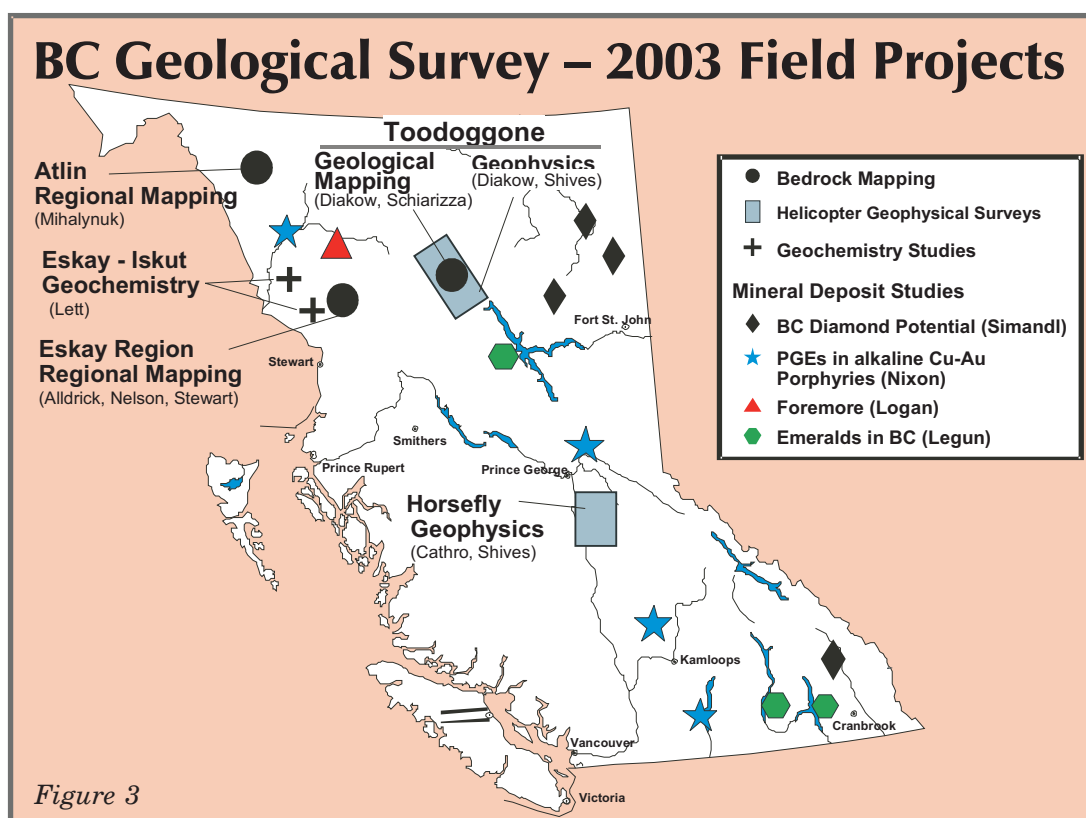
Figure 2. Drilling on the NAK (Jossa'lun) property by Imperial Metals and joint venture partner, Copper Ridge Explorations Inc. intersected widespread copper mineralization

Imperial Metals Corporation acquired the Jossa'lun discovery, made by Mitch Mihalynuk in 2002, and carried out a program of drilling, geophysics and geochemistry on the property in 2003. Along with expenditures by other companies in the area, the resulting exploration expenditures exceeded government's total cost for the regional mapping program, funded by the Targetted Geoscience Initiative.

In the Toodoggone River area, Larry Diakow initiated a regional mapping program to the north of and including the Kemess mine, to better define the magmatic, structural and lithological evolution of the Toodoggone mining camp. This program is targeted to complete 1:50 000 scale map coverage of the Toodoggone with complimentary regional geochemical and geophysical data. This new mapping work is critical to better developing an understanding of the geology and setting of the important Cu-Au porphyries in the northeast, such as the Kemess deposits, and the vein-type gold deposits such as at the old Baker and Shasta mines. As part of the BCGS efforts to develop geoscience partnerships, Steve Rowins of The University of British Columbia joined Larry in the field to ascertain how best to develop new graduate research to better characterize the porphyry setting of the Toodoggone area.

To the south in the Johanson Lake area, Paul Schiarizza started a mapping program to help extend coverage of the attractive Quesnel Terrane south from the Toodoggone Mining Camp. As an underexplored area, the regional geological understanding has been limited and Paul's new work will help define both the regional geology and provide a better indication of the economic potential of the many small mineral showings known to occur within the map area.

The Toodoggone and Johanson Lake regional



mapping and geophysical programs received significant funding and in-kind support from five industry partners who are working on various mineral properties in the region. Supported by combined funding from the TGI program and industry partners, the airborne magnetic and radiometric survey created renewed interest in the Toodoggone camp at a time when investment funding was difficult to acquire.

The BCGS started a two-year regional mapping program designed to better define distribution of the key stratigraphy hosting the Essay Creek mine in the highly prospective region to north of the mine along the Iskut River. Dani Alldrick and JoAnne Nelson completed 1:50 000 scale mapping in the Kiniskan Lake area. This work identified three new mineral showings in addition to those already documented and tested by exploration. Essay-facies rocks were proven to extend north to Kiniskan Lake and are correlative with the newly defined bimodal volcanics of the Willow Ridge.

Mineral Deposits

Jim Logan examined the Foremore massive sulphide mineralization in the More Creek area, located south of Dease Lake. Working from expertise acquired from earlier regional mapping, and taking advantage of significant new exposures as a result of glacial retreat, he was able to refine our understanding of the geology of these occurrences and identify at least one new stratigraphic interval within Paleozoic strata, with potential for VMS mineralization. In the southern part of the province, Jim continued work on the Iron Mask project near Kamloops where he and Mitch Mihalynuk have carried out mapping and age dating studies to attempt to better define the geology of the Iron Mask batholith and its relationship to porphyry deposits in the area.

Graham Nixon continued his project to study



Figure 4. Jim Logan (left) discusses the geology of the Foremore property with Roca geologists.

copper- platinum group mineralization in alkaline plutonic complexes by sampling the Afton deposit in central British Columbia. This is part of a provincial program of mapping and sampling a number of alkaline porphyries which is expected to better define platinum and palladium potential in alkaline porphyry deposits. The results from Afton indicate that PGEs are intimately associated with chalcopyrite and bornite but further work is required to better define the mode of occurrence as the current study relies on a limited number of samples enriched in PGE.

Industrial Minerals

George Simandl, started fieldwork focused on the diamond potential of British Columbia with an emphasis on northeastern BC. Funding for field and analytical expenses were provided by the Rocks to Riches program of the BC and Yukon Chamber of Mines. George and Danae Voormeij, a graduate student at the University of Victoria, also contributed to CO₂ sequestration research supported by the Resource Development and Geosciences Branch of the ministry. As the Branch's industrial minerals specialist, George also carried out property visits throughout southern and central parts of British Columbia and provided technical and marketing expertise and presentations to numerous clients.

Andrew Legun carried out a preliminary review and fieldwork related to better defining the geology, setting and potential for emeralds in British Columbia. This project was supported by funding from the BC and Yukon Chamber of Mines Rocks to Riches program. A summary of current activity and recommendations for new exploration work appear in Andrew's Geological Fieldwork paper for the 2003 field season and a final compilation will be published as a digital publication.

Regional Geochemical Survey Fort Fraser Area

Results of a stream sediment and water geochemical survey of the Fort Fraser area (NTS 093K) were released in June 2003 (BC RGS 57; GSC Open File 1766). The survey includes multi-element geochemical data from 795 sites covering about 10 500 square kilometres at a density of 13.2 square kilometres per sample. The survey led to identification of several gold and base metal anomalies which resulted in a seven fold increase in claim staking in the months following release of the Open File. Local First Nation band members were among those who staked claims, aided by a prospectors training program sponsored by the BC and Yukon Chamber of Mines

Geophysical Surveys

The first detailed airborne geophysical surveys since 1997 were completed under the Targeted Geoscience Initiative in the Toodoggone Mining Camp and a second survey, supported by the British Columbia and Yukon Chamber of Mines, was completed in the Horsefly-Mt. Polley area. Rob Shives and other staff of the Geological Survey of Canada helped to coordinate the surveys. These were aeromagnetic and multi-spectral gamma ray airborne surveys flown with a line spacing of 400 metres. The surveys are particularly helpful for identifying porphyry copper and copper-gold deposits. The Survey results, including data and maps were released to the public in early 2004 by making the entire geophysical dataset available from the Geological Survey website as Open Files 2004-8, 9 and 10 and as thematic layers on the MapPlace website.

The release of data in these formats created significant interest in the mineral potential of the selected survey areas and provided industry clients relatively rapid access to the new data.

GEOSCIENCE INFORMATION PROGRAM

The BCGS is the custodian for a number of important geoscience databases, including those for mineral occurrences (MINFILE), industry assessment reports (ARIS), regional geochemical surveys (RGS) and others. The Survey has also taken a leadership role in making this information available to clients over the Internet in formats that are accessible to individual prospectors as well as mineral industry companies. In 2003 the BCGS received an award from the BC government for its innovative MapPlace website described below.

MapPlace

www.MapPlace.ca

The MapPlace continued to be the premier portal for access to British Columbia geoscience information. The web site recorded over 2.5 million hits in 2003; many of them repeat visits by clients who now rely on the convenient access.

Larry Jones worked to improve the site, which included the addition of 450 new data layers and ten major functional improvements, including the new *MapperWrapper* facility which provides an ability to create layers and add map objects, such as lines, polygons, symbols, text and custom grids, to existing MapPlace basemaps. With this program, MapPlace can now be used for display of proprietary information in a restricted and secure environment resident only on the client's own computer.

Also added is a new *Image Analysis Toolbox* program resulting from a Rocks to Riches project with Cal Data Ltd. The IAT is a framework to add, process and display a variety of multi and hyperspectral imagery. The IAT includes Enhanced Satellite Imagery delivered by McElhanney Consulting Services Ltd.

A number of training courses on navigating the MapPlace were held throughout the Province.

MINFILE – ARIS Databases

Maintenance of the MINFILE database by Laura de Groot, Larry Jones and Ian Webster included updating deposit descriptions and addition of over 50 new occurrence descriptions and updates to more than 3800. The MINFILE web pages have been updated with enhanced searches and reports. Five mineral assessments in support of treaty negotiations with First Nations were completed.

Allan Wilcox coordinates review of mineral assessment report submissions by industry as part of the mineral tenure requirements. These reports are routinely scanned digitally and posted to the website. In 2003, a total of 340 reports were submitted. The Survey continues its program of scanning historic assessment reports with more than 1000 mineral and 360 coal reports completed and roughly two-thirds posted to the ministry web site by the end of the year. Approximately 500 geoscience reports were added to property file.

British Columbia Digital Geology Map

Nick Massey and Pat Desjardins continued to work on a new digital geological map of British Columbia. This map is being compiled in GIS format and is based on the best lithological mapping available. The initial data was compiled by all the geologists in the BC Survey as part of the province's mineral potential evaluation in the 1990s. Subsequently, new information has been acquired in the field and our understanding of the province's geological framework is constantly improving. A total of nine geological map tiles covering the province at 1:250 000-scale, were released as GeoFiles during 2003.

OTHER GEOSCIENCE INITIATIVES

A geochronology database, "BCAge", for British Columbia was compiled by Katrin Breitsprecher and Jim Mortensen of The University of British Columbia in cooperation with the BC Geological Survey. This new compilation of geochronological data for the Cordillera was first published as Open File 2004-3 by the BC Geological Survey and forms the

foundation for an ongoing program of compiling age data for the BC Cordillera. It contains over 7767 age determinations derived from over 4837 rock samples summarizing about 625 published manuscripts, theses or unpublished reports. The data is fully relational and compatible with a similar database prepared for the Yukon. Funding, and most of the age dates, for the database were provided by the BCGS and the Geological Survey of Canada.

REGIONAL OFFICES

Vancouver Mineral Development Office

The Vancouver Mineral Development Office provides the Lower Mainland geoscience community with access to key staff and geoscience and mineral industry information. The office has computer terminals for accessing MapPlace, MINFILE and mineral tenure, a library, rock collections and notice boards. Tom Schroeter, the Senior Regional Geologist, worked with the regional geologists to produce the annual '*BC Mineral Exploration Review*', which was published in late January, 2004 for the Mineral Exploration Roundup in Vancouver.

Regional Geology Offices

The Regional Geologists, part of the Mining Division, are based in Cranbrook, Kamloops, Prince George and Smithers. They provide assistance and advice to prospectors, exploration geologists, and land planners; monitor and report on exploration and mining activities; conduct property examinations and research; and promote mineral development in their parts of the province. They continued to lead and support the delivery of successful exploration conferences throughout the Province, such as Minerals North, CIM Branch Meetings, the Kamloops Exploration Conference, Smithers Rock Talk and Mineral Exploration Roundup. Through posters and oral presentations, the Regional Geologists promote BC's exploration and mining opportunities at national and regional meetings. Public outreach activities included participation in trade shows and school visits.

The RGs are responsible for producing '*Exploration and Mining in British Columbia*', an annual review of mineral activity which is usually published in late spring. These reports continue the tradition of the valuable Minister of Mines Annual Reports, published since 1874.

PUBLICATIONS AND WEBSITE

www.em.gov.bc.ca/geology/

Geoscience publications in hardcopy and digital format are the prime vehicle for disseminating new geoscience information.

During the year the Survey published 5 Open Files, 7 Geoscience Maps, 1 Paper, *Geological Fieldwork 2002*, *Exploration and Mining in BC 2002*, 23 GeoFiles and numerous other brochures and print products. As well, the BCGS assisted publishing 2 GeoFiles and 4 geoscience maps by other groups.

The Survey presented about 30 geoscience posters at the annual Mineral Exploration Roundup and other mining-related meetings around the province. Ministry staff also presented new geoscience information and reviews of government and industry activity through numerous presentations and workshops at regional meetings.

The Survey continues to convert its historic, geoscience publications to digital format and post these products on the website for free access by the public. All new geoscience maps and reports are routinely made available in a digital format from the website.

MINISTER'S TECHNICAL LIAISON COMMITTEE

The Minister's Technical Liaison Committee reviews the British Columbia Geological Survey's program bi-annually. They provide critical direction on how the Survey can best serve clients from outside government, such as the mineral industry and universities. The Committee recognized the role of the new program of formal public-private partnerships to provide operating funds for geoscience activities during a period of declining government funding. However, they viewed the heavy reliance on P3s in fiscal year 2003-04 as a "stop-gap" measure and recommended that the Survey strike a better balance of funding sources in future.

The members of the 2003 Technical Advisory Committee for the BCGS were Wayne Roberts (Chair), Ben Ainsworth, Lindsay Bottomer, Peter Bradshaw, Rob Cameron, Dave Caulfield, Fred Daley, Peter Holbek and Steve Rowins.

Alberta Program Highlights 2003

MINERALS PROGRAM – OVERVIEW FOR 2003

During 2003, the Alberta Geological Survey (AGS) Minerals Section continued regional (1:250 000-scale) mapping and thematic studies. The objective was to improve Alberta's geoscience base, particularly in northern Alberta, in support of mineral exploration and economic development. The AGS Minerals Section continued to work collaboratively with the Geological Survey of Canada (GSC) on two new federal-provincial initiatives that began April 1, 2003 and extend to March 31, 2007. These are funded federally under the:

- ✧ Northern Resources Development (NRD) program, entitled "*Shallow Gas and Diamond Opportunities in Northern Alberta and British Columbia*" (a joint initiative with contributions by the GSC, AGS and BC Ministry of Energy and Mines);
- ✧ Targeted Geoscience Initiative #2 (TGI 2) (a joint initiative with contributions by the GSC and AGS).

Mineral Resources Program

Alberta is known for its wealth of energy resources and its continued investment in the subsurface of the Alberta sedimentary basin has produced world-class datasets. Despite recognition that Alberta has similar geological characteristics to numerous non-energy mineral deposit environments throughout the world, the shallow subsurface to surficial geology of Alberta is virtually unmapped at the level of detail needed for mineral exploration. Rock assemblages and tectonic features in Alberta provide the conditions in which, for example, diamondiferous kimberlites, SEDEX base metal, epithermal (lode) gold and Mississippi Valley type (MVT) lead and zinc deposits may be found. The mineral resources program focuses on baseline mapping and thematic studies in support of metallic/non-metallic minerals, diamonds, industrial minerals and aggregate (sand and gravel). The activities during 2003 included

- ✧ Quaternary surficial mapping of the geology of northern Alberta at 1:250 000-scale of the Zama Lake (NTS 84L) map area (in collaboration with GSC).
- ✧ Quaternary stratigraphy, drift thickness and bedrock topography in northwestern Alberta (NTS 84L).
- ✧ Ongoing study of the Proterozoic Athabasca

Group and underlying basement in northeastern Alberta with an intent to provide information of interest to the uranium exploration industry, and resolve the previously existing provincial border 'fault' between Alberta and Saskatchewan. As well, completion of an MSc study (by Ms B. Kupsch at the University of Alberta) of the Maybelle River uranium prospect in northeastern Alberta.

- ✧ Ongoing study of the regional basement and structures in northern Alberta.
- ✧ Mineral-aggregate and industrial minerals studies and mapping. Compilation to a digital format of the previously completed aggregate mapping for parts of Alberta is complete, and the focus during 2003 was to get as much as possible of these data released, particularly via the internet.
- ✧ Ongoing petrographic, geochemical and isotopic characterization of Alberta kimberlites. This included assisting with the 8th Kimberlite Conference Field Trip which was run through northern Alberta and the NWT during June and July 2003.
- ✧ Completion of the Mississippi Valley-type (MVT) Pb-Zn carbonate TGI 1 (April 1, 2001 to March 31, 2003) studies, and preparation of final papers for inclusion in a GSC final summary volume.
- ✧ Under the NRD-TGI 2 program, further geochemical stream sediment and water surveys in the northern portion of the Buffalo Head Hills (portions of northwestern NTS 84B, and southern NTS 84F and 84G). As well, a joint release of GSC Open File Report 1790/AGS Special Report 66 that documented the results from the geochemical stream sediment and water surveys done during 2001 and 2002 in the northwestern part of NTS 84B.

Metallic, Non-metallic and Industrial Mineral Assessment and Activities

During 2003, approximately 2.2 million hectares were staked in Alberta, and to December 2003 the total area in good standing included 10.6 million hectares. In 2003, about \$590 000 was filed for assessment, a significant decrease from the \$12.4 million filed in 2002.

The majority of exploration in 2003 continued to

focus on diamondiferous kimberlites, with attention also directed to precious-base metal deposits in northern Alberta, uranium in the Athabasca Basin of northeast Alberta, and paleoplacer titaniferous magnetite deposits in southwestern Alberta near Burmis, and in north-central Alberta in the Pelican Mountains.

A total of 48 kimberlites have been discovered in Alberta to the end of 2003; these include 2 at Mountain Lake in northwestern Alberta, 38 at Buffalo Head Hills in north-central Alberta and 8 at the Legend area in the Birch Mountains in northeastern Alberta. Of the 38 pipes discovered in the Buffalo Head Hills area, the best results are from K252, where a 22-tonne sample yielded an estimated diamond content of 55 carats per hundred tonnes. During 2003, diamond exploration was mainly focused at the Buffalo Head Hills area in north-central Alberta, where Ashton Mining of Canada Inc has discovered kimberlites (*e.g.*, K252, K296 and K300) by using airborne or ground electromagnetic methods, instead of using magnetic method alone. As a result, Ashton has recently announced a \$650 000 exploration program to follow-up by ground geophysical surveys at ten other airborne electromagnetic anomalies; all or some of these targets may be diamond-drill tested during summer 2004.

At the Maybelle River uranium prospect in the Alberta portion of the Athabasca Basin, Cogema Inc recently reported intersections of up to 40% U³O₈. This is a definite improvement over prior drill results from 1980s, where a 5-metre core-length intercept of 23% U³O₈ was reported. However, as yet, Cogema has not released any detailed information about the average grade, dimensions and geometry

of the Maybelle River uraniferous zone.

At the Pelican Mountains magnetite paleoplacer deposit, which is about 200 km north of Edmonton, CoreMetric Development Corp recently stated they plan to mine the deposit as an 'iron feedstock' for cement making at Inland Cement in Edmonton. This deposit consists predominately of magnetite, ilmenite and rutile in a northwesterly trending paleo-beach strand deposit within the Wapiti Formation. A resource estimate completed in 2000 by Blue Diamond Mining Corporation reported a total inferred resource of between 900 000 and 1 250 000 tonnes with 15% to 18% magnetite, 21% to 24% rutile, and 33% to 36% ilmenite. A 40 000 to 45 000-tonne iron, per year, quarry operation will crush material onsite and transport the iron ore to Edmonton.

In southwestern Alberta, Micrex Development Corp submitted a proposal for development of the Burmis magnetite deposit, which is on the eastern slopes of the Livingstone Range north of the town of Burmis. The deposit is hosted by Late Cretaceous Belly River Formation sandstone, and crops out or is traceable via magnetic surveys for distances of over 12 km, and reaches a thickness of up to 4 m. The proposed quarry would produce approximately 40 000 tonnes of product per year as feed to a proposed newly constructed grinding and upgrading facility. The product will apparently be used mainly for coal beneficiation at the Elk Valley coal mines in southeastern British Columbia.

Alberta has a long history of industrial mineral production. Production value is down slightly, but is quite stable at about \$600 million. At present, the

Assessment Report Submissions in Alberta

Summary	Year 2001	Year 2002	Year 2003
Number of permits worked on	242	148	11
Hectares worked	2,030,682	1,079,044	44,810
Work expenditure	\$2,516,600	\$12,356,000	\$590,000
Geophysical Work			
Airborne geophysics line km	4,807	11,536	0
Airborne geophysics expenditures	\$120,103	\$1,079,044	\$0
Ground geophysics line km	477	751.2	62.5
Ground geophysics expenditures	\$306,206	\$1,306,459	\$95,621
Drilling			
Metres drilled	1,127	33,430	497
Number of drillholes	11	370	12
Drilling expenditures	\$416,667	\$7,268,510	\$114,151

main production is from limestone for cement and lime, sand and gravel for mineral aggregate. There is also production of salt, clay and a few other commodities. The need to plan for aggregate resource mining was highlighted by development appeals in the Calgary area, one of the largest aggregate consuming regions in Alberta. Discussions are underway within

ENERGY PROGRAM – OVERVIEW FOR 2003

The Energy Section completed two significant reports in 2004 on coalbed methane (CBM) producibility in Alberta. Each received wide attention in the technical community and in the media. The topics pertained to geological controls on CBM production and the chemical quality of groundwater in coal aquifers. Through distribution of CDs and direct downloads of PDF files from the AGS website, these reports vaulted into the ranks of the most popular AGS reports ever in a mere two weeks following public release. The Energy Section continued to focus on the geological characterization of Upper Cretaceous-Tertiary strata in Alberta, but with a renewed focus on the structural controls on productivity trends in unconventional gas.

The Energy Section completed several government-client reports pertaining to the geology and hydrogeology of deep injection and the sequestration of acid and greenhouse gases (H_2S and CO_2) for the reduction of both H_2S and CO_2 emissions into the atmosphere. These reports and related work have been captured in a new AGS webpage devoted to progress on this topic. This webpage is GIS-enabled to allow Internet users to search and query AGS data holdings on acid-gas and greenhouse-gas injection.

The Energy Section continued work in support of regulation of oil sands development in northeastern Alberta. Work continued on mapping the hydrogeology of drift aquifers in the Cold Lake-Beaver River drainage basin in partnership with Alberta Environment. This work, which will be completed in 2004, will form the technical basis for a new Water Management Plan for the drainage basin. The Energy Section also undertook a major mapping effort in the Athabasca Oil Sands Area as part of the EUB's Regional Geological Study in support of adjudicating the long-running and contentious gas-over-bitumen dispute. This effort contributed to a new understanding of the distribution of gas pools and potentially commercial bitumen accumulations in Athabasca. It will be used by EUB to adjudicate disputes wherein bitumen leaseholders are arguing that their long-term thermal recovery projects are being adversely affected by gas production in adjoining gas deposits.

The Energy program includes a large measure of

the Alberta government to develop a more coordinated approach by selected government departments, municipalities, the Alberta Geological Survey and industry towards aggregate resource planning.

direct regulatory support to the EUB and to other provincial agencies. In 2003, the Energy Section provided technical expertise on regulatory topics, including:

- ✧ suitability of oil and gas reservoirs for enhanced recovery by CO_2 injection;
- ✧ scope and nature of CBM development and participation in public meetings;
- ✧ participation in joint provincial-federal review teams and hearing panels on oil sands, mine environmental impact assessments and mine applications;
- ✧ groundwater-monitoring network design at in-situ oil sands projects; and
- ✧ regional geological suitability for carcass disposal in event of foreign animal disease.

GEOSCIENCE SUPPORT SECTION

This section provides administrative, financial, clerical, communication and information technology support to the Alberta Geological Survey (AGS). It also manages and operates the AGS Library, the Information Sales office and the AGS Internet site at:

www.ags.gov.ab.ca

As a member of the NEOS Library Consortium, the AGS Library strives to offer improved service to its patrons each year. A review of library services completed this year confirmed the value of the library services to AGS geoscientists. The library continues to offer an increasing number of digital products and services each year, including full-text, online journals, reference database searching and internet searching. The library webpage can be found on the AGS Internet site.

The AGS Information Sales office continues to move toward distributing AGS publications as digital products. All new publications are available in digital format and more are becoming available as PDF files on the AGS Internet site.

A new service was added to the AGS Internet site this year in the form of a Web Map Service featuring

spatial datasets from the geological map of Alberta, hydrogeology/water well chemistries and AGS RADARSAT-1 data holdings. In addition, new information on coalbed methane, Alberta kimberlites and greenhouse gases and CO₂ sequestration in geological media was published on the site.

Over the past decades, AGS has amassed a large amount of geological data and information in a variety of formats. Many AGS staff will retire in the next decade, and this would have resulted in a significant loss of knowledge about this legacy information. Therefore, a first round of culling and indexing occurred to capture the staff members' knowledge about this material. This led to a decision to create a software system, based on the Federal Geographic Data Committee spatial metadata standard, to capture metadata about the legacy information. Now, newer staff members are familiarizing themselves

with AGS legacy information holdings as they refine the information captured during the first review using the new metadata capturing application.

AGS continues to be an active contributor to the Canadian Geoscience Knowledge Network (CGKN). Several staff members contribute to the following CGKN working groups:

- ✧ metadata
- ✧ mineral deposits
- ✧ geochemistry
- ✧ surficial geology

In addition, AGS staff attended the CGKN annual meeting in Toronto where they made a presentation on the state of information management at the Alberta Geological Survey.

Saskatchewan Program Highlights 2003

The Saskatchewan Geological Survey, which comprises the Petroleum Geology and Northern Geological Survey branches, continued to deliver a diversified geoscience program focused on supporting the exploration for, and development of, the province's mineral and hydrocarbon resources. Several major projects are nearing completion, and new initiatives and partnerships are being developed to replace them. Most research is undertaken in partnership with the Geological Survey of Canada, various universities, industry and, in some cases, other provincial government departments.

PRECAMBRIAN GEOLOGY AND METALLIC MINERAL DEPOSITS

Three major mapping projects begun in previous years continued and one new project was initiated:

- ✧ In the northeast corner of the province, 1:100 000-scale bedrock mapping of the northern half the Phelps Lake map area (NTS 64M) was completed. This project was undertaken in order to identify mineral development opportunities and to provide background geoscience information to help in the selection of the boundaries of a large Representative Areas Network site (park) proposed for the area. A project synthesis report is in preparation and 1:250 000-scale, digital bedrock and surficial geology maps are being prepared for the Phelps Lake map sheet (NTS 64M).
- ✧ Bedrock and surficial mapping continued in the Peter Lake Domain, which is perceived to have a high potential for platinum group elements. In 2003, mapping focused on the southeastern part of the domain along the west Shore of Reindeer Lake. In partnership with the Geological Survey of Canada, a multiparameter airborne geophysical survey of the Peter Lake Domain was begun. Due to weather and technical problems the survey will not be completed until the summer of 2004.
- ✧ Work resumed on the Uranium City Project with bedrock mapping focusing on the eastern Zemlack domain, west of Uranium City. This is the continuation of a long term project to improve understanding of the thermo tectonic history and metallogenesis of the Rae Province north of Lake Athabasca. A new but related component of this project involves the development of a metallogenic database for the Tazin Lake map sheet NTS 74N. The purpose is to improve understanding of the mineral potential

of this polymetallic district.

- ✧ A new project was begun that entails a series of bedrock mapping transects of the Rottenstone Domain in the northwest margin of the Trans Hudson Orogen. This work will provide insight into the thermotectonic history of the Rottenstone Domain and the context of mineral occurrences hosted there. The first transect, which was partially completed, was through the central Rottenstone Domain in the vicinity of the Rottenstone Mine.

The EXTECH IV - Athabasca Uranium Multidisciplinary Study, a partnered 3 year investigation of the Athabasca Basin and its uranium deposits, is in the wrap-up stage. Work on the 15 subprojects is completed; key results were presented to the project partners in a series of workshops and a project synthesis volume is in preparation. In addition to Saskatchewan Industry and Resources, other funding partners were the Geological Survey of Canada, Cameco Corporation, COGEMA Resources Inc and the Alberta Geological Survey (AGS).

To facilitate and help focus the renewed interest in gold exploration in the La Ronge and Glennie domains, a program was begun to undertake detailed structural investigations of selected deposits. Work in 2003 focused on the Seabee and Bingo deposits.

INDUSTRIAL MINERALS

Work continued on the "Diamondiferous Kimberlites of Central Saskatchewan" project. The project, initiated late in 2001, and partially funded through the Geological Survey of Canada's Targeted Geoscience Initiative and successor Targeted Geoscience Initiative 2 program, is a multi-disciplinary federal-provincial-industry-university project designed to facilitate and promote further diamond exploration in Saskatchewan. During 2003, the project team continued detailed logging of drill core, while processing and interpretation of 2-D and 3-D seismic data continued. A volcano-stratigraphic framework that defined units on the basis of petrologic, geochemical and geophysical characteristics was developed. The time-stratigraphic relationships of the kimberlites and the Cretaceous country rock were refined based on detailed micro-paleontology. Three-dimensional modeling software was employed to elucidate the relationships between the various volcano-stratigraphic units, their feeder systems and the Cretaceous country rock.

Additional data was committed to the Saskatchewan *Kimberlite Indicator Mineral Database*, a searchable internet resource at:

www.ir.gov.sk.ca/dbsearch/SaskKimbQuery/

A review of geochemical and geophysical data relevant to diamond exploration led to staking of new claims for diamond exploration over geophysical targets.

A draft report on the gold potential of the Cypress Hills Formation (a Tertiary quartzite-chert gravel, which caps high ground and fills pre-glacial valleys in the province's southwest) was completed. New ground was staked southwest of Swift Current in response to the presentation of preliminary results.

Limited fieldwork on the province's sodium sulphate resources was carried out, as the project moved into a wrap-up phase.

A draft report of the province's coalbed methane potential was completed. Evaluation of the resource and preparation of the report for publication continues.

PETROLEUM GEOLOGY

The five and ten-year research programs are in advanced stages of development, both for the Petroleum Geology Branch and for a collaborative of provincial geoscience agencies and, industry. This will enable the multidisciplinary, structured approach to developing a geoscience framework in the 40 000 km² Weyburn CO₂ Monitoring and Storage Project to be extended throughout the rest of Saskatchewan's Phanerozoic strata.

The current research activity of Saskatchewan Industry and Resources (SIR) Petroleum Geology Branch (PGB) primarily focuses on:

- the development of a Geoscience Framework (Task 2) for the International Energy Agency (IEA) Weyburn CO Monitoring and Storage Project,
- the study of shallow gas potential in the Shackleton area and elsewhere east of current production in southwestern Saskatchewan, and
- in conjunction with NRCan and the Manitoba Geological Survey, the implementation of a multi-disciplinary geoscience study in eastern Saskatchewan and southwestern Manitoba through NRCan's (GSC) Targeted Geoscience Initiatives (TGI 2) program.

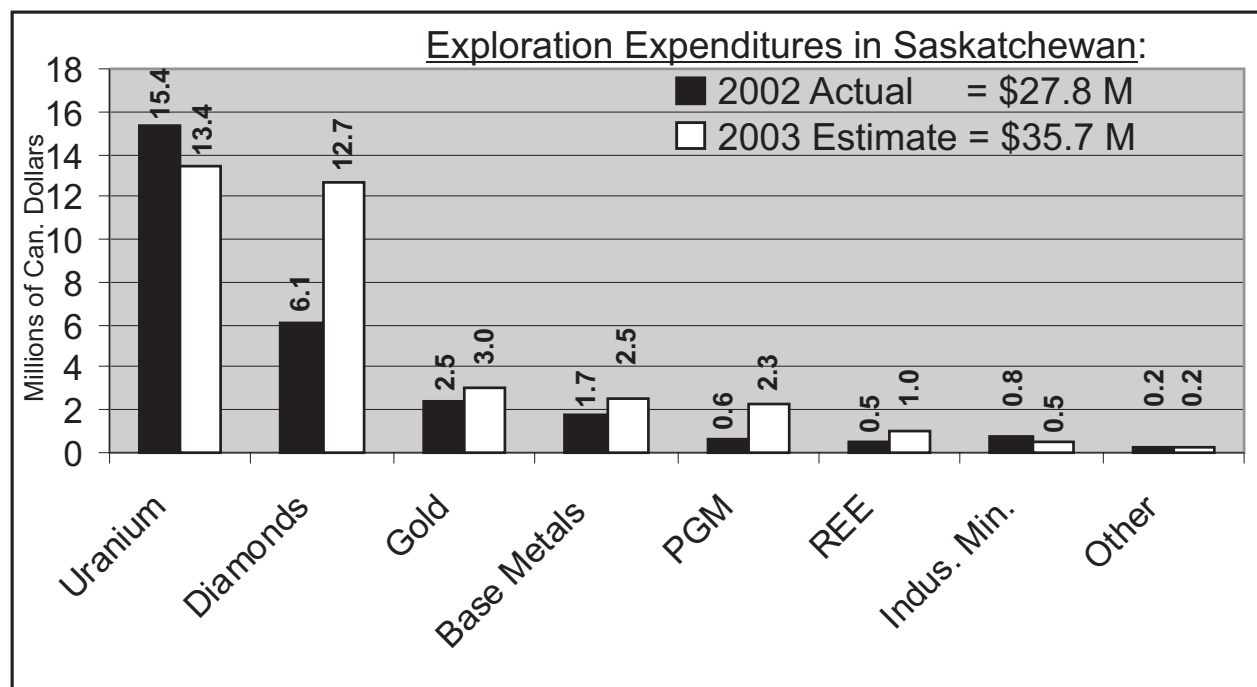


Figure 1. Mineral exploration expenditures in Saskatchewan. Data in histogram compare actual expenditures for 2002 with estimates for 2003 which are compiled from the annual survey of exploration expenditures by the Saskatchewan Geological Survey.

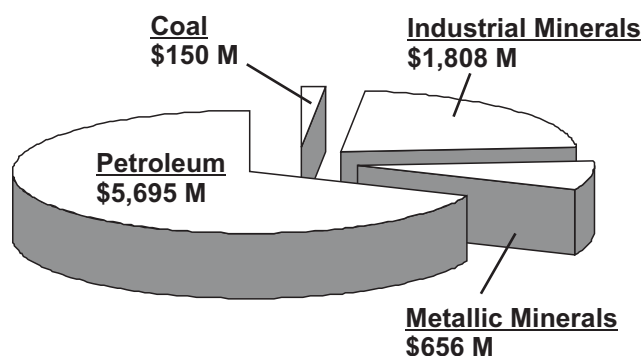


Figure 2. Breakdown of the gross values of the non-renewable resources in Saskatchewan in 2002. Data from the Mines Branch, Sask. Industry and Resources.

In the (IEA) CO₂ project, several PGB staff members, with support from five contracted geological and GIS consultants, have been responsible for mapping and interpreting the geological history of the full stratigraphic section from basement to the Upper Cretaceous Bearpaw Formation in the Canadian part of the 200 x 200-km project area.

Jointly with the North Dakota Geological Survey (NDGS), the PGB released a test version (on CD) of isopach and structure maps of Devonian strata in the project area, and plans to release maps of all Mississippian and younger strata in early 2004. It has also been co-ordinating another 11 geoscience framework studies, which include hydrogeology, till characterization, reflection seismic, remote imagery analysis, soil gas monitoring, high-resolution aeromagnetic data analysis, describing natural CO₂ reservoir analogues elsewhere in Saskatchewan, and a special coring and logging program.

Results from these Task 2 studies are being integrated to establish a comprehensive geoscience framework that will help identify geological controls of CO₂ migration and storage within the geosphere. This information will be used to address requirements of those project researchers who are responsible for assessing performance and risk associated with long-term CO₂ storage in the Weyburn Midale reservoir.

Of the project's total funding of approximately \$20.5 million, about \$2 million have been spent on Task 2. In 2003, presentations about the Geoscience Framework component of the project were delivered to delegates attending the 11th Horizontal Well and Petroleum Conference in Regina, the 2nd Annual National Energy Technology Laboratory Conference on Carbon Sequestration in Washington DC, and the CSPG/CSEG Joint Convention in Calgary. The first

Gross Value of the Major Industrial Minerals, 2002
Total = \$1,807 M

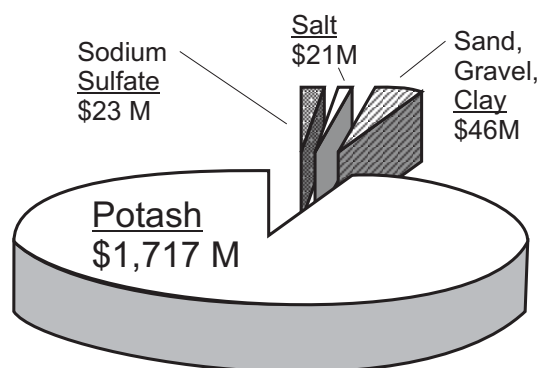


Figure 3. Value of the major industrial minerals in Saskatchewan in 2002. Data from Mines Branch, Sask. Industry and Resources.

major release of Weyburn project results into the public domain will be at the 7th International Conference on Greenhouse Gas Control Technologies (GHGT-7) in Vancouver in early September, 2004.

Preliminary results of shallow gas studies were published in the *Summary of Investigations 2003*, Volume 1, Saskatchewan Geological Survey (MR 2003-4.1), which is posted on the SIR website at:

www.ir.gov.sk.ca/Default.aspx?DN=3938,3442,3440,3385,2936,Documents

PGB-industry communication has been active and effective throughout 2003 as efforts are made both to improve understanding of geological controls on the province's shallow gas accumulations and to discover new occurrences.

The two-year, \$780 000 TGI 2 project, Williston Basin architecture and hydrocarbon potential (Phase 1), has presented participants from all three jurisdictions with logistical challenges. Consequently, geoscience studies were not fully in place by the end of 2003. The TGI project area surrounds the Canadian portion of the Weyburn CO₂ project. Plans therefore call for the expansion of major research components of that project including regional subsurface geological mapping, reflection seismic, regional hydrogeology and remotely sensed imagery, as well as for introduction of new components such as gravity investigations and assessment of hydrocarbon potential. This project is due for completion at the end of 2004-2005.

In 2003, other initiatives in which PGB was active included:

- a) Cretaceous Colorado Group rocks, in particular the Milk River of the Shackleton area where new shallow gas development is taking

place with industry-based estimates of ultimate reserves in the area is 14 x 109 m studying Paleozoic strata, in particular those of Devonian age,

- b) finalizing annotated digital and hard-copy 1:2 000 000-scale structure and isopach maps of the province's main Lower Paleozoic stratigraphic units,
- c) releasing Dr J.E. Christopher's Report 223, *Jura-Cretaceous Success Formation and Lower Cretaceous Mannville Group of Saskatchewan*, in digital format,
- d) rewriting relevant sections of Geology, and Mineral and Petroleum Resources of Saskatchewan (MR 2003-7),
- e) organizing, with the NDGS, the 11 Williston Basin Horizontal Well and Petroleum Conference,
- f) publishing the 2003 Summary of Investigations (MR 2003-4.1),
- g) updating the digital Saskatchewan Stratigraphic Correlation Chart,
- h) completing, with NRCan (GSC) Geoscape Southern Saskatchewan, and
- I) supporting three University of Saskatchewan and one University of Regina geoscience research programs in the Phanerozoic subsurface.

Five and ten-year geoscience-research programs continue to be refined, both for the PGB and for possible collaborative studies. The Williston Basin TGI 2 project is an example of the kind of post-Weyburn initiative that enables resulting experience and expertise to continue benefitting the province, as is the

South Central Block project which is planned to commence in 2004. Guidance in formulating these long-term programs is provided by the Southern Saskatchewan Geological Resources Advisory Committee (SSGRAC), made up of four geoscientists from industry, two from academia and one from each the federal and provincial governments. SSGRAC met several times in 2003 and continues to monitor PGB progress.

In May 2003, Simon Hanmer, Mark Williamson and other NRCan (GSC) staff met with SIR geoscientists to explore issues and long-term programs of relevance to the proposed cross-Canada Co-operative Geological Mapping Strategies (CGMS). Later, at the Western Canada Sedimentary Basin (WCSB) Working Group's 4th annual meeting in Calgary, a main item of discussion was the potential for GSC to resume work in the Western Canada Sedimentary Basin, likely through implementation of CGMS. The need was recognized to have CGMS placed on the agenda of the Energy Ministers' Conferences in 2004, and the creation of a related communication plan was discussed.

During 2003, one research geologist was hired, bringing the total number of research geologists on staff to eight, six of whom are at a senior level, and enhancing PGB's geoscience research capacity. The branch's regulatory data-management functions were affected by the province's high drilling activity

4157 oil and gas wells were drilled compared with 3478 wells in 2002. PGB staff members have been hard pressed to process the large volume of well data and some backlogs have resulted. Use of the Subsurface Geological Laboratory for core and sample examination has been modest, especially consid-

Table 1. Annual exploration expenditures in Saskatchewan: 1991- 2004

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004**
Uranium	9.69	8.07	7.25	11.06	12.54	16.76	27.32	22.4	14	17.74	14.02	15.43	13.27	14.11
Diamonds	2.67	4.19	3.99	10.14	3.76	5.72	2.3	1.01	1.43	4.11	4.77	6.06	11.71	22.63
Gold	5.03	5.5	2.17	3.67	8.38	7.42	3.5	2.76	0.95	0.73	1.01	2.46	2.87	3.34
Base Metals	5.65	3.8	4.15	4.18	3.96	5.2	10.11	3.68	5.64	4.47	1.39	1.73	2.23	1.15
PGM	—	—	—	—	—	—	—	—	0.91	1.02	0.14	0.59	0.49	0.1
REE & Other	—	0.25	0.55	0.1	—	0.32	0.15	0.21	0.81	0.14	1.58	1.51	0.45	0.1
Total	23.04	21.81	18.11	29.15	28.64	35.42	43.38	30.06	23.74	28.21	22.91	27.78	31.02	41.43

* Data published annually in "Exploration and Development Highlights", Saskatchewan Industry and Resources

** Data from a preliminary survey by Natural Resources Canada.

ering the high drilling activity.

COMPUTERIZATION

Digital product and processing capability continues to develop not only in the Saskatchewan Geological Survey but also throughout the Saskatchewan Department of Industry and Resources. GIS software is being used to aid in map production and geological interpretation. All current Precambrian geology maps included with the Summary of Investigations are produced using ArcMap and Microsoft Access on digital bases provided by Information Services Corporation (ISC). The colour maps and associated data files are available digitally and on a plot-on-demand basis. PDF file representations of the maps are available for viewing and downloading at the department's website. The Geological Atlas of Saskatchewan CD-ROM version 6 (2003), released at the 2003 Open House Meeting in early December, includes new datasets as well as updates and enhancements of datasets included on previous releases.

The Saskatchewan Geological Survey is represented on several Canadian Geoscience Knowledge Network (CGKN) working group committees whose purpose is to investigate and develop methods to establish computerized links to all government geological surveys in Canada and provide national and international access to Canadian geoscience knowledge. The Saskatchewan portion of the CGKN On-line Geoscience Metadata Catalog, which allows textual and graphical searches of available publications, is available on a GSC server with plans to move it to a local server. Other representation includes the Geochem On-line, Surficial Geology and Mineral Deposits working groups.

The internet site for the Saskatchewan Survey (www.ir.gov.sk.ca) was rebuilt in 2003 with many enhancements and additions. The new on-line Publications Centre allows users to search and order department geoscience publications. An ArcIMS map server (http://142.165.150.133/website/SIR_Geological_Atlas) contains most of the layers available on the Geological Atlas CD. Data layers can be displayed, queried, and downloaded. The Mineral Dispositions layer is presently the only one kept current.

MINERAL RESOURCE ASSESSMENTS

Regional mineral resource assessments (MRAs), of known and potential mineral and oil and gas resources, are being done in response to Saskatchewan's Representative Areas Network program to preserve areas of ecological diversity, and various re-

gional integrated land use planning processes. They are also available upon request to provide a source of information for industry and government clients.

In 2003, updates of 4 NTS map sheets were completed at a scale of 1:250 000. These included the Amisk Lake (NTS 63L-K), Pelican Narrows (NTS 63M-N), and Reindeer Lake South (NTS 64D) map sheets using the new digital bases. All of the maps for the province are now on the digital bases. The Reindeer Lake North (NTS 64E) map sheet was also updated from a 1999 assessment. The goal is to update all of the 44 assessments at least every 5 years. Developed by the Ontario Geological Survey, the mineral assessment methodology is qualitative and integrates, through a structured process, geoscience and mineral and oil and gas exploration and development data with assessment criteria derived from descriptive mineral deposit models. Participation of the mineral and oil and gas industries is a critical component of the process. Digital geological compilation and mineral and petroleum assessment maps in AutoCad are the main products of the assessments. The MRA maps in the north have been upgraded to an Arcview GIS format and are available on the Geological Atlas of Saskatchewan.

EXPLORATION AND DEVELOPMENT

Minerals

Surface mineral exploration was robust in Saskatchewan in 2003. Uranium, diamonds and gold were the primary focus. Total annual expenditures are estimated to be \$35.7 M, up about 29% from the actual total annual expenditures in 2002 of \$27.78 M (Figure 1). Production in 2003 included uranium, copper, zinc, gold and silver, and potash and numerous other industrial minerals.

The Athabasca Basin continues to be the world's premier exploration district for high grade uranium deposits. Although exploration budgets in 2003 decreased slightly from the previous year, a steady rise in the spot market price of uranium during the past 30 months bodes well for future activity. Global uranium industry leaders Cameco Corporation and COGEMA Resources Inc are the most active, but more than a dozen companies are active. Programs span reconnaissance work utilizing sophisticated geophysical methods to target deeply buried deposits, regional target testing and follow-up target delineation by diamond drilling, and aggressive mine-area exploration.

Diamond exploration in the Fort à la Corne District located northeast of Prince Albert in central Saskatchewan was robust in 2003. On October 1, more than 50 companies and individuals held a total

of 648 000 ha. Total expenditures are forecast at \$12.7 M, up significantly from the actual total expenditure in 2002 of \$6.0 M (Figure 1). The Fort à la Corne Joint Venture completed a major diamond drill program on numerous kimberlites to follow-up results announced for 2000-2001 and 2002 bulk sample programs, Shore Gold began shaft sinking for its underground bulk sampling program on the Star Kimberlite, and the first kimberlite discovery in the district since 1996 was made on the East Side Diamond Property by Forest Gate Resources. Overall, the advancement of capital-intensive diamond evaluation projects reflects a positive long-term view for the exploration potential of the district.

Gold exploration expenditures are forecast to exceed \$3 M, up about 25% compared to last year, and four times higher than in 2000. Work is being done by junior exploration companies and small-cap mining companies. Aggressive exploration around its Seabee Mine by Claude Resources was successful and will be continued in 2004. In the La Ronge Gold Belt, work by Golden Band Resources spanned reconnaissance geochemistry to winter drilling of established targets, mostly on a large and consolidated land holding centered on the Jolu Mill complex. Select high grade intersections will be followed up in 2004, and economic models are being developed to evaluate the central processing of high grade ore from numerous satellite bodies. The steady increase in gold exploration parallels the rise in gold price from the month-end close of US\$264.80 on Oct 31, 2000 to the close of US\$411.10 Jan 16, 2004.

Exploration levels for base metals remained low in 2003. Persistent evaluation of targets in the Flin Flon Domain and its southern extension under Paleozoic cover continued by Hudson Bay Exploration and Development Corporation. Leader Mining is arranging financing to re-evaluate and further explore the nearly 20 Mt Knife Lake copper-zinc deposit to the northwest of Flin Flon in the Glennie Domain. Sediment-hosted copper showings around Janice Lake in the Wollaston Domain were staked by Phelps Dodge Corporation of Canada Ltd, in 2002 and explored in 2003; work included prospecting, ground-based geophysics, geochemistry and diamond drilling.

Exploration of select rare earth and rare metal prospects in northern-most Saskatchewan continued in 2003. Great Western Minerals obtained additional material to continue metallurgical testing of the extensive, and open, JAK zone at its Hoidas Lake Property.

On the production side, mineral resources continued as one of the cornerstones of the provincial economy. Overall, the non-renewable resources, including petroleum, coal, metallic and industrial min-

erals are the most important primary industrial sector, accounting for 12.8% of the provincial GDP in 2002 compared to about 5.7% for agriculture, and just under 40% of the gross value of provincial exports in 2001 (Figure 2). Saskatchewan is the second-ranking province in oil production, and third-ranking province in both gas and coal, and the third-ranking province in gross, non-fuel mineral production. Industrial and metallic minerals were valued at \$2.46 B in 2002, and they generated more than \$250 M in direct crown revenues. Metallic mineral production in 2003 included uranium, gold, copper, zinc, and silver. Industrial mineral production includes potash, aggregate, salt and sodium sulfate, and minor bentonite and structural clay.

The mines of the Athabasca Basin in northern Saskatchewan, and those of the Prairie Evaporite in central Saskatchewan, continue to be the world's most important supply of uranium and potash respectively. In 2002, Saskatchewan produced 100% of Canada's uranium from five operations, and accounted for 34% of world output. Saskatchewan produced 95% of Canada's potash from ten underground operations including two solution mines, and accounted for about 33% of world production and 43% of world trade. Potash reserves are extensive.

There was uranium production from three operations in 2003, Rabbit Lake, McClean Lake, and the McArthur River / Key Lake operations. Mining at McArthur was temporarily suspended in the second quarter because of underground flooding. Site preparation work continued in 2003 at the Cigar Lake Mine, which is targeted for start-up in 2006 providing all of the necessary permits are received. Global uranium industry leaders, Cameco Corporation and COGEMA Resources Inc, operate all of the aforementioned mines and processing facilities and control about 57% and 35% respectively of identified reserves in the basin. Total production of uranium in 2002 was approximately 12 684 t of uranium (32.98 M-lb U_3O_8), virtually unchanged from the 2001 annual output of 12 586 t U (32.72 M lb U_3O_8). Forecasts for total annual production for 2003 are down about 33% from 2002 due mainly to the temporary shutdown at McArthur. The spot price for uranium has continued to rebound from the all time low of US\$7.10/lb U_3O_8 at the end of 2000. The restricted spot price was US\$9.30 on October 1st 2001, and it rose to US\$9.75/lb U_3O_8 by October 1st 2002. The price rise continued through 2003, and has increased significantly since August; the weekly close on Feb 9th, 2004 was US\$15.50/lb U_3O_8 .

The Seabee Gold Mine, owned by Claude Resources, completed its 12th year of continuous operation in 2003. It has surpassed the 600 000 oz mark and is Saskatchewan's largest ever primary gold producer. Operating costs were US\$232/oz for the third

quarter of 2003, and the average realized gold price was US\$381/oz. Total annual production in 2002 was 41 500 ounces of gold, with an average head grade of 6.59 g/t (0.19 oz/ton) Au. By comparison, the average grade for the first half of 2003 was 8.2 g/t (0.24 oz/ton) Au, with forecasted annual production of 52 000 ounces. Overall, increased ounces and lower production costs in 2003 are the result of mining deeper, higher grade ore combined with efficiency and throughput upgrades made to the mill in 2002.

Base metals were produced exclusively from the Proterozoic Flin Flon Domain in the east-central part of the province in 2003. They were mined from the Konuto Lake Deposit, and that part of the Callinan Deposit in Saskatchewan. The McIlvenna Bay deposit remained dormant in 2003.

Industrial minerals are an important component of the non-renewable resource sector in Saskatchewan (Figure 2). They have consistently accounted for between 20 and 50% of the gross value of provincial mineral production during the past 30 years. Not including coal, the four major products are potash, salt, sodium sulfate and aggregate, with minor production in structural clay, clinker, a naturally fired brick made from mudstone, and bentonite. Potash production in 2002 from ten underground operations, including 2 solution mines, was 12.9 M t valued at \$1.7 B. The total value of industrial mineral production for the year was \$1.8 B (Figure 3).

Petroleum

Final figures for fiscal year 2002/2003 show that Saskatchewan received approximately \$1.02 billion dollars in revenue (Crown royalties, freehold production taxes, mineral rights sales and miscellaneous) from the oil and gas industry. Natural gas became an increasingly important commodity in the province with 8.43 billion cubic metres produced with a sales value of some \$0.91 billion. Capital spending on gas was about \$250 million, and direct employment of about 1290 people. Equivalent figures for oil are: production - 24.4 million cubic metres, sales - \$4.65 billion, capital spending - \$1.23 billion, and direct employment - 7280 people. In 2002, the value of oil exports from the province accounted for 26% of total exports, making this commodity the most valuable separately identified product (agriculture was second at 21%). Along with potash (10%) and gas (2%), the value of resources from Saskatchewan's sedimentary strata amounted to well over a third of provincial exports.

In 2003, 4157 (2002: 3478) oil and gas wells were drilled in the province. Of these, 2294 were for gas, setting a new record for the fifth consecutive year

(2002: 1864 wells), 1662 (1408) were for oil, 138 (126) were dry, and 63 (80) were for other purposes. As in 2001 and 2002, horizontal drilling (313 wells) exceeded vertical (209 wells) in southeastern Saskatchewan. In the other three defined areas of the province (centred on Lloydminster, Kindersley and Swift Current), drilling of vertical wells (1055, 547, 1919 for the respective areas) was vastly higher than that of horizontal wells (92, 19, 3). As a result of this activity, petroleum exploration and development expenditures in Saskatchewan are projected to total around \$1.9 billion. Jobs generated by the petroleum industry are estimated to be approximately 23,000 (direct and indirect). While the budget revenue estimate for 2003/2004 fiscal year was \$609.2 million, more recent estimates indicate that actual revenues may be approximately \$890 million due to stronger than expected resource prices and Crown land sales bonus bids received to date.

Exploration for new oil resources was limited throughout the province in 2003, and no major new discoveries were reported. Since June 2002, gas production from the Shackleton area has risen dramatically and is approaching 2.8 million cubic metres (100 million cubic feet) per day. The area has already produced 0.57 billion cubic metres (20 billion cubic feet) of gas and presently has 321 wells on production. The number of wells grows by about 20 per month. The play now extends over 140 km in an east-west direction and over 60 km in a north-south direction and companies are still trying to find its boundaries.

EnCana's Weyburn Unit CO₂ miscible flood EOR project continues to progress well, and by mid-2003, incremental production was approaching 954 m³ of oil per day (6000 bopd). By late 2003, CO₂ was being injected into 32 patterns, and takes from Dakota Gasification Company were approximately 2.69 x 10⁶ m³ per day (95 mmscfd). Cumulative CO₂ injected as of June 30, 2003 was almost 2 x 10⁹ m³ (69.6 billion standard cubic feet), including 0.23 x 10⁹ m³ (8.1 bcf) of recycled gas. This is about 71% of the injected amount expected by that time at the start of the project. Much of the shortfall was due to CO₂ supply and operational problems early in the project. In mid-2003, produced gas was being recycled at the rate of 0.71 x 10⁶ m³ per day (25 mmscfd), resulting in a total injection rate at that time of 3.03 x 10⁶ m³ per day (107 mmscfd).

The Lloydminster and Cummings coals of the Cretaceous Mannville Group in the Kindersley area are of particular interest as potential coal bed methane (CBM) sources and are being evaluated by the University of Regina, in conjunction with Saskatchewan Industry and Resources and the Petroleum Technology Research Centre. The department has also received numerous inquiries with regards to the

Belly River coals in the southwestern portion of the province. These coals are currently producing CBM in their lateral equivalents in Alberta. It is intended that preliminary examination of these shallow coals

will commence in 2004 to determine the feasibility of CBM production.

Manitoba Program Highlights 2003

GEOSCIENCE PROGRAM

The primary roles of the Manitoba Geological Survey (MGS) are to provide geoscience information to support and facilitate mineral exploration in the province, and to conduct a broad range of geoscience activities that address land-use and environmental issues facing Manitobans.

The 2003-2004 geoscience program reflects a balance between providing support to traditional mining camps, stimulating new exploration and development opportunities in frontier areas, and supporting land-use, geohazard 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 representatives from the University of Manitoba and the Geological Survey of Canada (GSC).

The federal government's Targeted Geoscience Initiative (TGI) was extended for an additional two years, to March 2005. This initiative will provide \$5 million per year to enhance geoscience programming across Canada. In Manitoba, two TGI projects are integrated with MGS activities:

- ✧ Trans-Hudson-Superior Margin Metallotect (with Saskatchewan, Ontario and Quebec): \$800 000 in TGI funding over two years. Project components in Manitoba include a federally funded aeromagnetic survey, federally funded remotely sensed imagery, and multi-agency bedrock mapping, geochronology and tracer isotope work, and structural geology studies. In addition to the federal funding, the Manitoba Geological Survey and partners (Manitoba Hydro, universities of Waterloo and Alberta) have committed \$1.5 million to bedrock investigations in the project area over the next three years.
- ✧ Williston Basin Architecture and Hydrocarbon Potential (with Saskatchewan): \$720 000 in TGI funding over two years. Project components include geoscience knowledge inventory, regional mapping (sub-surface), geophysical investigations, regional hydrogeology, remotely sensed imagery, hydrocarbon assessment and 3-D geological modelling.

Precambrian Mapping

Baseline geological mapping in the Precambrian Shield was conducted primarily in the Thompson Nickel Belt (TNB) and larger Superior Boundary Zone, the northern Superior Province, and the Flin Flon Belt.

THOMPSON NICKEL BELT

Fieldwork was conducted in the southern part of the exposed TNB, aimed at completing the geological compilation maps and accompanying report. In part, this work was undertaken to address the need to widen exploration to new targets beyond those traditionally considered in the TNB. Currently, all known nickel deposits are hosted by the relatively well-explored Pipe Formation (Ospwagan Group), which is typically metamorphosed to amphibolite-facies mineral assemblages. New work by MGS at Paint Lake and elsewhere in the TNB, however, shows that distinct segments of supracrustal sequences strongly resembling the Ospwagan Group are known to exist at granulite facies. These rocks were previously assumed to be part of the Archean basement and thus older than the Ospwagan Group. If they are indeed Ospwagan, they could represent new and significant exploration targets.

MGS work along the western boundary of the TNB has shown that Archean basement rocks and/or remnants of Ospwagan-like supracrustal rocks with Archean Nd model ages extend into the margin of the Paleoproterozoic Kiseeynew Domain. These first results have now defined the lithological components at the boundary, and the analytical tools to use to uniquely identify them. The inferred presence of Archean crust along the margin of the Kiseeynew Domain may expand the geographic limits for effective nickel exploration.

SUPERIOR BOUNDARY ZONE

A new collaborative program along the northern margin of the Superior Province was initiated this summer. The three-year project is being conducted in collaboration with researchers from the universities of Alberta and Waterloo. It applies an integrated approach, including bedrock mapping, geochemistry, isotope geology, geochronology and structural studies, to specific areas in the region. The region has a wide range of mineral potential, including nickel, platinum group elements and shear-hosted gold. Additionally, preliminary results indicate that a piece of ancient stable crust exists along the Superior Boundary Zone (SBZ) in the Assean Lake area, and that



Figure 1: Field photograph of a dramatic paleoshoreline/unconformity at Churchill, Manitoba. Ordovician lagoonal carbonates infiltrate around in-place Paleoproterozoic boulders. By chance, this equatorial Ordovician paleoshoreline corresponds exactly with the modern, subarctic, Hudson Bay shoreline.

See Young, G.A., Elias, R.J. and Dobrzanski, E.P. (2003): Paleozoic drillcore from the Churchill area, northern Manitoba: preliminary results (NTS 54K and 54L); in Report of Activities 2003, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p171-177.

diamond potential could therefore be considerable.

Bedrock mapping at Gull Rapids forms an integral part of the new Superior margin program. Located at the northeastern margin of the Superior Province in Manitoba, Gull Rapids hosts a spectacularly well exposed sequence of dominantly Archean supracrustal and intrusive rocks. A planned hydroelectric project could make most of this exposure inaccessible to future investigation. This study will provide accurate bedrock maps and structural data of the Gull Rapids area for Manitoba Hydro engineering purposes, as well as for explorationists and other land-use clients.

The northwestern margin of the Superior Province consists of several terrains of unclear tectonic affinity. One of the largest of these, the Split Lake Block, is the focus of a new multiyear mapping initiative conducted by researchers at the University of Alberta. Additionally, work at the University of Waterloo, sponsored by MGS, will provide understanding of the nature of major terrane-bounding shear zones within the SBZ that will be critical in developing a more robust geological framework for the region.

NORTHERN SUPERIOR PROVINCE AND FLIN FLON BELT

In the northern Superior Province, geological mapping and structural analysis have significantly upgraded the geological understanding of the Sharpe Lake area. This area contains a 35 km long, exposed portion of the Stull Lake-Wunnummin Fault Zone, a major gold metallotect in the northern Superior Province.

The MGS is helping to sponsor a PhD study of the Island Lake greenstone belt at Waterloo University. Identification of a similarity in ages of volcanism with those observed in the Red Lake greenstone belt suggests that contemporaneous processes were occurring on both the north and south margins of the North Caribou Terrane. These similar ages may have potentially important economic implications for the Island Lake greenstone belt, as the Red Lake greenstone belt hosts one of the world's richest gold mining camps.

In the northern Flin Flon Belt, MGS fieldwork is defining the nature and distribution of the distinctive tectonostratigraphic components through detailed (1:20 000 scale) geological mapping and geo-

chemical investigations. MGS has also helped fund, together with the Saskatchewan Geological Survey and Hudson Bay Exploration and Development Co Limited, detailed lithological mapping in the footwall of the Flin Flon, Callinan and 777 deposits. The mapping is being conducted by researchers at Laurentian University and has proven highly successful in establishing mine stratigraphy.

Mineral Deposit Studies

Multidisciplinary studies in the Lynn Lake greenstone belt have been making progress over the past five years in advancing our understanding of gold mineralization in the belt. New U-Pb age and Nd isotope results suggest the subdivision of the Lynn Lake belt into two terranes with distinct age and isotopic characteristics. The distribution of the two terranes indicates a more complex structural assembly of the Lynn Lake belt than previously suspected, and one that includes terrane-internal displacements.

In 2002, the MGS initiated a multidisciplinary program of targeted 1:20 000-scale bedrock mapping, structural analysis, lithogeochemistry and U-Pb geochronology in the Rice Lake belt, in order to provide the exploration community with practical constraints on the timing, distribution and structural setting of orogenic lode-gold deposits in the Rice Lake belt. Mapping in 2003 led to the discovery of several occurrences of distinctive veins whose mineralogy, paragenesis and setting are closely analogous to those hosting spectacular high-grade gold mineralization in the Red Lake mine in Ontario.

Massive sulphide deposit documentation in the Snow Lake area included the completion of a collection of reference samples for volcanogenic massive sulphide (VMS) mines. The establishment of this reference collection of ores, rocks and data from each mine in the district will provide a valuable archive and reference for future work on the metallogensis of the region.

Work by the MGS to determine the residual mineral potential in the Ruttan and Lynn Lake areas utilized drillcore stored in the provincial core-storage facility at Lynn Lake. The rationale for the work is the observation that strong positive or negative Eu anomalies in conductors or favourable strata that contain only low or negligible metal values can indicate proximity to otherwise blind massive sulphide deposits. This database can be utilized by property holders to re-evaluate the mineral potential of properties in the Lynn Lake area with low metal values. The results of similar geochemical studies undertaken at the Ruttan mine in 2002 have shown that 'europium deviation' in the exhalite provides a reliable vector to volcanogenic massive sulphide miner-

alization at a distance of over 400 m from significant zinc assay values.

A PhD study, based at the University of New Brunswick, was initiated to study the systematics of rare earth elements and other trace elements in the sulphide ores and hostrocks of the Fox mine at Lynn Lake. Comparison of data from this deposit with other massive sulphide deposits will determine if there is a correlation between deposit size and rare earth element systematics.

Recent discoveries of platinum group elements (PGE) within and in the vicinity of gabbroic bodies intruded into mafic volcanic rocks of the Bear Lake Block highlight the potential of the Flin Flon greenstone belt to contain economically significant PGE mineralization. Work this year concentrated on the Mikanagan Lake sill and Tartan Lake gabbro complex.

The Mayville intrusion, located in the northern flank of the Bird River greenstone belt in southeastern Manitoba, is a proven repository of PGE with characteristics similar to other intrusions with 'contact-type' PGE mineralization. This type of mineralization is characterized by the presence of sulphide-bearing igneous breccias that can be associated with substantial PGE tenor. Present investigations of the Mayville intrusion are aimed at gaining a better understanding of the magma chamber configuration, emplacement history and provenance of the intrusion, and the composition and emplacement history of contained sulphides.

A scoping study for hydrothermal iron-oxide copper-gold (IOCG or Olympic Dam-type) deposits was initiated in 2002 by researchers at the University of Brandon. Initial investigations identified the Trans-Hudson Orogen as the geological province of greatest interest. In 2002, a large REE-rich carbonatite complex was discovered at Eden Lake, and follow-up work in 2003 revealed a system of high-grade but narrow REE-Y-U-Th veins. In 2003, work also focused on a unique style of mineralization that is abundant in the Kiseynew Domain, and may be related to IOCG-type deposits. This unique style of iron-sulphide copper-graphite (ISCG) mineralization occurs in relative abundance along the northern margins of the Kiseynew. These essentially unexplored deposits are significant because the mineralization has a magmatic-hydrothermal origin, similar to some types of IOCG deposits, and is strongly enriched in copper, graphite and silver.

Indicator-Mineral and Geochemical Surveys

Although results from kimberlite indicator-mineral surveys in the past 20 years have been promis-

ing, no discoveries of diamondiferous kimberlite have been announced in Manitoba. In order to provide geoscience support to the diamond exploration effort in Manitoba, MGS has compiled all geological data pertinent to kimberlites in the province. These studies strongly suggest that kimberlitic sources occur in Manitoba, a suggestion that is further evidenced by the single documented occurrence of kimberlite at Wekusko Lake in the Flin Flon Belt. The presence of a locally thick and complex till stratigraphy has proven to be a significant factor complicating effective diamond exploration in the province. Compilation of existing data from a number of surveys and agencies into a single database will provide explorationists with a comprehensive view of public-sector survey results. Coupled with ongoing analysis of till stratigraphy in the Hudson Bay Lowland, these data will provide important new information relating to diamond potential in Manitoba.

A preliminary investigation of analytical data from twigs, sphagnum, peat-bog material, lake-bottom sediment and underlying clay beneath a bog at Reed Lake in the Flin Flon Belt demonstrates significant variations in the distribution of metals within several of the media.

Soil and spruce-bark samples were collected along transects across the surface expression of the McBride Lake zinc-rich massive sulphide deposit and the gold-bearing Rainbow Zone at the MacLellan mine, in Lynn Lake. These studies are being undertaken to investigate the applicability of using the rare earth elements in discriminating geophysical anomalies related to barren mineralization from those associated with economic mineral deposits.

Phanerozoic Investigations

The Manitoba Stratigraphic Database (MSD) contains all subsurface Phanerozoic stratigraphic and core-storage data for all Phanerozoic wells in Manitoba. Formation tops are being updated for all wells, and it is anticipated that the database will be completely updated by mid-2004. Users can request tops on a specific well by location, or request information on specific tops or groups of tops over any size of area.

The MGS conducted diamond drilling through the Paleozoic rocks at Churchill in collaboration with researchers from the Manitoba Museum and the University of Manitoba. The Upper Ordovician and Lower Silurian sedimentary rocks at Churchill were deposited in a unique shallow-marine setting around a tropical archipelago, the islands of which were formed by ridges of Proterozoic Churchill Quartzite. The results of this project will fill a major gap in the basic knowledge of Manitoba stratigraphy, and may be applied to the understanding of the Hud-

son Bay Basin's geological history. The comprehensive synthesis of paleoenvironments at several unique fossil sites should encourage the development of new attractions that will benefit Churchill's emerging ecotourism industry.

The proposed Manitoba Lowlands National Park lies adjacent to the highly prospective Thompson Nickel Belt, which is buried beneath Phanerozoic formations in the Grand Rapids area. Parks Canada and Manitoba Conservation hope to include representative parcels of the region's significant karst landscape into the national park. The majority of documented karst features, however, occur over the buried TNB, in areas that are accessible by road and trail. To document more fully the distribution of karst in the Manitoba Lowlands, MGS conducted office inventories of karst features in the Honeymoon Lake area, in and around the town of Grand Rapids, and in the Devils Lake area, all of which lie east of the TNB. Field investigations of karst features were conducted in a remote area south of The Pas Moraine. These investigations confirmed the presence of near-surface bedrock and karst in areas where there is no conflict with mineral-exploration potential.

Preliminary studies of stream-derived kimberlite indicator minerals (KIM) in the Porcupine Hills of west-central Manitoba, released in 2001 and 2002, confirmed that the north slope of the Porcupine Hills contains anomalous quantities of KIM relative to other localities along the Manitoba Escarpment. Examination of aeromagnetic maps north of the Porcupine Hills has revealed the presence of a cluster of magnetic anomalies near Grassy Bay on Red Deer Lake, less than 20 km north of the anomalous KIM sample sites. The anomalies in the cluster bear a striking resemblance, in relative magnitude and shape, to the documented aeromagnetic signatures of the Fort à la Corne kimberlites.

Quaternary

Surficial and 3-D geological mapping are required for effective land-use planning, as well as for hydrocarbon, groundwater and industrial-mineral development. In 2003, progress was made on the production of a seamless, digital, 1:250 000-scale compilation of surficial geology for all of Manitoba. The surficial-geology compilation will replace the 1981 Surficial Geological Map of Manitoba. All of the most current and most detailed paper maps required for the 1:250 000-scale compilation have been digitized. Edge matching and polygon conflicts are being resolved with the aid of a digital elevation model derived from the recently released data from the shuttle radar topography mission. Original mapping of several previously unmapped areas was also carried out with the aid of the digital elevation model and limited ground truthing.

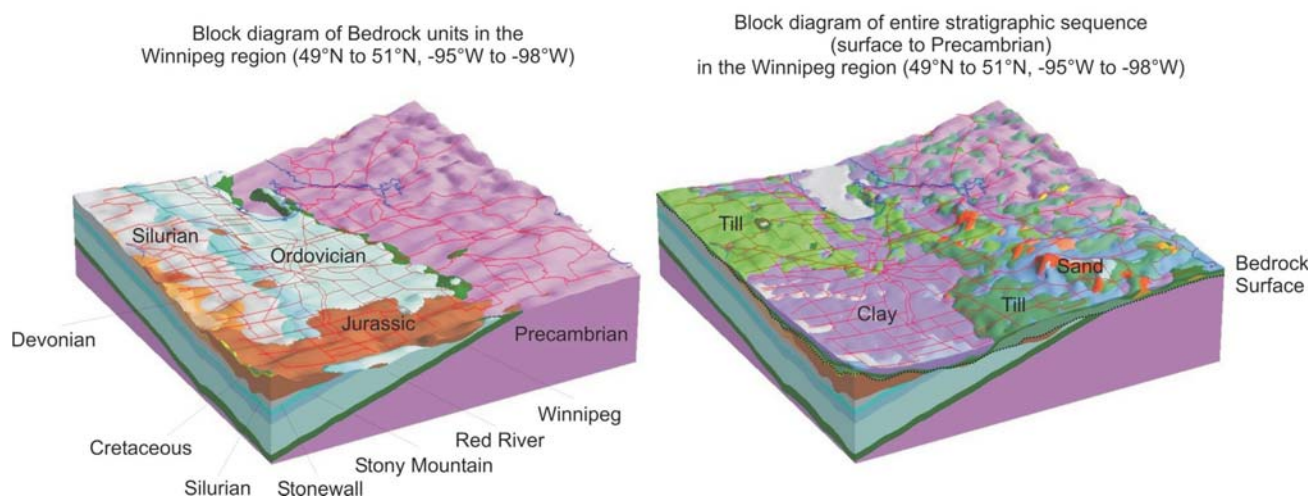


Figure 2: 3-D models of Phanerozoic and Quaternary stratigraphy in the Winnipeg area, southern Manitoba. The model, constrained by more than 80 000 water-well drill hole logs, is providing key information for a variety of uses including groundwater (livestock management), flood potential, engineering and hydrocarbon potential. The model will be extended to the Saskatchewan border under the auspices of the Williston Basin Targeted Geoscience Initiative.

Three-dimensional geological mapping of the Phanerozoic succession in southern Manitoba, south of latitude 55°N and west of longitude 95°W, is being completed as a successor activity to the Prairie component of the National Geoscience Mapping Program (NATMAP). The Lake Winnipeg basin is nearing completion and, in combination with the already completed southern Prairie NATMAP area of southeastern Manitoba, this will enhance understanding of the eastern edge of Phanerozoic rocks in Manitoba. The 3-D model for the Winnipeg-area NATMAP has been used to model groundwater flow across the Winnipeg region and to assess climate-change scenarios with respect to impacts on groundwater systems.

A new study (PhD at the University of Arizona) was begun, as a successor project to the Red River Flood Program, to document the frequency, severity and causes of extreme droughts and low flows in the Winnipeg River basin. The Winnipeg River currently supports six hydroelectric generating stations in Manitoba. The river also provides the largest single contribution to Lake Winnipeg and thereby has an important influence on the production of nearly 4000 megawatts from the Jenpeg Generating Station and other stations on the Nelson River. Given the direct correlation between precipitation, runoff and hydro generation, an improved understanding of

the frequency, magnitude and causes of past droughts and periods of low streamflow across the basin will provide information critical to the management of hydroelectric facilities in Manitoba.

Industrial Minerals

The use of exposed Precambrian and Paleozoic bedrock as an aggregate source in the Churchill area will likely expand in the future as the depletion of favourable sand and gravel resources continues and the need to preserve undisturbed habitat for ecotourism intensifies. During 2000 and 2003, a few weeks were spent near Churchill collecting samples of the Proterozoic Churchill Quartzite, in order to assess its potential as a source of silica and to follow up on earlier reports of metallic mineralization. Trace-element analyses of both the Churchill Quartzite and Paleozoic dolomite indicate that they are barren of economic mineralization. An attempt is being made to recover a high-purity silica source from a crushed composite Churchill Quartzite sample through selective screening, washing and sorting.

REGIONAL OFFICES

The Flin Flon and Thompson regional offices provide regulatory and technical assistance to the mineral-exploration and mining communities in the Flin Flon-Snow Lake region.

In Flin Flon, these activities include recording new mineral claims, maintaining an up-to-date library of claim and land-status maps for the Province of Manitoba, and answering claim-status inquiries and accepting assessment-work submissions. In addition to the staff from the previous year, including the Regional Geologist, Resident Geologist and Mining Claims Inspector, an Assistant Deputy Mining Recorder joined the office team. Technical and logistical assistance was provided for several research projects undertaken in the region.

The Thompson Regional Geologist responds to a range of inquiries, including regional geology, potential of mineral properties and mineral identifications.

CORE-STORAGE FACILITIES

Diamond drilling of a mineral prospect is the most important and costly phase in the evaluation of any mining property. The preservation of diamond-drill core can help reduce costs of redrilling these prospects when new exploration techniques and geological concepts evolve. It also serves as a valuable asset to researchers, especially in areas of extensive overburden or where Paleozoic cover rocks overlie the Precambrian basement.

Manitoba's Mineral Resources Division has been storing Precambrian drillcore, obtained primarily from exploration drilling, since the early 1970s. A substantial repository of drillcore is now stored at five locations throughout the province. In 2003, work continued on updating drillcore inventories at all the northern facilities, especially the Centennial site near Flin Flon.

COMPILATION AND PARTNERSHIPS

The newly formed Compilation and Partnership Section has taken on the task of generating a wide range of up-to-date compilation maps for MGS. The first compilation map will stitch six updated 1:250 000-scale Bedrock Geology Compilation Map Series (BGCMS) maps to produce a 1:500 000-scale map of a portion of the northern Superior Province.

Partnerships and collaborative projects continue to expand the ability of MGS to provide multifaceted,

effective geoscience programming in Manitoba. Such partnerships make the best use of combined funds and expertise, and result in programs that vastly expand the traditional geological survey mapping programs. The federal government, other provincial governments, the mineral industry and several universities are currently involved in collaborative projects in Manitoba. These projects will generate approximately \$1.5 million toward geoscience funding in Manitoba for 2003-2004. The range of university studies, from dendrochronology to isotope geochemistry, is impressive; the young scientists include two Post Doctoral Fellows, four PhD candidates, seven MSc candidates and one BSc candidate, from five Canadian and two American universities.

GEOSCIENCE INFORMATION INITIATIVES

Considerable time has been devoted over the last year to large compilation projects. Conversion of more than 60 archival 1:250 000 and 1:100 000-scale Quaternary geology maps to digital format was completed, and the process of edge matching the maps into a seamless 1:250 000-scale, digital surficial geology map of Manitoba is underway.

The Bedrock Geology Compilation Map Series program focused on provincial-scale compilation at 1:250 000 scale. No new maps were released this year, but 14 existing maps were edge matched in preparation for production of a seamless 1:250 000-scale geological base for Manitoba. This base will be used as the background map for all Internet Map Server presentations and will be simplified for a new version of the 1:1 000 000-scale Geology of Manitoba.

The MGS continues to develop new projects and features for the Internet Map Server (IMS). The legend interface is being redesigned to make map projects clearer and easier to use. A new IMS project portraying data from the Protected Areas Initiative is currently under development.

Substantial advances have been made under the Canadian Geoscience Knowledge Network's Metadata Initiative. Preparation of metadata for all provincial publications has been completed and entry of metadata for external publications is underway.

CLIENT SERVICES

Client Services provides communications, outreach and information production and distribution services, including publication of MGS reports and maps and maintenance and development of the Mineral Resources Division website.

Information production and distribution services focused on expanding and improving access to geoscientific information sources through the website. Consequently, several in-house databases are now available for on-line searches, including the Mineral Resources Library catalogue, the Bibliography of Manitoba Geology, mineral inventory records and a news clippings database. Access to free downloads of MGS reports and maps was also improved with on-line search capabilities for digital releases.

A new On-line Publications Catalogue of MGS reports and maps available for purchase was developed to enhance search capabilities and simplify ordering. The new catalogue is tied in to secure on-line credit-card purchasing capabilities.

Client Services outreach activities included min-

eral-education initiatives such as the Schools Program of the Manitoba Mining and Minerals Convention and Provincial Mining Week. Hands-on activities were designed to complement the earth-sciences curriculum and increase public awareness of minerals and mining to Manitobans.

Special projects included the coordination of an introductory Prospector Training Program. The community-based program was held in June for participants from the Sagkeeng First Nation. The intensive four-week course was developed in collaboration with Sagkeeng and delivered by Mineral Resources Division staff and other government and industry experts. Ten students graduated from the course with a Manitoba Prospecting Licence and Blasting Certificate.

Ontario Program Highlights 2003

In the fall 2003, the Ministry of Northern Development and Mines (MNDM) announced a re-organization that affected several parts of the ministry, including the re-establishment of an Ontario Geological Survey (OGS) Branch, under the leadership of a Director, and the Mineral Development and Lands Branch, under the leadership of Director, Dick Cowan. As part of this reorganization, the following business units now operate formally as part of the OGS: Precambrian Geoscience Section, Sedimentary Geoscience Section, Resident Geologist Program, Geoscience Laboratories, and Information and Marketing Services Section. It is anticipated that the position, OGS Director, will be filled permanently in 2004. In the interim, OGS Senior Managers backfill the position.

Prior to the establishment of the OGS Branch, geoscience responsibilities for Ontario were shared across several administrative units: a) Precambrian Geoscience Section (Precambrian bedrock mapping and geophysics); b) Sedimentary Geoscience Section (surficial geology and geochemistry, Paleozoic and aggregate mapping and groundwater studies); c) Resident Geologist Program (front line customer service, mineral occurrence mapping and land-use planning); d) Geoscience Laboratories (geochemical analysis service); e) Information and Marketing Services Section (map and report preparation and library function); f) Mineral Development and Lands Commodity Program (industrial mineral and building stone expertise); g) Mining Lands (approval of assessment files); and h) Business Solutions Services (digital information archive and distribution).

The 2002-2003 base budget for the geoscience activities of the Mines and Minerals Division (*see* budget table) was approximately \$11 million. This covers salary, benefits and operations expenses for the geological mapping function, the Resident Geologist function, the Geoscience Laboratories function, geoscience assessment function, the library function, the publication function and the data warehouse and distribution functions. Not included in the 2002-2003 base budget is the Groundwater budget of \$1 million and the \$2.5 million for the Ontario Mineral Exploration Technologies (OMET) program.

Peter Barnett, a senior geoscientist with the Sedimentary Geoscience Section was honoured in September by receiving the Provincial Geologist Medal for 2003. The Committee of Provincial Geologists present this national award to an individual who has produced outstanding work at one of Canada's provincial or territorial Geological Surveys. The award

recognizes major contributions in the areas of geoscientific research developments or applications that meet the mandates of the Geological Surveys.

We invite you to come and explore the Mines and Minerals Division web pages at:

www.mndm.gov.on.ca/MNDM/

GEOSCIENCE ACTIVITIES – HIGHLIGHTS

Economic Activity – Significant Exploration Projects

DIAMONDS

- ✧ Victor Kimberlite Project, De Beers Canada Exploration Corporation.
- ✧ Gem Quality (GQ) Project, Band-Ore Resources/Kennecott Canada JV.
- ✧ Festival Property, Pele Mountain Resources Inc./DeBeers Canada Exploration Inc.
- ✧ Temiscaming Diamond Project, Sudbury Contact Mines Ltd.

GOLD

- ✧ Pamour Superpit, Porcupine Joint Venture (Placer Dome/Kinross)
- ✧ Red Lake Mine Project, Goldcorp Inc.
- ✧ McFinley Mine Project, Rubicon Minerals Corporation.
- ✧ Sidace Lake Project, Planet Exploration Inc./Goldcorp Inc.
- ✧ Madsen Mine Project, Placer Dome and Claude Resources.
- ✧ Timmins Gold Project, Holmer Gold Mines Limited/Lake Shore Gold Corp.
- ✧ Kirkland Lake Projects, Kirkland Lake Gold Inc.

PGE

- ✧ River Valley Project, Pacific Northwest Capital Corp. and Anglo American Platinum Corporation.
- ✧ Tib Lake Project, Houston Lake Mining Inc. and Agnico-Eagle Mines Ltd.
- ✧ East Bull Lake Intrusion projects, Mustang Minerals and Impala Platinum Holdings Limited.
- ✧ Shakespeare Project, Ursa Major Minerals Lim-

ited.

RARE METALS

- ✧ Agor Carbonatite Project, Niocan Inc.

NICKEL-COPPER-PGE

- ✧ Nickel Rim South (Sudbury) Project, Falconbridge Limited.
- ✧ Montcalm Nickel (Timmins) Project, Falconbridge Limited.
- ✧ Sudbury Basin Projects, FNX Mining Company Inc, Dynatec Corporation and Inco Limited.
- ✧ Bannockburn Twp Project, Mustang Minerals Corp.
- ✧ Volcanogenic Massive Sulphides (Cu-Zn-Pb-Au).
- ✧ McFaulds Lake Project, Spider Resources Inc/KWG Resources Inc.
- ✧ Canagau Mine Project, Wallbridge Mining Company

New or Expanded Mine Operations

GOLD

- ✧ Red Lake Mine, Goldcorp Inc.
- ✧ Campbell Red Lake Mine Deep Development, Placer-Dome.
- ✧ Pamour Superpit, Porcupine Joint Venture
- ✧ Palladium and Platinum.
- ✧ Lac des Isles, North American Palladium.

ZINC/COPPER

- ✧ Kidd Creek, Falconbridge Ltd.

PRECAMBRIAN GEOSCIENCE SECTION (PGS)

The core functions of PGS are to:

- ✧ provide geological maps, reports, data, technical talks and posters, new concepts and ideas describing the Precambrian bedrock geology; and
- ✧ provide regional airborne magnetic and electromagnetic geophysical data, derivative products, and concepts and ideas based on those geophysical data to support the bedrock mapping program.

In calendar year 2003, PGS produced 10 preliminary maps, 9 open file reports, 10 miscellaneous data releases (MRDs) and 4 final maps. More than 150 airborne geophysical hard-copy maps and 50 airborne geophysical digital data sets were released. PGS staff, at various geoscience forums throughout the year, presented approximately 32 technical talks and 28 posters promoting the geological and mineral resource endowment of Ontario. The highlights of the 2003 OGS program are summarized in the Report of Activities report released in December 2003.

OGS strategic thrusts are achieved through a variety of initiatives that are built upon one or more projects. Project planning, selection, development, and implementation are based on the strategic thrusts and initiatives to achieve alignment of individual projects with Ministry priorities.

PGS presently has 35 active core projects. PGS was also involved in 17 active collaborative project agreements in various stages of completion and with a variety of partners. Collaborative project agreements include 11 active projects with the Geological Survey of Canada. In all, the PGS supported 52 geoscience projects during the 2003-2004 fiscal year. Project focus is Abitibi Subprovince, Wabigoon Subprovince, Hudson Bay and James Bay lowland basement, north-



Figure 1. Bedrock mapping, Kirkland Lake area, Ontario.

ern Grenville Subprovince, and Lake Nipigon area.

In addition to its core business, PGS bid, for the first time, on a Request For Proposal issued by the Ontario Prospectors Association to conduct a two-year bedrock mapping project in the western Nipigon Embayment as part of the Lake Nipigon Region Geoscience Initiative (LNRGI). The PGS bid was successful and is responsible to deliver the bedrock mapping function for the LNRGI. PGS also provided some technical support to the Discover Abitibi initiative.

In preparation for far north geological mapping, the PGS management and staff were engaged in communication, information exchange, and relationship-building with several remote First Nation communities. A Memorandum of Cooperation was signed in December 2002 between Eabametoong First Nation and MNDM.

SEDIMENTARY GEOSCIENCE SECTION (SGS)

In 2003, work was conducted on several projects by staff of the Sedimentary Geoscience Section (SGS). The most significant of these projects are highlighted below.

Regional scale geochemical lake sediment surveys were completed in the Kenora and Gogama areas to assist in evaluating the mineral potential of the regions and provide exploration targets. The majority of the terrain covered by each of the surveys was located over Archean greenstone belts. Additionally, interpretation of data from earlier surveys in the Eagle Lake and Sudbury areas was completed.

A modern alluvium-sampling project was undertaken in the area west of Kirkland Lake. The focus of this project was to gain an understanding of the distribution of kimberlite indicator minerals, base/precious metal indicator minerals and gold grains. Analytical (microprobe) work and data interpretation continued on a previously completed survey undertaken in the New Liskeard region.

Partnerships with industry, academia and various government agencies are key elements in augmenting the SGS program. Joint projects include: research to develop exploration protocols for PGEs using surficial materials, a project funded by the LNRGI; case studies to maximize the effectiveness of selected leach sample analyses in kimberlite/diamond exploration, a partnership with Discover Abitibi; and an OMET-industry funded research project designed to develop new geochemical exploration techniques for use in areas of thick drift.

As part of a provincial strategy to assess and pro-

tect groundwater, SGS continued its groundwater-mapping program. Work completed under this program included: publication of a seamless, GIS based surficial geology database for southern Ontario; development of a data model for groundwater related earth science data; and investigations to create 3-dimensional materials/stratigraphic frameworks for the areas surrounding the Waterloo and Oro moraines. Additionally, partnerships have been formed with several Conservation Authorities to create watershed-scale hydrogeological reports.

Work on two pan-provincial, thematic projects also continued. Data loading progressed on the Sedimentary Geoscience Observations (SGO) database; the completed project will see all legacy surficial geochemical data generated by SGS available as a consolidated database. Work also progressed on the digitization of the Northern Ontario Engineering Geology Terrain Study maps, a series of 1:100 000-scale maps covering a large portion of Ontario.

RESIDENT Geologist PROGRAM

During 2003, staff of the Resident Geologist Program responded to more than 31 000 direct and indirect client inquiries; conducted 325 client property and mine/quarry field investigations; provided 47 geological field trips to mineral sector clients and promoted Ontario mineral investment opportunities at 12 national and international trade shows and conferences. Program staff was also very active in numerous land-use planning and management issues and activities, including the ongoing implementation of Ontario's Living Legacy (OLL), the government's Northern Boreal and Room to Grow initiatives, municipal land use planning and First Nation land claim settlements. Prospector training courses were delivered to 5 First Nation communities situated in remote regions of northern Ontario.

Higher, sustained gold prices have resulted in a major resurgence in gold exploration in Ontario, particularly in and around the province's traditional gold camps of Red Lake, Timmins, Kirkland Lake and Hemlo. During the year there were approximately 265 active grassroots to advanced exploration/mine development gold projects operating in Ontario. Exploration and development activity across the province also continued to focus heavily on diamonds, Ni-Cu-PGE mineralization and industrial minerals. With over 400 junior mining companies actively exploring in Ontario, exploration expenditures in the province rose during 2003 to more than \$200 million. About \$150 million was used on grassroots projects and the balance was spent on exploration and deposit appraisal expenditures at mine sites. Flow-through shares financing in Ontario could



Figure 2. Sieving coarse grained sand and gravel for kimberlite indicator minerals.

reach \$90 million, or one third of the \$270 million expected to be raised through this mechanism and spent on mineral exploration in Canada in 2003. Flow-through financing accounted for approximately 45% of the more than \$200 million invested in mineral exploration in Ontario during the year.

The 2003 edition of the Resident Geologist Program's Annual Report of Activities will be available on the Internet in April 2004. For further information on the Program and mineral exploration activities in Ontario, the reader is invited to visit the Resident Geologist Program on the Ministry of Northern Development and Mines website at:

www.mndm.gov.on.ca

INFORMATION AND MARKETING SERVICES SECTION

The Information & Marketing Services Section is the heart of information delivery for the Mines and Minerals Division. It produces and disseminates all digital and paper products of the Ontario Geology Survey and collects and disseminates statistical data on Ontario's mineral development sector. It also ad-

ministers all trade and investment activities of the Mines and Minerals Division and plays a key role in promoting mineral development opportunities in Ontario. The division participated at 10 domestic and 4 international investment trade shows during the fiscal period.

From the Publications Services Section through to Digital Data Distribution and the Geoscience Library, the Information and Marketing Services Section delivers high quality products and services to clients throughout the world. Between September 2002 and August 2003, 199 maps, 28 reports, 14 digital information products and 117 digital data sets were newly released.

BUSINESS SOLUTIONS SERVICES SECTION

Business Solutions provides services to the Mines and Minerals Division in the areas of business case development, process analysis and design, and application system acquisition, development, maintenance and support. In 2003, Business Solutions focused on improvements to existing applications for the Mines and Minerals Division.

Maintenance continued on CLAIMapsIII, the application that provides 24 hours/day, 7 days/week land tenure information and maps to the exploration clients via the Internet. Digital data for specific areas can now be extracted directly from the application. The entire land tenure layer in digital format is also available directly from the ministry website.

Business Solutions continued to support and maintain the Earth Resources and Mineral Exploration (ERMES) application. This year, focus was on the data for the Mineral Deposit Inventory (MDI) database, with a refresh of the data achieved in May 2003. Work continued on the digital submission project, which will allow exploration clients to submit required assessment work online to the ministry. Support was also offered to the Sedimentary Geoscience Observations database project. A system to display the inventory of the Drill Core libraries on the Internet was developed and set for launch in early 2004.

A review of the Laboratory Information Management System (LIMS) was conducted for the Geoscience Laboratories, with a recommendation to come forward in early 2004.

The CLAIMSII system utilized by Mining Lands to log incoming legal documents and track thousands of mining related transactions on Crown land in the Province, was upgraded to run on improved operating systems and databases.



Figure 3. OGS image of Resident Geologist (Peter Hinz, red plaid coat) leading a geological field trip, Dryden area.

Business Solutions and its Mines and Minerals Division partners continued to be recognized for their achievements in information technology. The Division was a finalist in the CIO Canada ITX awards in June 2003. The Division won a prestigious Canadian Information Productivity Award in November 2003, in the category of Organizational Transformation.

GEOSCIENCE LABORATORIES

The Geoscience Laboratories (Geo Labs) of the Ontario Geological Survey (OGS) is a full-service inorganic analytical facility with a focus on providing high quality, research-grade analyses and services in geochemistry, mineralogy, preparation of reference materials, and method development. The Geo Labs was established in 1898, and was housed in Toronto before being moved to the Willet Green Miller Centre (WGMC) in 1991 as part of the Ministry of Northern Development and Mines (MNDM) relocation to Sudbury, Ontario.

Approximately 75% of the dollar value of the analyses and services provided by the Geo Labs is to its largest client, the OGS. Other clients include government agencies, universities, and the private sector.

A quality policy and program, and a quality assurance/quality control (QA/QC) program ensures that all analyses and services provided by the Geo Labs are of the highest quality and standards. The Geo Labs has ISO 9001:2000 certification, and is applying for ISO 17025 accreditation. Regular participation in many national and international proficiency testing programs, including CAEAL, PTP-MAL, NWRI, and IAG, verifies that only the highest quality research-grade analyses are produced by the Geo Labs.

A new PerkinElmer Elan 9000 ICP-MS was added to the spectrometry section, increasing the number of ICP-MS units to three.

The electron microprobe in the mineralogy section was primarily used for diamond exploration ser-

vices (automated analysis of kimberlite indicator minerals) in support of the OGS overburden sampling programs being carried out throughout the province to define favourable areas for diamond potential.

The Geo Labs produces reference materials, and currently has four products available for purchase: an ultramafic komatiite (OKUM), and three Lac des Iles PGE-bearing gabbros (LDI-1, LDI-2, and LDI-3). A number of other geological materials are in production. Reference materials are also produced for clients on a custom basis.

An initiative is currently underway with Laurentian University (LU) to amalgamate LU's Cen-

tral Analytical Facility (CAF) into the Geo Labs. This collaboration will create an "analytical centre of excellence" supporting research in mineral deposits and Precambrian Geology. It will also support the recently accredited PhD program obtained by LU's Department of Earth Sciences. LU geology, chemistry, biochemistry and engineering staff and students make extensive use of the equipment, analytical methods, and services available in the Geo Labs facility.

A copy of the Geo Labs Schedule of Fees and Services and other information can be found on the Geo Labs web site:

www.mndm.gov.on.ca/mndm/mines/labs/

Le programme du Québec accentue 2003

INTRODUCTION

Le ministère des Ressources naturelles, de la Faune et des Parcs (MRNFP) appuie le développement économique durable des régions du Québec en favorisant la connaissance, la mise en valeur et l'utilisation optimale du territoire québécois et de ses ressources énergétiques, forestières et minérales.

Géologie Québec est l'unité administrative du MRNFP qui est responsable du développement de la connaissance géoscientifique du territoire, en vue de l'établissement et de la promotion du potentiel minéral du Québec. Géologie Québec rend disponibles à la clientèle de l'exploration minérale toutes les données géoscientifiques recueillies depuis 150 ans au Québec grâce au SIGÉOM, un système d'information géominière à référence spatiale unique en son genre.

En 2003-2004, Géologie Québec dispose d'un effectif de 174 employés, dont 113 permanents, répartis à Charlesbourg et dans six bureaux régionaux. L'organisation est constituée de cinq services (voir organigramme). Elle compte sur un budget de 12,9 M\$.

L'adresse du site Internet de Géologie Québec est :

www.mrnfp.gouv.qc.ca/mines

INVENTAIRES ET ÉTUDES GÉOSCIENTIFIQUES

Encore une fois cette année, la priorité a été accordée à l'acquisition de nouvelles connaissances géoscientifiques. Géologie Québec a consacré près de 6 M\$ à la réalisation de six levés géologiques et d'une vingtaine d'études thématiques ou d'autres types de levés dans les diverses régions du Québec. Le choix des projets découle d'une vaste consultation de la clientèle qui a permis d'élaborer des plans triennaux pour l'ensemble du territoire.

Grand-Nord

Géologie Québec a poursuivi pour une cinquième année le programme de cartographie géologique à l'échelle de 1/250 000 dans le Grand-Nord québécois. Au cours de l'été, deux levés géologiques couvrant plus de 25 000 km² ont été réalisés dans les secteurs de Povungnituk et du lac Minto, sur la rive est de la

baie d'Hudson. La synthèse géologique et métallogénique du Grand-Nord, ainsi que les travaux sur les minéraux indicateurs pour le diamant ont été poursuivis également. Enfin, le projet de synthèse géologique et métallogénique de la Fosse du Labrador a été complété et fera l'objet d'une publication en 2004.

Abitibi et Baie James

Un nouveau plan triennal couvrant la période 2003-2006 a été amorcé pour l'Abitibi et le territoire de la Baie James. À l'est de Matagami, deux nouvelles cartes géologiques à l'échelle de 1/50 000 ont été produites dans un secteur propice aux minéralisations polymétalliques volcanogènes.

Par ailleurs, Géologie Québec a débuté la cartographie d'un vaste segment du Front du Grenville au sud de Chibougamau; un volet métallogénique est rattaché à ce projet. Trois cartes géologiques ont été réalisées au cours de l'été et plusieurs indices minéralisés ont été caractérisés.

Dans la région de Rouyn-Noranda, l'étude métallogénique amorcée l'an dernier le long de la faille Porcupine-Destor a été complétée. Un modèle 3D a été produit dans le cadre de ce projet. Une autre étude, visant à mieux définir le contexte gîtologique et volcanogénique du Groupe de Blake River, a été entreprise au cours de l'été. Finalement, l'étude métallogénique du Bassin de Mistassini s'est poursuivie en collaboration avec l'Institut national de la recherche scientifique (INRS) et le Mistissini Geological Resources Centre.

Appalaches et Grenville

Dans le cadre du plan triennal des Appalaches, plusieurs cartes géologiques ont été mises à jour ou révisées dans le sud et le centre de la Gaspésie.

Dans la Province de Grenville, une nouvelle carte géologique au 1/50 000 a été produite dans la région de Mont-Laurier et des travaux de métallogénie (Ni-Cu dans Portneuf) et de synthèse géologique (secteur de Manicouagan) ont été menés. Par ailleurs, une synthèse des travaux menés depuis 1995 par Géologie Québec dans la région de la moyenne Côte-Nord (partie est de la Province de Grenville) a été publiée à l'automne.

MINÉRAUX INDUSTRIELS

À la suite de la mise en chantier de la réfection de la route 175 entre Québec et la ville de Saguenay, un programme d'inventaire des ressources en granulats a été entrepris dans la réserve faunique des Laurentides. Trois cartes à l'échelle de 1/50 000 ont été produites à l'été 2003. Une étude sur le potentiel en métaux rares a été réalisée sur le territoire de la Baie James. Enfin, divers gîtes de calcaire et d'ardoise ont été visités dans le cadre d'une étude synthèse effectuée dans le sud du Québec.

LEVÉS GÉOCHIMIQUES ET GÉOPHYSIQUES

À l'automne, Géologie Québec a complété la réalisation d'un levé gravimétrique régional de la Gaspésie, en partenariat avec des compagnies d'exploration minière et gazière. La publication des résultats de ce levé, qui avait débuté l'an dernier, est prévue en novembre 2004.

Un autre partenariat avec quatre compagnies minières et deux organismes régionaux a permis la réalisation d'un levé géochimique de sédiments de lac dans la région de Baie-Comeau, sur la Côte-Nord. Ce levé, qui couvre plus de 40 000 km², permettra d'identifier de nouvelles cibles d'exploration dans un territoire favorable notamment pour des minéralisations en nickel-cuivre et en graphite.

ÉVALUATION DU POTENTIEL MINÉRAL

Le système de production des cartes de potentiel minéral (SPCPM) permet de générer de telles cartes en utilisant les données géominières du SIGÉOM. En 2003-2004, Géologie Québec a produit sept nouvelles cartes SPCPM à l'échelle de 1/250 000 :

- ✧ cinq cartes sur le potentiel en minéralisations de type Olympic Dam - Kiruna dans le Moyen-Nord (sous-province d'Ashuanipi);
- ✧ deux cartes sur le potentiel en minéralisations de type sulfures massifs volcanogènes en Abitibi.

BUREAUX RÉGIONAUX

Les services à la clientèle de l'exploration minière sont rendus par le comptoir de Charlesbourg et les six bureaux régionaux : Val-d'Or, Rouyn-Noranda, Chibougamau, Montréal, Sept-Iles et Sainte-Anne-des-Monts. Chaque bureau régional est sous la responsabilité d'un géologue résident.

Au cours de l'année 2003, le personnel des bu-

reaux régionaux a accueilli 11 400 clients et a répondu à 13 500 autres demandes de service acheminées par téléphone. Par ailleurs, les géologues résidents ont produit le Rapport sur les activités d'exploration minière au Québec en 2003. Ce rapport détaillé est disponible sur le site Internet du Ministère.

QUÉBEC EXPLORATION 2003

La ville de Québec accueillait, du 24 au 27 novembre, l'événement Québec Exploration 2003. Issue d'une collaboration entre le Ministère et l'Association de l'exploration minière du Québec (AEMQ), cette première édition a permis d'attirer 1 100 participants provenant des secteurs minier, financier, pétrolier et de la recherche. Compte tenu du succès obtenu, l'événement reviendra pour une 2^e édition en novembre 2004 à Québec.

COMPILATIONS GÉOMINIÈRES

Géologie Québec fournit un accès Internet à sa base de données bibliographiques nommée "SIGÉOM-Examine". Quelque 65 000 documents du Ministère ou des compagnies minières sont indexés dans cette base de données et composent le fonds documentaire géoscientifique de la province. Actuellement, plus de 20 000 de ces documents sont numérisés et peuvent être visualisés à l'écran. Le SIGÉOM permet de consulter et de commander en ligne les rapports du fonds documentaire, sur support papier ou numérique.

Géologie Québec a poursuivi la compilation et l'intégration dans le SIGÉOM des données géoscientifiques contenues dans les rapports d'exploration minière déposés au Ministère par les compagnies. Les informations disponibles dans le SIGÉOM, à la fin de l'année 2003, sont:

- ✧ la localisation des périmètres des travaux d'exploration pour l'ensemble de la province;
- ✧ la localisation et la description de 5 600 indices métalliques et de 900 gîtes de minéraux industriels;
- ✧ la localisation et la description de plus de 127 000 forages au diamant;
- ✧ la couverture géologique complète de la province à différentes échelles (1 470 cartes) ;
- ✧ les résultats d'analyses chimiques de 119 000 échantillons de roche et de 434 000 sédiments de ruisseau ou de lac;
- ✧ les produits géophysiques (champ magnétique total et résiduel, gradient magnétique vertical calculé et anomalies électromagnétiques);

- ✧ la compilation des blocs erratiques et des stries glaciaires;
- ✧ la compilation des gisements de pierres industrielles et de matériaux de construction.

ASSISTANCE FINANCIÈRE

En 2003-2004, l'aide aux prospecteurs, aux

compagnies d'exploration, ainsi qu'aux fonds miniers régionaux n'a pas été renouvelée. Toutefois, un montant de 650 000\$ a été octroyé à trois fonds autochtones d'exploration: le Fonds d'exploration minière du Nunavik (actif depuis 1998), le Fonds minier innu Nitassinan (actif depuis 2000) et le Conseil cri sur l'exploration minérale (créé en mars 2002).

New Brunswick Program Highlights 2003

GEOLOGICAL SURVEYS BRANCH

The Minerals, Policy and Planning Division of the Department of Natural Resources consists of three branches: Geological Surveys; Mines; and Policy and Planning. The Geological Surveys Branch is responsible for promoting mineral and hydrocarbon exploration as well as for advising the government and the public on issues such as land use, environment and construction. The branch has a staff of 25 and two regional offices - Bathurst and Sussex. The major activities of the branch are bedrock and surficial geological mapping; studies related to metallic minerals, industrial minerals, and hydrocarbon resources; geophysical and geochemical surveys; coastal zone mapping; and the management of exploration support programs and services.

Geoscience Projects – 2003

Bedrock Geological Mapping - Detailed (1:20 000 scale) bedrock mapping was carried out in the Tetagouche Falls (NTS 21P/12c) and Ramsay Brook (21 O/10a) areas of northern New Brunswick. Mapping at 1:50 000 scale was undertaken in the Moncton area (NTS 21H/15, 16; NTS 21I/1, 2, 3, 4) of southeastern New Brunswick.

Surficial Geological Mapping and Geochemical Surveys - The Department acquired Surfer® and Digger® software programs to convert geochemical data into colour contour maps that will show anomalous zones and trends relative to geographic position. Till geochemical surveys are in progress in the St. George (NTS 21G/2), Saint John (NTS 21G/8), Napadogan (NTS 21J/7), and Hayesville (NTS 21J/10) map areas.

Metallic Minerals - Staff continued to update the Mineral Occurrence Database. Investigations were carried out at the Lake George deposit and in the Clarence Stream area in southwestern New Brunswick, and at the Flat Landing Brook deposit in the Bathurst Mining Camp.

Geophysical Surveys - Collection and interpretation of gravity data was completed in the Clarence Stream area (NTS 21G/2, 3, 6, 7).

Industrial Minerals - Database-related projects along with reports and inventories of New Brunswick's silica and natural stone resources were completed in 2003. By establishing better access to technical data, these projects should assist in providing a suitable foundation for exploration concepts

and development alternatives.

Hydrocarbon Resources - Geological mapping and hydrocarbon resource assessment projects were carried out north and south of Moncton. North of Moncton (NTS 21I/02), in the Indian Mountain area, mapping of Lower Carboniferous beds revealed the presence of an unconformity that has a major control on what part of the Cocagne Basin is prospective for petroleum. In the Hillsborough area (NTS 21H/15), the discovery of the stratigraphic position of the Boyd Creek Tuff within the Weldon Formation provides a method of correlating sections in oil and gas exploration wells and equivalent surface sections, thereby constraining petroleum exploration models.

Geoscience Information Systems - The Minerals, Policy and Planning Division is developing a new promotional web site that will provide electronic access to geoscience databases. The web site is being created on a departmental server that will allow access to databases utilizing Web Mapping Servers. A textual geoscience database search site and a map browser are being developed to be located at:

www1.gnb.ca/0078/GeoscienceDatabase/index.htm

A bedrock database of the province is being created, and will include bedrock stratigraphy descriptions that were previously included in the Lexicon of Stratigraphy, with links to GIS data files.

Publications - In 2003, 28 reports and 51 maps were prepared for publication. Seven Open Files data releases were issued, six were geochemical reports with 15 accompanying maps and one was a geophysical report with two accompanying maps. "*Current Research 2002*" contained coloured figures for the first time.

Incentive Programs

The Province of New Brunswick announced (Telegraph Journal, Oct 9, 2003) a new exploration incentive program for the Bathurst Mining Camp, whereby it will invest up to \$2 500 000 annually over the next five years, if the private sector provides matching funding. Only producing mines are eligible to take advantage of this new program. As a result of this program, Slam Exploration Ltd signed a joint-venture agreement with Noranda Inc "to explore approximately 200 square miles of claims" in the Bathurst Mining Camp using new deep-penetrating geophysical techniques that will provide the

means to locate hidden deposits at depths of up to 2000 m. The joint venture agreement calls for the expenditure of \$25 000 000 over the next five years.

The New Brunswick Prospector Assistance Program (NBPAP) provides financial assistance to valid New Brunswick prospectors and small exploration companies who are engaged in grass-roots mineral exploration.

The New Brunswick Junior Mining Assistance Program (NBJMAP) provides financial assistance to junior mining companies conducting exploration in New Brunswick.

Four introductory prospecting courses were held in 2003.

Two prospectors received cash rewards for the most spectacular new showing discovered during the year. In addition, nine prospectors were awarded funding to attend a major conference (Prospectors and Developers Convention in Toronto or Mineral Exploration Roundup in Vancouver).

Partnership Programs

The New Brunswick Geological Surveys Branch worked closely with the Geological Survey of Canada, University of New Brunswick, Acadia University, and industry in 2003. The Targeted Geoscience Initiative (TGI) project titled "*Metallogeny of Intrusion-related Gold Systems in Southern New Brunswick*" ended in 2003. The renewed TGI is a two-year program that will include an aeromagnetic survey in the Marriatown area of southern New Brunswick, and hydrocarbon potential studies in the Carboniferous Moncton Subbasin and in Devonian rocks of northern New Brunswick. The New Brunswick Department of Natural Resources and the Geological Survey of Canada co-fund the Targeted Geoscience Initiative.

During 2003, the New Brunswick Department of Natural Resources partnered with the University of New Brunswick and Acadia University on six and three projects, respectively. Studies included detailed bedrock mapping on Grand Manan Island and in the Mechanic Settlement, McCully and Tetagouche Falls areas; geophysical modelling in the Clarence Stream area; and mineral deposit studies in the Clarence Stream area and Bathurst Mining Camp.

A metadata catalogue of New Brunswick geoscience data, funded by the Canadian Geoscience Knowledge Network (CGKN) and the New Brunswick Department of Natural Resources, is being created to increase and simplify access to this type of data on the internet. The catalogue, in MS Access

format (containing approximately 400 metadata records), has been connected to the GeoConnections search portal. This database is being updated to include all New Brunswick geoscience data collections and publications. The database has been converted to Oracle format to allow connection to the GeoConnections and CGKN portals from a departmental server.

REVIEW OF ACTIVITIES

The 28th annual Review of Activities was held Nov 3rd to 5th, 2003. The theme of this year's conference was "*A Celebration of New Brunswick's Mining History... Gesner's Dream Come True*". Two pre-conference events attracted delegates. The University of New Brunswick Geology Department's student chapter of the Society of Economic Geologists, in association with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), sponsored a workshop on "Modern Methods in Exploration Geochemistry". A field trip, titled "*A Look at an Ancient Volcanic Environment in the Meductic Area, West-Central New Brunswick*", was sponsored by the New Brunswick Department of Natural Resources. More than 45 geoscience posters and prospector displays were a key element of the Review. In addition to the technical and poster sessions, prospector core shack, industry trade show and special events, the conference concluded with a mineral claims staking forum. Approximately 250 delegates attended.

During the Review of Activities, the New Brunswick Branch of the CIM hosted a half-day session; presenters spoke on topics related to the base metal, potash and oil and gas sectors.

EXPLORATION AND PRODUCTION STATISTICS

The mineral exploration expenditures for New Brunswick were approximately \$3.2 million in 2002 compared to \$9.4 million in 2001. During 2003, \$2 million was spent on seismic surveying for oil and natural gas.

The number of new claims recorded in New Brunswick in 2003 was 2936 (1326 in northern New Brunswick and 428 in the south). During the latter part of 2003, a surge in mineral claim staking was experienced in northern New Brunswick. The number of claims in effect has increased 2.5% to 13 493 (9890 in the north and 3603 in the south).

The preliminary value of New Brunswick's mineral production for 2002 is \$652.3 million, a decrease of 19% from the final value of \$807.2 million for 2001.

MINERAL EXPLORATION

Highlights – 2003

Although a few major mining companies hold land in New Brunswick, none were active during 2003. A number of junior mining companies, local exploration companies and prospectors were active exploring for mainly gold and base metals.

In northern New Brunswick, interesting gold assays have been reported in the North Tetagouche and Ramsay Brook areas and in the vicinity of the Nicholas Denys Granodiorite. The Chester, Flemming Brook, Mount Costigan and Goodwin Lake properties were explored for base metals, and the Malachite property was explored for cobalt.

Much of the exploration activity in southern New Brunswick during 2003 focused on gold in the vicinity of Clarence Stream, east of St. Stephen. Work conducted by exploration companies, provincial and federal geological surveys, and the University of New Brunswick in this area and in south-central New Brunswick has demonstrated that a world-class gold district is emerging in the region. The intrusion-related gold model has been firmly established for most of the deposits and occurrences, and their association with the Saint George and Pokiok granitic batholiths has been confirmed.

Outside the Clarence Stream district, a number of areas were explored for gold, including Poplar Mountain, Cape Spencer, Canaan River, Marrrtown, Annidale. In the Cape Spencer area, several, new high-grade mineralized zones were discovered. In the Canaan River area, prospectors delineated a soil geochemical anomaly (up to 237 ppb Au) that extended over several kilometres. Further exploration in this area could open up exploration opportunities in the province's extensive Carboniferous basins.

Interest has been renewed in the St. Stephen Ni-Cu-Co deposits; lamprophyre dikes throughout the province were examined for their potential to generate economic precious metal and gem mineralization.

A high-calcium limestone property at Flatlands and a limestone-dolomite property west of Saint John are being explored. In the Doaktown area, a lo-

cal stone company is investigating flagstone development opportunities.

HYDROCARBONS AND UNDERGROUND STORAGE

Legislation

Review of the Oil and Natural Gas Act continued with phase two of a program initiated to modernize outdated legislation; this will result in a new drilling and production regulation, an amended geophysical exploration regulation and a new royalty regulation.

The Department of Natural Resources established a posting schedule for the sale of New Brunswick's oil and natural gas rights. This schedule will alert the oil and gas industry and interested parties of closing dates for nominations, publishing dates and sale closing dates. Call for Tenders #18 ONG 01-04 was issued for nine licences to search under the Oil and Natural Gas Act.

Highlights

Corridor Resources Inc. and partner Potash Corporation of Saskatchewan Inc (PCS) commenced natural gas production in April of 2003 from the first two wells drilled in the McCully field located near Sussex. The gas is being delivered by two pipelines to a gas plant where it is processed prior to fuelling PCS's potash mill located 2 km from the wells. The planned natural gas production rate, to meet expected mill demand, is 2.3 MMcf/d. The natural gas production from McCully is the first to occur in New Brunswick since production from Stoney Creek, New Brunswick's only other gas field, ended in 1991. The companies continue their work to delineate the reservoir. In November, a 30 km² 3-D reflection seismic program was initiated by Corridor in the area of the McCully field.

Companies holding underground storage exploration licences continued to assess their agreement areas without undertaking on-the-ground drilling and seismic exploration.

Nova Scotia Program Highlights 2003

INTRODUCTION

Government geoscience activities in Nova Scotia are largely carried out by the Geological Services Division of the Department of Natural Resources. These activities are designed to stimulate and support exploration for mineral and onshore hydrocarbon resources and to provide geoscience information and expertise to other provincial government departments for a variety of uses. Some geoscience-related support for onshore hydrocarbon resources is provided by the provincial Department of Energy, which until recently was focused on activities in the Atlantic offshore.

The Geological Services Division comprises three sections - Geological Mapping and Geochemistry, Resource Evaluation and Geoscience Information Services. The Division's program is delivered by 18 professional geologists, who are supported by 5 technical and administrative staff.

Base funding for the Geological Services Division in 2003 was approximately \$1.9 million, which is the same level as the two previous years. This funding was supplemented by contributions from the federal government's Targeted Geoscience Initiative, Phase 2, and its GeoConnections program, which provided funding to the Canadian Geoscience Knowledge Network. The Division also received project-specific funding from Enterprise Cape Breton Corporation, the provincial Office of Economic Development and the Strait-Highlands Regional Development Authority.

GEOLOGICAL MAPPING AND GEOCHEMISTRY

A highlight of the 2003 program for the Geological Mapping and Geochemistry Section was the initiation of a collaborative bedrock mapping project with the Geological Survey of Canada - Atlantic within Phase 2 of the Targeted Geoscience Initiative. The new project, which follows successful completion of a project in Phase 1 of TGI, will update and enhance the geoscience database for a large area in central Nova Scotia that includes the St. Mary's Graben and the Cobequid-Chedabucto Fault Zone. The sedimentary rocks of the graben structure are of interest to the hydrocarbon industry, and the fault zone has been a conduit for mineralizing fluids that are evident in many mineral occurrences along its length (see discussion of IOCG deposits below). This project will continue through 2004-05.

The Geological Services Division's geochemistry expertise is used primarily to support mineral exploration. In 2003, however, staff were recruited to help other provincial departments understand and respond to issues related to metals in the environment. These included anomalously high levels of radioactive lead in drinking water and accumulations of heavy metals in soils and waters in urban neighbourhoods. Division staff are also participating in a Geological Survey of Canada project to study mercury in tailings of historical gold mines in Nova Scotia. These activities are new and important uses of the Division's expertise, which is not well known within government.

RESOURCE EVALUATION

Higher prices for gold in 2003 were directly reflected in substantially increased interest in Nova Scotia's gold deposits, which are predominantly hosted in the metasedimentary rocks of the Cambro-Ordovician Meguma Group. By the end of the year, six deposits in the Eastern Shore area of northern mainland Nova Scotia, including past-producing mines, were being actively explored by a variety of junior mining companies. The Resource Evaluation Section supported this work by providing advice and expertise on the geological settings of the deposits, which are structurally complex. The Section also helped company geologists access, compile and interpret existing information about the deposits, and in interpretations of diamond drill core acquired in exploration programs. These exploration efforts are, in turn, resulting in acquisition by Section geologists of important new clues about the formation and distribution of gold mineralization in the Meguma terrane. New underground exploration, in the form of re-opening of old workings and in new workings, is especially useful.

Efforts by the Resource Evaluation Section in the past several years to promote the major Cobequid-Chedabucto Fault Zone that crosses central Nova Scotia as an environment for iron oxide - copper - gold (IOCG) mineralization came to fruition in 2003, when several companies took out large land positions as a base for exploration. Division staff are assisting these efforts through new field and laboratory investigations that will enhance the government's database and encourage more work by the private sector.

Much of Nova Scotia's current mineral production comes from industrial minerals, including gypsum, salt and aggregate. During 2003, the Resource

Evaluation Section responded to a significantly greater number of requests for information about industrial mineral commodities, including significant interest in aggregate and carbonates (limestone, dolomite, marble). Nova Scotia's advantage of potential aggregate resources located on ice-free deep water has engendered interest from the northeastern United States, where renewal of the existing infrastructure and expansion of communities has created a demand for aggregate that cannot be accommodated by local sources. Industry interest in carbonate resources located in Cape Breton Island resulted in collaboration by the Geological Services Division with several economic development agencies. A joint project was developed in which local companies holding the rights to a number of deposits were provided funding support to acquire additional geological information to help them market their deposit to offshore interests. The Division provided overall geoscience direction and advice to the funding agencies, and also received some funding to carry out similar work on Crown-held resources. This was a very successful venture that the Division hopes to repeat in the future.

GEOSCIENCE INFORMATION SERVICES

The Geoscience Information Services Section is responsible for the publication of all map, report and data products resulting from the Division's program.

The GIS Section also operates a Core Storage Facility that contains extensive drill core holdings and other geological sample materials.

The Geological Services Division, like its counterparts across Canada, is striving to make all of its information holdings more readily available to clients via the Internet, particularly through the application of Internet Map Services (IMS). In 2003, the Division continued to develop its IMS applications and to complete the preliminary work required to make its data operable in these applications. An important facet of this work was the Division's participation in activities related to the development of the Canadian Geoscience Knowledge Network, which is an initiative of the National Geological Surveys Committee to make the geoscience information holdings of all government geological surveys interoperable and available via the Internet.

Another important activity for the Division in 2003 was work to consolidate its core and sample holdings. These are currently distributed in three widely separated buildings in southern mainland Nova Scotia. The Division is working to consolidate these holdings within the largest facility, which is located in Stellarton. When completed, this work will improve the efficiency of the sample storage program by eliminating duplicate and unnecessary holdings, updating information about holdings and reducing operating costs.

Newfoundland and Labrador Program Highlights 2003

INTRODUCTION

The Geological Survey of Newfoundland and Labrador (GSNL)'s project roster for 2003-2004 consisted of 27 projects, seven of which were field-based studies. The other 20 consisted of write-up work, digital map compilation, geochemical analysis, cartography, etc. Due to budget constraints, field work is conducted on a planned rotation basis such that approximately 7-8 geoscientists are in the field at any one time.

GSNL's budget for 2003-2004 was \$3 738 444, of which \$20 000 represents temporary funds allocated from elsewhere in the Mines Branch. Two permanent positions remain vacant as part of the Survey's contribution to a government-wide cost-cutting measure. All funding is from government appropriation.

Exploration expenditures in Newfoundland and Labrador for 2003 are projected to be \$25-million, down from the \$44.2-m of the previous year. Approximately \$10-million is projected for Labrador and \$15-million for the Island. Approximately 12 000 new claims were staked in 2003, 5000 in Labrador and 7000 in Newfoundland. A total of approximately 60,000 claims were in good standing at the end of 2003.

PROGRAM HIGHLIGHTS

Bedrock Geology Surveys

The Survey has just one major bedrock-mapping project in Labrador. It occurs in a corridor north of Voisey's Bay, stretching from the coast to the Québec border. Bruce Ryan and Don James are carrying out the 1:50 000-scale systematic mapping in an area underlain by Archean gneisses, Paleoproterozoic anorthosites and gabbros, and the Mesoproterozoic Nain Plutonic Suite (NPS). It is a troctolite unit within the NPS that hosts the Voisey's Bay deposit. The focus will be on mapping the NPS multiple plutons in the corridor. Given the nearly indistinguishable appearance of some of the plutons, geochronology will be an indispensable tool. In this regard, the second Targeted Geoscience Initiative (TGI) has become an important part-

ner, and is sponsoring a comprehensive geochronological program to assist with the mapping.

On the Island, the Survey had two bedrock-mapping projects in 2003. They are focused on areas where only reconnaissance mapping exists, or detailed re-mapping is needed to upgrade existing maps. In this way, all of the mapping is working toward filling the knowledge gaps in the province's bedrock-geology coverage.

In central Newfoundland, a project to provide detailed structural and stratigraphic information on the Ordovician Roberts Arm Group continued. Brian O'Brien focused his studies in the area containing the former Gullbridge base-metal mine, which is underlain by bi-modal volcanic rocks and associated sedimentary rocks. These units are disposed in a northwest-dipping, southeast-verging thrust stack, a similar geometry to that described for the rocks that host the famous Buchans deposits. Understanding the complex structure of the region is fundamental to supporting further exploration in this part of the Roberts Arm Group.

GSNL has had a long-term program of mapping and re-mapping the Neoproterozoic redbeds and volcanic rocks of eastern Newfoundland's Avalon Zone. This continued in 2003 with Sean O'Brien carrying out mostly 1:50 000-scale work on the Bonavista Peninsula. The project's goal is to put the sedimen-



Figure 1. The Big Land! Northern Labrador field area, 2003, with (l-r) Steve Colman-Sadd, Bruce Ryan and Don James examining anorthosite.

tary-hosted stratiform copper mineralization (the focus of significant exploration) into its stratigraphic and structural context within the Avalon Zone's Neoproterozoic basins. Importantly, the shallow-marine to terrestrial mineralized rocks are already better constrained vis-à-vis the somewhat older, less prospective turbidites. A fascinating sidebar to the mapping was the discovery in 2003 of Ediacaran fossils in the Conception Group on the Bonavista Peninsula. These fauna are typical of the world-famous occurrence at Mistaken Point, and will no doubt shed further light on these rare Late Precambrian life forms.

Surficial Geology/Geochemical Surveys

The Survey's aggregate work continues to be of significant importance to road construction and municipal development. Granular-aggregate studies were carried out along a new section of the Trans-Labrador Highway in southeastern Labrador in 2003. Led by Jerry Ricketts, the mapping has identified several glaciofluvial sand and gravel deposits that could be exploited for future developments. Jerry also carried out a pilot project with colleague Shirley McCuaig that tested ground-penetrating radar as a means of determining the thickness of an aggregate deposit, with positive results.

Till geochemistry is one of the more successful programs for stimulating and guiding mineral exploration in Newfoundland and Labrador. To this end, the Survey has maintained a program of systematic sampling and regional-anomaly follow-up through-

out the province, to provide both prospect-specific and blanket coverage. In 2003, Martin Batterson and Dave Taylor focused their efforts in eastern Newfoundland around the Avalon Peninsula. They collected 1000 samples, which will be analyzed for a standard suite of elements. Till cover throughout the region is fairly expansive so the analyses will provide an excellent picture of metal distribution. Multiple ice-flow directions were also identified through striae and clast-provenance analysis.

Mineral Investigations

A new metallogenic study was initiated in the Cambro-Ordovician sequence of western White Bay, western Newfoundland. Andy Kerr is attempting to determine how the lithostratigraphy and known gold mineralization may be a guide for exploration, and to see if the Carlin-type model might apply to the mineralization. The sedimentary sequence is comparable to the lower Paleozoic platformal rocks elsewhere in western Newfoundland, and the gold mineralization is concentrated in Cambrian units close to the regional unconformity with Grenvillian basement. Samples from drill core and elsewhere will be analyzed for their trace-element geochemistry to look for distinctive signatures relating to the nature of the gold mineralization.

GSNL continued its research into the VMS potential of the Tally Pond Belt of central Newfoundland with the focus remaining on Aur Resources' advanced Duck Pond – Boundary project. Work in 2003 was carried out by Gerry Squires who recently joined the Survey (replacing Paul Moore who returned to industry). Gerry has many years experience in central Newfoundland with Noranda, Thundermin Resources and Aur Resources, and is considered an expert on the Duck Pond Deposit. He is focusing on re-logging drill core, which has resulted in the recognition of new quartz-phyric tuff units that are important marker horizons in all the mineralized sections. A new mylonite zone has also been recognized in drill core separating late Precambrian volcanic rocks from the Cambrian volcanic rocks of the Tally Pond Belt. At the end of his Tally Pond work, Gerry briefly initiated a new project that will look at the gold mineralization,



Figure 2. Unconformity (arrow) between Cambro-Ordovician cover rocks and Grenvillian basement, western White Bay. Field assistant Mark Tobin for scale.

stratigraphy and structure of the so-called Botwood Basin, the focus of much of the gold exploration activity during the past two years in Newfoundland.

Other Activities

The Survey continues to support students doing Honours and Masters theses at Memorial University of Newfoundland. This is done in a way whereby the students' research and that of their supervisors generally complement some element of research being carried out by GSNL geoscientists. This has historically been a mutually beneficial liaison, which in 2003 saw support for these students:

Chad Pennell (MSc) is doing his thesis study on a dome-and-basin structure around Powder Horn Lake in central Newfoundland, where prospective rocks of the Roberts Arm Group are exposed in the dome. The study will include detailed analysis of the structure and metamorphism. Chad has been Brian O'Brien's field assistant for the last two years.

Jacqueline O'Driscoll (MSc) is mapping and sampling five transects across the Davidsville and Botwood groups in the Botwood Basin of east-central Newfoundland. Using geochemistry, geochronology and paleontology, Jacqueline hopes to shed light on the nature and timing of gold mineralization in the numerous showings of the Botwood Basin.

Greg Sparkes (M.Sc.) continues his study on the timing and nature of volcanism, plutonism and gold mineralization in the Neoproterozoic Harbour Main Group of eastern Newfoundland. Greg's field work on such low-sulphidation gold-bearing quartz veins as Steep Nap is being supervised by Sean O'Brien.

There are many other office-based projects, familiar to our clients, that are essential to the effectiveness of GSNL. These include GIS and IT services, geochemical laboratory, Mineral Occurrence Data System (MODS), publications and cartography, and information services. Below are other activities or highlights worthy of mention this year:

A long-term project of merging geophysical data from various surveys continues under geophysicist Gerry Kilfoil. He has been compiling aeromag and EM surveys, using both regional government data

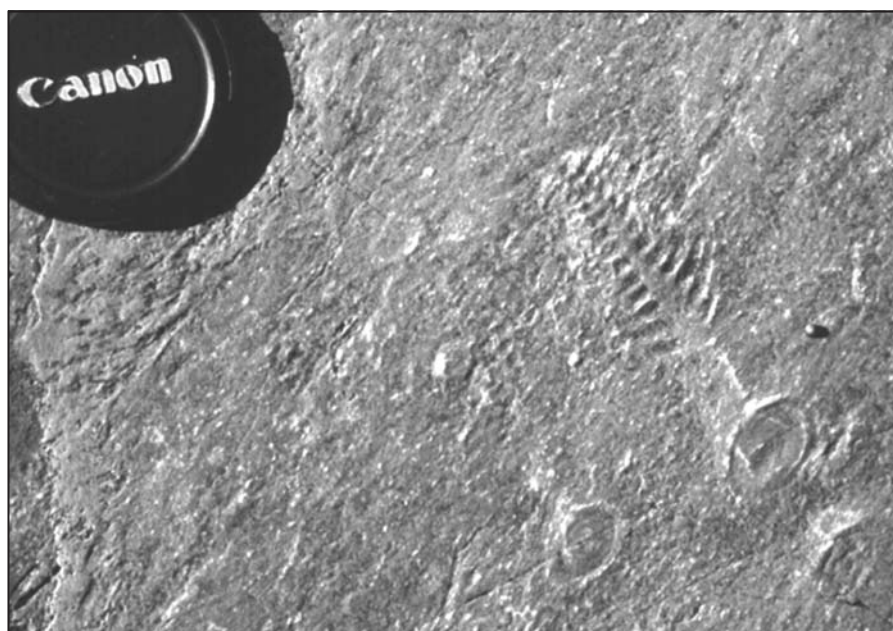


Figure 3. Ediacaran fossils in late Precambrian rocks of the Bonavista Peninsula, discovered by Sean O'Brien in 2003.

and detailed, area-specific, industry data contained in assessment reports. All these data are merged into a seamless layer, and in 2003 a Digital Atlas of Merged Magnetic Data was released on CD-ROM for northern Labrador. Gerry is currently concentrating on a similar product for Newfoundland.

Good progress is also being made on a digital compilation of all existing bedrock-geology maps for the Island. Under the leadership of Steve Colman-Sadd and with the assistance of Loretta Crisby-Whittle, the compilation now encompasses most of the Island. Steve has written two pieces of software (GeoLegend and PlotSymbol – released to the public in 2003) that allow the creation, merging and integration of myriad geological data from numerous maps of varying vintages and scales, to produce customized, unified digital maps in a GIS environment. From this, a GIS presentation of bedrock geology is possible via CD or the Internet.

The maintenance of industry mineral-assessment reports in a searchable retrievable database is an important service to clients, and is carried out by Catherine Patey and Cindy Saunders. The project captures the immense contribution that industry geoscience makes to the province's knowledge base, and the data's enduring value to current and future exploration. During 2003, a major contribution was made to the knowledge base by Noranda, which donated its voluminous geological files on Newfoundland from its 35 years of exploration in the province. GSNL is extremely grateful for the gift, and will integrate the new records into its existing databases. Further, pending on funding approval, the Survey

intends to scan all its assessment-file holdings to make them accessible online. This has already been done in some other provinces and is appreciated by clients everywhere. GSNL would also like to acknowledge the support it has received from NRCan's Geoconnections program toward the integration of the province's geoscience documents into a web-accessible format compatible with the standards of the Canadian Geoscience Knowledge Network (CGKN).

The third North Atlantic Minerals Symposium (NAMS) was held in Dublin, Ireland, September 1-3, 2003. It was co-organized and overlapped with the International Geochemical Exploration Symposium. NAMS is sponsored by the Geological Survey of Newfoundland and Labrador and the Geological Survey of Ireland. The meeting attracted participants from around the world and was judged a great success. The next NAMS is scheduled for May 2005 in Halifax, Nova Scotia, in conjunction with the annual meeting of the Geological Association of Canada and the Mineralogical Association of Canada.

Open House 2003

The 27th Annual Review of Activities of the Department of Mines and Energy took place on October 30, 2003, at the Delta St. John's Hotel. It was held in conjunction with the 50th Annual Newfoundland Branch meeting of the Canadian Institute of Mining, Metallurgy and Petroleum, Oct 30 to Nov 1.

Over 300 delegates attended the review and conference. All divisions in the Department summarized their activities for the year, and through invitation, the highlights of Memorial University's Earth Sciences Department were presented. All GSNL technical information was presented in the poster session, which also included posters on GSC activities in the province.

The 8th Annual Public Lecture sponsored by GSNL was presented on the evening of October 30. Lawson Dickson spoke on the topic "*Building Stone: Its History and Use in Newfoundland and Labrador*" to a full house. His talk was very well received, and was followed with many questions and much discussion on the use of stone in St. John's.

Yukon Program Highlights 2003

OVERVIEW

Eleven years ago, the Canada-Yukon Geoscience Office opened its doors and marked the beginning of a de facto Yukon Geological Survey (YGS) with the creation of the Yukon Geology Program. In April of 2003, that vision finally became a reality when responsibilities for management of Yukon's natural resources devolved from Federal Government to the Government of Yukon. The Department of Energy, Mines and Resources now has responsibility for minerals, oil and gas, forestry, agriculture and lands. The new Yukon Geological Survey (Fig. 1) supercedes the Geology Program. YGS is part of the Minerals Development Branch, and is co-managed by Grant Abbott and Rod Hill, under the direction of Jesse Duke. The Geological Survey integrates the Exploration and Geological Services Division (EGSD) of the Department of Indian Affairs and Northern Development (DIAND), with the Yukon Geoscience Office, the Mineral Assessment Group and the Yukon Mining Incentives Program (YMIP) of the Department of Energy, Mines and Resources of Government of Yukon (YTG). The Geological Survey of Canada (GSC) also maintains an office with the YGS.

Funding for the YGS remains at the same level as it was in previous years for the Geology Program. This year, in addition to core funding, we benefitted from additional short-term funding from DIAND through the industry led Northern Geoscience Initiative and through the Knowledge and Innovation Fund. The last Federal Budget renewed the Natural Resources Canada Targeted Geoscience Initiative for two more years. Yukon Government will see substantial funding this year, with YGS as a partner.

Over the past year we were sorry to lose Roger Hulstein and Robert Stroshein from the Mineral Assessment Group to the private sector. We are pleased to welcome mineral assessment geologist Geoff Bradshaw and project geologist Steve Israel.

The Technical Liaison Committee to the YGS reviews our Program twice a year. We are grateful to Chair, Gerry Carlson and members Al Doherty, Moira Smith, Jean Pautler, Forest Pearson, Bernie Kreft and Jim Christie for their valuable support and constructive advice.

A mandate for the YGS has been developed in consultation with senior management in Energy, Mines and Resources and the Technical Liaison Committee. The YGS now has the responsibility, "to build, maintain, and communicate the geoscience

and technical information base required to enable stewardship and sustainable development of the Territory's energy, mineral, and land resources". The mandate formalizes much of the work that has been underway over the last few years through the Geology Program, and opens the door for projects in new areas. Support for the mineral industry remains the primary focus, but more resources are being dedicated to mapping and studies of areas with hydrocarbon potential. Effort is also going into environmental studies that have relevance to the extractive industries and land use issues. In recent years, interest and demand for geoscience information has increased substantially from regulators, First Nations, the general public and schools. In addition, the interests of resource industries are best served by informed decision making and informed public opinion. As a result, perhaps the largest change is not in what we do, but in the increased diversity of our clients.

FIELDWORK

The YGS is committed to providing a balanced complement of field projects that not only quickly stimulate mineral and hydrocarbon exploration, but also take the longer-term view towards developing an understanding of the Yukon regional geological framework, and building the Yukon Geoscience database. Field projects carried out in 2003 are shown in Figure 2, and the present state and location of geological, geochemical and geophysical surveys are shown in Figure 3.

Bedrock mapping continues to be the cornerstone of the YGS. Several projects are in the completion and writeup stage this year. Lee Pigage has a bulletin in press on the geology of the Anvil District, and is writing a bulletin and papers on the Labiche mapping project as part of the Central Forelands National Mapping Project (NATMAP). Grant Lowey has a bulletin in press on the placer geology and potential of Stewart River map area. NATMAP is in its final year. Maurice Colpron and Don Murphy are each writing bulletins on the Glenlyon and Finlayson areas respectively. Maurice Colpron is organizing and editing a summary volume for the Canadian Journal of Earth Sciences. The volume will summarize the results of more than four years of work in Stewart River, Glenlyon, Finlayson Wolf Lake map areas in Yukon, parts of northern and southern BC and Alaska by authors from the YGS Geological Survey of Canada, British Columbia Geological Survey, United States Geological Survey, Alaska Division of Geological and Geophysical Sur-



Figure 1. Yukon Geological Survey staff from left to right: Geoff Bradshaw, Charlie Roots, Steve Traynor, Lara Lewis, Rob Deklerk, Grant Lowey, Diane Emond, Ken Galambos, Grant Abbott, Karen Pelletier, Jo-Anne vanRanden, Ali Wagner, Bill LeBarge, Amy Stuart, Rose Williams, Lee Pigage, Craig Hart, Panya Lipovski, Crystal Huscroft, Mike Burke, Kaori Torigai, Don Murphy, Julie Hunt, Rod Hill, Jeff Bond, Maurice Colpron.

veys and several universities. This work has made a seminal leap in our understanding of the geology and mineral potential of the Yukon Tanana Terrane, one of the least understood parts of the North American Cordillera.

Field work in 2003 included ongoing bedrock mapping in the Finlayson Lake map area where Don Murphy continues to define and expand areas of potential for volcanic-hosted massive sulphide (VMS) deposits and emeralds. Maurice Colpron and Charlie Roots participated in the GSC's Stewart River mapping project where accelerated mapping with contract helicopter support allowed timely completion of fieldwork. Lee Pigage undertook a short exploratory trip into eastern Coal River map area to determine possible correlations of Late Proterozoic and Early Paleozoic volcanic and siliciclastic rocks near Toobally Lakes with possibly equivalent strata in adjacent Labiche maps area. Our most important new initiative is the Whitehorse Trough Project. The Whitehorse Trough project will be a multidisciplinary partnership with the Geological Survey of Can-

ada and universities, much like the current NATMAP. The purpose is to more accurately determine the hydrocarbon potential of the northern portion of the Trough by more clearly defining its stratigraphic and structural framework. This year, Grant Lowey began a stratigraphic and sedimentological study of the Laberge Group. Later this year, the GSC, with funding from the Targeted Geoscience Initiative will conduct a seismic survey across the Trough along the Campbell and Klondike highways. Stratigraphic sedimentological, structural studies and bedrock mapping will continue over the next two years.

Craig Hart is completing a PhD Program at the University of Western Australia. Most of the requirements for the degree will entail writing papers on his previous field studies of the Tintina Gold Belt and other Yukon gold occurrences. This year, Craig and Lara Lewes carried out a wide ranging reconnaissance of Tungsten and beryl occurrences.

Julie Hunt has returned to school to undertake a

PhD program at James Cook University in Australia. YGS is funding her fieldwork. Julie partnered with Derek Thorkelson to complete fieldwork on the Wernecke Breccias, and is taking advantage of the Australian connection by comparing the Yukon breccias with similar Australian rocks which host giant copper-gold ore deposits.

Bill LeBarge and Mark Nowasad completed their studies of the relationship between sedimentology, grain size distribution and water quality of effluent from placer deposits. Their results will be evaluated for possible long-term applications and further research. Data gathered from this study was useful in the 2003 review of the Yukon Placer Authorization.

Jeff Bond continued surficial mapping of the greater Whitehorse area to be published as two 1:50 000-scale maps. The project will provide baseline information to support land use decisions, groundwater studies and public education.

Jeff and Kristen Kennedy studied the surficial geology and ice-flow patterns in the Seagull Creek area, and determined that glacial flow was to the north, up-valley, in the opposite direction to what had previously been believed. These results have a significant bearing on the interpretation of soil geochemical anomalies and potential of known gold occurrences in the area.

Jeff also provided advice and support to placer miners, First Nations and to the Department of Fisheries and Oceans on matters related to surficial geology.

EXTERNAL SUPPORT

The YGS is providing financial and logistical support, or is a partner with graduate students and university researchers in the following projects:

Fionnuala Devine began field work in the Finlayson Lake area for a Masters Thesis under Dr S. Carr at Carlton University. Her study of the geological setting and geochemical, petrological and geochronological character of high pressure metamorphic rocks of the Yukon Tanana Terrane will provide critical information on the metamorphic and tectonic history of these rocks.

2003 Field Projects

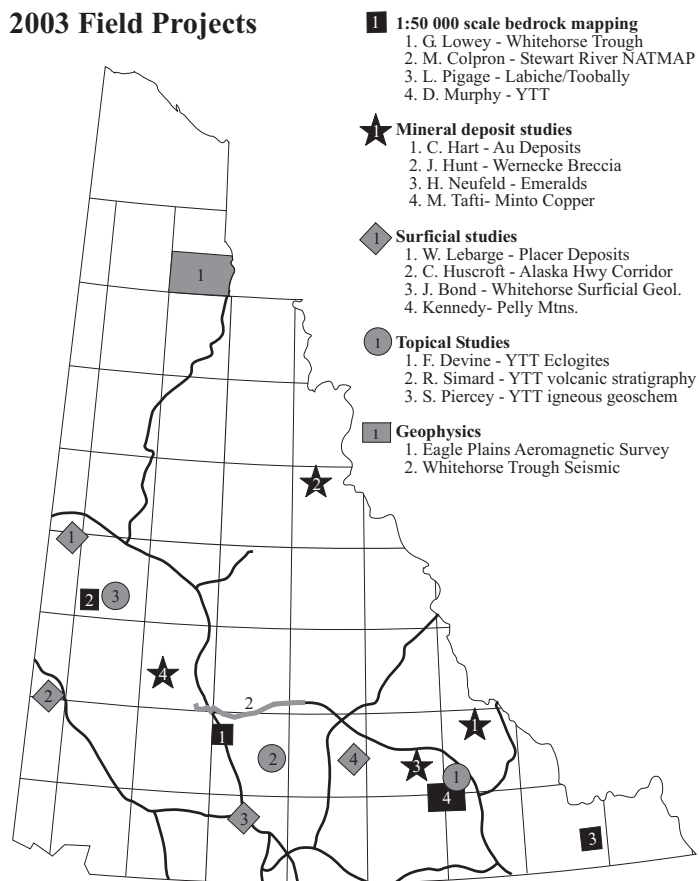


Figure 2. Field projects carried out or sponsored by the Yukon Geological Survey in 2003.

Reza Tafti is completing a study of the Minto copper deposit for his MSc at The University of British Columbia under the supervision of Jim Mortensen. Through the project we will attempt to gain a better understanding of the nature, age and origin of the main host rocks to the Minto deposit and the Cu-Au mineralization contained within them. This information will be used as a basis for developing an exploration model for similar mineralization elsewhere in the Minto-Williams Creek belt.

Heather Neufeld is completing a study of emerald and beryl occurrences in the Yukon and Northwest Territories for her MSc degree at The University of British Columbia under the supervision of Jim Mortensen and Lee Groat. The main focus of the study will be the Regal Ridge emerald deposit in the Finlayson Lake district. The purpose of the project is to understand the origin of the emerald occurrences and to develop exploration guidelines for the northern Canadian Cordillera.

Renée-Luce Simard is completing a study of the volcanic stratigraphy, composition and tectonic evolution of Late Paleozoic successions in central Yukon for her PhD thesis at Dalhousie University under the direction of Dr J. Dostal. The project compares and

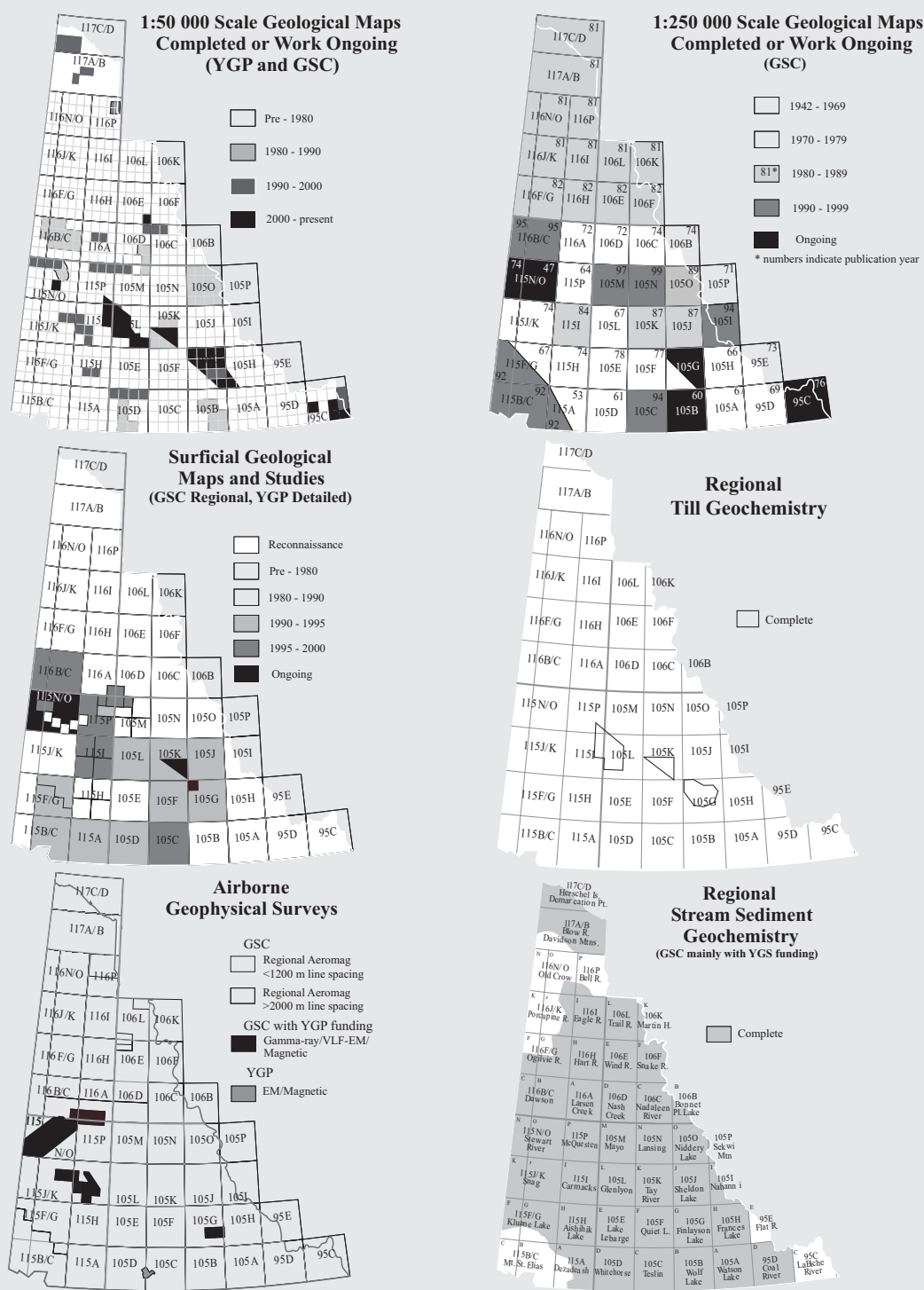


Figure 3. Summary of available geological maps, and regional geochemical and geophysical surveys in the Yukon.

contrasts the depositional style, composition and tectonic setting of several volcanic successions within the belt of pericratonic terranes in the Northern Cordillera. These include the Klinkit succession in Wolf Lake map area, the Little Salmon succession in Glenlyon map area and the Boswell and Semenoff Formations in central Laberge map area.

Steve Piercey at Laurentian University, as part of the Ancient Pacific Margin NATMAP Project, is completing a study of the field, geochemical and isotopic attributes of volcanic and intrusive rocks in the Stewart River map area. The study will, in part, determine the similarities and differences of these rocks to volcanogenic massive sulphide (VMS)-bearing rocks in the Finlayson Lake district.

In addition to providing geochronological support to the GSC's Stewart River project, Mike Villeneuve has been using argon geochronology to: 1) determine the cooling and uplift history of the Klondike region to aid in understanding mineralizing and tectonic processes in that region; 2) define the timing of recent volcanism in the Yukon, particularly the Fort Selkirk region; and, 3) provide timing constraints on intrusion-related gold mineralization in the Tintina Gold Belt.

REGIONAL MINERAL POTENTIAL ASSESSMENTS

Over the last several years the Mineral Assessment Group has had to change focus twice to support government priorities. Regional Mineral Assessments for most of the Yukon were completed in 2001 in support of the Yukon Protected Areas Strategy (YPAS) and Land Claims Negotiations. By spring of 2002, the YPAS process had been shelved and work focused on detailed assessments of Special Management Areas selected under land claims. These were completed in the spring of 2003. This year, the land use planning process, as mandated under the First Nations Umbrella Final Agreement was established in two Traditional Territories. The YGS is using previous regional assessments to become engaged with the land use planning commissions and affected communities.

ENVIRONMENTAL STUDIES

Karen Pelletier continued to administer the Mining and Environmental Research Group (MERG) YTG. The 2003 funded studies include: The Evolution of Metal Tolerant Vegetation in Native Yukon Vegetation Invading Abandoned Mine Sites: A Strategy for Long-Term Regulation by Thomas Hutchinson, Trent University; Bioengineering Experimentation - Noname Creek and Gold Run Creek,

Feasibility Study and Field Trials by Laberge Environmental Services; Permafrost and Freezing: Implications for Northern Mine Sites by EBA Engineering Consultants Ltd; Examination of Natural Attenuation of Metals in Soils in Northern Environments by Access Consulting Group; and Evaluation of Distributions of Bacteria, Sediments, Aqueous Chemistry and Heavy Metals in Yukon Wetlands by EBA Engineering Consultants Ltd.

Karen continues to review Mining Land Use and water license applications, and monitor reclaimed sites to document the effectiveness of mitigation practices. Karen also represents YGS on a several committees which sponsor environmental research that involves geology.

Funding from the DIAND Knowledge and Innovation Fund has supported a project by Crystal Huscroft to characterize the settings of landslide hazards along the Alaska Highway Corridor. Many of the landslides in the region are related to degradation of permafrost and the influence of frozen ground on soil drainage. This study will help to assess the potential impact of global warming on terrane stability and the risk to future development such as the Alaska Highway pipeline.

YUKON MINING INCENTIVES PROGRAM

The Yukon Mining Incentives Program (YMIP) received ninety-three applications and a total of \$987,000 was offered to 61 successful applicants. Nine of these programs were approved under the Grassroots-Prospecting module, nineteen applicants were part of the Focused Regional module and thirty-three proposals were approved under the Target Evaluation module.

With the increased price of gold on the world market, applicants were well poised with their exploration targets this season. Precious metal exploration under the program was up significantly to 56% of the applicants searching for gold and platinum group elements. Base metal exploration accounted for 30% of approved programs, while the remaining 14% of programs explored for gemstones and other commodities. Exploration programs were proposed for all four mining districts and were fairly evenly dispersed over the entire territory. This year there have been four option agreements signed for properties that have been explored under YMIP with at least five more currently under negotiations.

Highlights for the year, for both placer and hard rock exploration programs, include the discovery of significant gold and pathfinder anomalies in both soils and rock and the extension of known showings through prospecting and geophysics.

LIAISON AND SUPPORT TO INDUSTRY, FIRST NATIONS AND THE PUBLIC

Mike Burke and Bill LeBarge, our main links to the exploration industry, continued to monitor Yukon hard-rock and placer mining and mineral exploration activity, visit active properties, review reports for assessment credit, and maintain the assessment report library.

The YGS continues to focus more attention on increasing awareness among the public, schools and First Nations of geology and its importance to the mining industry, land use planning and environmental management. Karen Pelletier, Charlie Roots and other YGS staff continue to make presentations in the schools and conduct fieldtrips in the communities. Karen also organized field trips with First Nations groups to visit exploration properties to examine modern reclamation practices. We are in the process of developing an interpretive guide to the Whitehorse Copper Belt through a contract with Danièle Héon.

INFORMATION MANAGEMENT AND DISTRIBUTION

With the increasing volume of information generated by YGS and others, and rapidly evolving digital technology, the Survey has placed more effort and resources into making geological information more accessible. A large part of our effort has gone into developing and maintaining key databases, and making all of our information internet-accessible. Ongoing activities include support for the H.S. Bostock Core Library and the Elijah Smith Library.

DATABASES

With new reporting requirements to securities regulators, widely recognized mineral deposit models are becoming increasingly important. In cooperation with the British Columbia Geological Survey, the YGS has contracted Anna Fonseca to adapt the British Columbia Geological Survey Mineral Deposit Models for the Yukon. These models are now incorporated into Yukon MINFILE and will be published in early 2004.

Yukon MINFILE, the Yukon's mineral occurrence database, is maintained by Robert Deklerk. An update was released in November, 2003. The database now contains 2603 records of which 500 have been revised, and is complete to the end of 2001. All mineral occurrences are now assigned to a deposit model. Reserve tables have been completely revised and updated to match, as closely as possible, the Ca-

nadian Institute of Mining Standards for Reporting Mineral Resources and Reserves.

The Yukon Placer Database, compiled under the direction of Bill LeBarge, was released in the fall of 2002. The database is in Microsoft Access 2000 format and is a comprehensive record of the geology and history of Yukon placer mining. The database contains descriptions of 440 streams and rivers, and 1356 associated placer occurrences. It also includes location maps in Portable Document Format (PDF). An update is scheduled for the spring of 2004.

The Yukon Digital Geology compilation was updated this year by Steve Gordey and Andrew Makepeace of the Geological Survey of Canada with funding from YGS. It includes syntheses of bedrock geology and glacial limits, compilations of geochronology, paleontology, and mineral occurrences, and a compendium of aeromagnetic images. All are now available on CD-ROM. Bedrock geology and glacial limit paper maps are also available at 1:1 000 000 scale.

The Yukon Regional Geochemical Database 2003, compiled by Danièle Héon, contains all of the available digital data for regional stream sediment surveys that have been gathered in the Yukon under the Geological Survey of Canada's National Geochemical Reconnaissance Program. It is available on CD-ROM in Microsoft Excel 2000 format, in ESRI ArcView Shapefile format.

The YukonAge 2002 Database, compiled by Katrin Breitsprecher and Jim Mortensen at the University of British Columbia with funding from YGS, can now be viewed on the YGS map gallery in a version modified by Mike Villeneuve and Linda Richard with the Geological Survey of Canada. The database contains over 1500 age determinations derived from over 1100 rock samples from the Yukon Territory in both Microsoft Access 2000 format and as a flat file in Microsoft Excel 2000 format so that the data may be viewed without Microsoft Access. The database will be updated in the spring of 2004.

The Yukon Geoscience Publications Database, 2003, compiled by Lara Lewis and Diane Emond, is current to 2003 and contains more than 5000 references to papers on Yukon geology and mineral deposits.

Funding from DIAND for Northern Geoscience announced in May 2003 will be used in part to complete scanning of assessment reports and conversion to PDF format. The complete database of over 5000 files is expected to be available on-line by the spring of 2005.

H.S. BOSTOCK CORE LIBRARY

Mike Burke and Ken Galambos maintain the H.S. Bostock Core Library. The facility contains about 128 000 metres of diamond drill core from about 200 Yukon mineral occurrences. Confidentiality of material is determined on the same basis as mineral assessment reports. Confidential core can be viewed with a letter of release from the owner. Rock saws and other rock preparation equipment are available to the public.

EMR LIBRARY

The EMR library in the Elijah Smith Building is an invaluable resource that is available to the public, but often overlooked. It is Yukon's largest scientific library and includes collections that, prior to devolution, belonged to DIAND and the Department of Energy Mines and Resources. The library also houses Yukon assessment reports and contains most geological journals and a good selection of references on general geology, Yukon geology, and economic geology.

INFORMATION DISTRIBUTION

The YGS distributes information in three formats. We sell and distribute paper maps and reports through our Geoscience Information and Sales Office. In addition, many of our recent publications and databases are available in digital format at considerably lower prices than for paper copies. Most of our publications are available as PDF files on our website, free of charge.

www.geology.gov.yk.ca

A directory of assessment reports is also available online. We are pleased to make spatial data available through our interactive map server; the Map Gallery can be accessed through the YGS website. We are continuing to improve the site and have added coverages of regional stream geochemistry, mineral claims and geochronology to the existing coverages of regional geology, MINFILE locations, topography, roads and communities, and First Nations Land selections. Vector data can now be clipped and downloaded. Planned enhancements include addition of geophysics and paleontology, and addition of more attribute data to existing coverages. Users are encouraged to provide feedback and suggest improvements.

Northwest Territories Program Highlights 2003

INTRODUCTION

NWT geological survey functions are delivered through the C.S. Lord Northern Geoscience Centre (CSL), located in Yellowknife. The Centre is jointly funded and staffed by the federal Department of Indian and Northern Affairs and the territorial Department of Resources, Wildlife and Economic Development.

GEOSCIENCE PROGRAM

Minerals & Bedrock Mapping

WECHO RIVER

This is a 2-year project to upgrade the existing map, which is over 50 years old, and to link the geology in the Snare River area with that of the Yellowknife basin. During this first year of field mapping over 2500 square kilometres were covered.

CANTUNG AND SELWYN BASIN

Fieldwork for a one-year study of the CanTung Mine deposit, and a scoping study for future work in the Selwyn Basin (southern Mackenzie Mountains) was completed.

SOUTH WOPMAY AND SNOWBIRD LAKE AREAS

Preliminary compilations and field reconnaissance work have begun, in preparation for future mapping and associated thematic studies in these areas, to begin in 2004. New funding enabled the Centre to undertake a large, regional, aeromagnetic survey in the Snowbird and Wholdaia lakes area (65D, E half 75A). Products will be an Open Report digital compilation of existing bedrock geology, geochronology, assay and lithogeochemical data for Southern Wopmay Orogen plus an Open Report paper on selected mineral showings from the southeastern Wopmay Orogen.

SNARE RIVER

Final field checking was carried out during the 2003 field season, and selected samples were submitted for U-Pb geochronology to resolve questions about the time span of volcanism in the area.

Diamonds

The Centre's diamond geologist was involved in the planning and conducting of field trips run in conjunction with the 8th International Kimberlite Conference held in Canada in 2003, and presented results of recent petrologic studies carried out on Slave kimberlites (to be published in *Lithos*). The kimberlite indicator and mineral chemistry databases (KIDD, KIMC) are being kept up-to-date. The NWT diamond geologist is also an Inspector for the Kimberly Process.

Oil and Gas

The 3-person petroleum geology group at the Centre has completed its acquisition of basic petroleum data, including digital well reports, logs, and seismic profiles.

A hydrocarbon pool analyses book for the Great Slave Plain has been released and other research projects continue in the Colville Hills area and the southern NWT.

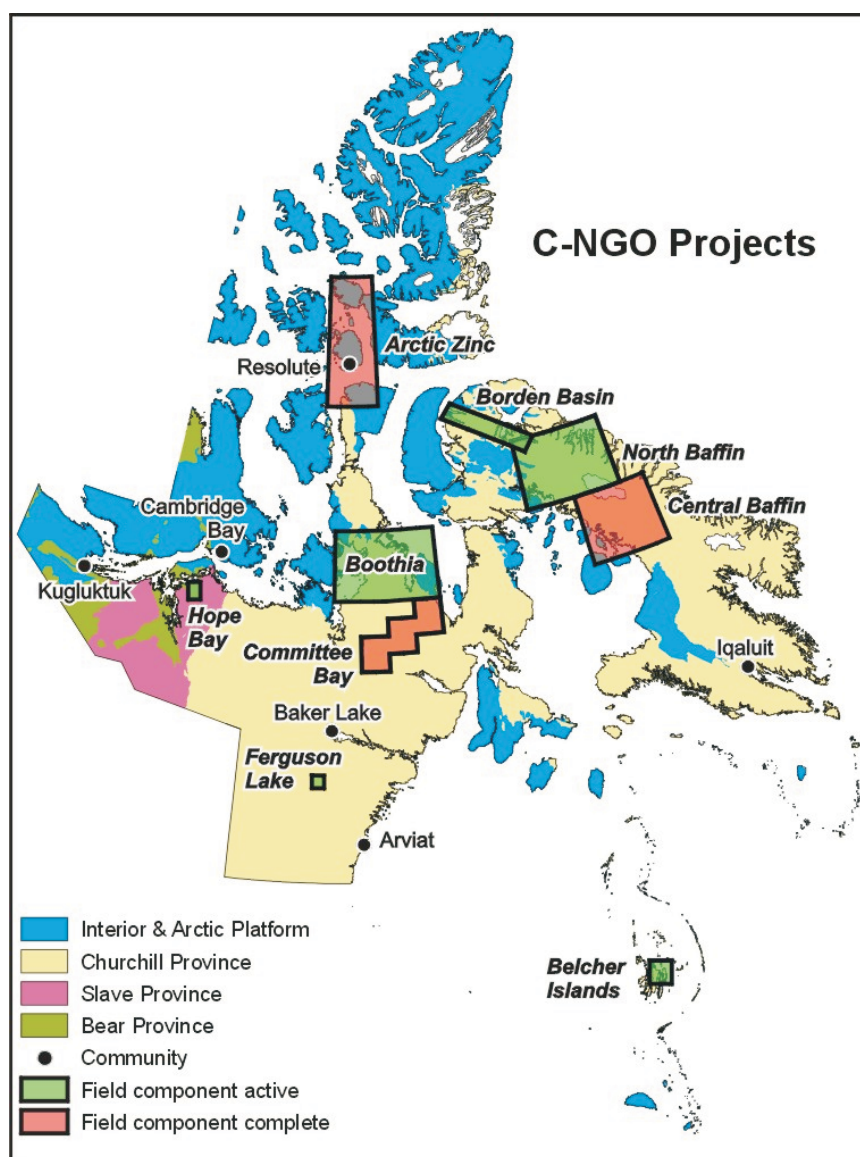
NWT is a partner with the Geological Survey of Canada (GSC) in building an Atlas of Petroleum Geology. A Formation Tops project at CSL is sponsored by the GSC's TGI-2 program and will result in an up-to-date, illustrated and consistent compilation of subsurface well picks for the NWT.

Resource Assessments

The Centre has two staff members performing mineral and petroleum assessment work in support of land use decision-making, including the Protected Areas Strategy (PAS). Summer fieldwork was undertaken this year in the Richardson Mountains (Gwich'in Land Use Plan), Edehzie (Horn Plateau PAS), and Sahyoue (PAS) areas.

The Centre completed a contract for the Deh Cho Land Use Planning Committee to assess the mineral and petroleum resource potential of the Deh Cho area. This will assist them in making informed land-use decisions. The petroleum volume has been released as a CS Lord Open File; the minerals volume is currently undergoing peer review.

Centre staff has participated in MERA working group meetings regarding Mineral and Energy Resource Assessments for the proposed Nahanni Park extension and the park reserve on the East Arm of Great Slave Lake. In the absence of a dedicated



MERA geologist, CSL geologists have been representing NWT's interests with respect to resource assessments for these areas.

OUTREACH

A Centre geologist led a field mapping and educational program in the community of Holman. Two community members were employed and many others, ranging from grade-school age to elders, participated in the 2-week project.

A geology field school at the Wecho River field camp was co-sponsored by the Centre and the University of Alberta. Five students spent two weeks mapping under the leadership and direction of Centre and university staff.

The Centre continues to be heavily engaged in the planning and organization of the technical program of the annual Geoscience Forum, held in November in Yellowknife, NWT.

Client Services

WEB SERVICES

Clients can communicate with the Centre through (www.nwtgeoscience.ca). Several changes were made in 2003 to the NORMN reference web application. These changes allow more efficient reference searches, and when the scanning of assessment reports is complete (spring 2004), will link the end user to a site that will allow direct downloads of reports.

LIBRARY / ARCHIVES

The major task of scanning all the Assessment Reports and relevant publications continues but is nearing its end. While we are not yet ready to make reports directly assessable through the web, the number of reports distributed either through our FTP site or on CD is increasing rapidly. This has improved our service to clients and reduced our own clerical workload immensely.

CSL acquired diamond drill-core and numerous files from the Con Gold Mine (longitudinal sections, drill core assays, geologic reports, etc) upon the mine's closure. These files are being stored and will eventually be merged with the core database and the Centre library's collections.

CS LORD PUBLICATIONS IN 2003

NWT Open Files

NWT Open File 2003-01
(GSC Open File 1541)

Kiss F, Coyle M, Forté S, Dumont R., 2003. Aeromagnetic Total Field, 106 K/SE-SW, Northwest Territories; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File 2003-01 (GSC Open File 1541). 1 map, scale 1:100 000.

NWT Open File 2003-02
(GSC Open File 1545)

Kiss F, Coyle M, Forté S, Dumont R., 2003. Magnetic First Vertical Derivative, 106K/SE-SW, Northwest Territories; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File 2003-02 (GSC Open File 1545). 1 map, scale 1:100000.

NWT Open File 2003-03

Gal, L.P. and Jones, A.L., 2003. Evaluation of oil and gas potential in the Deh Cho territory; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File 2003-03, 88p.

NWT Open File 2003-04

Cairns, S.R., MacLachlan, K., Relf, C., Renaud, J., and Davis, W.J., 2003. Digital Atlas of the Walmsley Lake area, NTS 75N; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File Report 2003-04. 1 CD ROM

NWT Open File 2003-05

Janicki, E.P., 2003. Hydrocarbon Pools of the South-eastern Great Slave Plain, Northwest Territories; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File 2003-05.

NWT Open File 2003-06

Turner, W.A., 2003. Microthermometric study of fluids associated with Pb-Zn mineralization in the vicinity of the Pine Point mining camp; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open File 2003-06, 30 p.

NWT Open Reports

NWT Open Report 2003-001

Falck, H., Moir, I., Hauser, B., Robb, M. and Canam, T., 2003. The History of Mining in Yellowknife. CS Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open Report 2003-001. 1 poster.

NWT Open Report 2003-002

Jackson, V.A., 2003. Preliminary compilation of the geology of the Snare River (1998-2002 results), Winjinnedi Lake, Labrish Lake and Russell Lake area; parts of 85N and 85O; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open Report 2003-002. Map, scale 1:100 000.

NWT Open Report 2003-003

Schreiner, D. (compiler), 2003. Diamond Drill Core held by the C.S. Lord Northern Geoscience Centre: A Compilation and Interactive Map; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open Report 2003-003, digital.

NWT Open Report 2003-004

Jones, A.L. (compiler), 2003. Proceedings of the Oil and Gas Technical Session, 2003 Yellowknife Geoscience Forum; C.S. Lord Northern Geoscience Centre, Yellowknife, NT. NWT Open Report 2003-004.

Nunavut Program Highlights 2002

BACKGROUND

Within Nunavut, there are primarily three government organizations which work together to develop the geology, exploration and mining program for the entire territory. Collaborations between these organizations span regulatory, research/development, and education/outreach aspects of the overall Nunavut program; these organizations and their respective highlighted projects are outlined herein.

The Government of Nunavut's Department of Sustainable Development (DSD) deals with issues related to Nunavut's minerals industry-being committed to the establishment of a sustainable and vibrant minerals industry across the territory, which contributes to the sustenance of healthy communities throughout Nunavut.

The Department of Sustainable Development focuses on community education and awareness, supports prospector development, and is committed to improving the geoscience database and upgrading transportation and human infrastructures. DSD is also committed to resource management, modernization of land use legislation and development of an exemplary mineral industry policy. DSD functions as liaison between industry and communities, local service sectors, educational institutions, work forces, and prospectors. These efforts will lead to improved investor confidence, which is already very strong.

The administration and regulation of Crown surface and sub-surface rights is carried out by Indian and Northern Affairs Canada's (INAC) Nunavut Regional Office in Iqaluit. The Mining Recorder's Office administers mineral claims, prospecting permits, and mining leases, whereas the Land Administrator issues land use permits. The Mineral Resources Division reviews and archives assessment data filed by industry, tracks industry activity within the territory, and undertakes research projects in conjunction with partners such as the Canada-Nunavut Geoscience Office, Nunavut Tunngavik Incorporated (NTI) and DSD. INAC's Northern Affairs Program in Ottawa assists

the Nunavut Office through policy and regulation development, royalty administration, and administration of oil and gas rights.

The Canada-Nunavut Geoscience Office (C-NGO) is a collaborative partnership between DSD, INAC, Natural Resources Canada (NRCan) and NTI. The C-NGO responds to these agencies' common geoscience program interests. Since officially opening in 2000, the C-NGO continues to operate a number of geoscience projects, ranging from regional, multi-disciplinary mapping initiatives and field-based thematic studies in priority areas across Nunavut, to office-based outreach and capacity building projects. Regional integrated mapping projects undertaken by the C-NGO are operated in collaboration with the Geological Survey of Canada, and often include partnership with industry; thematic investigation typically include collaboration with other federal agencies (*e.g.*, INAC) in addition to industry partnerships.

GEOSCIENCE AND RELATED ACTIVITIES

Regional Integrated Mapping

COMMITTEE BAY PROJECT, CENTRAL MAINLAND (C-NGO/GSC)

The Committee Bay Integrated Geoscience Project, co-delivered with the GSC, focused on the geol-



Figure 1. St. George's Society Cliffs (Society Cliffs Fm.) near Arctic Bay Nunavut

ogy of the Prince Albert group, located southwest of Committee Bay, in the north-central part of mainland Nunavut. The area contains Archean supracrustal rocks considered to have high mineral potential.

Over the course of the 2000, 2001 and 2002 field seasons, bedrock and surficial materials mapping has been carried out over NTS map sheets 56J, 56K, 56O and 56P. Bedrock geology maps at 1:100 000 scale have been published for NTS sheets 56K (Open File 4190), 56J (north) and 56O (south) (Open File 3777). Maps for NTS 56P will be published in 2004. Results of bedrock geochemistry and a compilation of assessment reports for the area are also available (Open File 4275).

The Quaternary component of this project included surficial geology mapping and reconnaissance-scale till geochemistry, gold-grain counts and a kimberlite indicator mineral survey across NTS sheets 56K, 56J (north), 56O (south) and 56P. Surficial geology maps (1:100 000 scale) have been published for NTS 56K (south and north; Open Files 4278 and 4279, respectively); maps of 56J (north) and 56O (south) will be published in spring, 2004; 56P will be published later in 2004. Complete results of the till geochemical and gold-grain count surveys are published (Open File 4493); results from the kimberlite indicator survey will be published in spring, 2004. Reports on technical aspects of this project were published in the February 2003 volume of the GSC's Current Research.

CENTRAL BAFFIN PROJECT (GSC/C-NGO)

In collaboration with the GSC, the Central Baffin Project focused on bedrock and surficial geology mapping and interpretation of the Paleoproterozoic Foxe Fold Belt in central Baffin Island. Over three field seasons (2000-2002) the project covered NTS map sheets 37A, 37D, and the western halves of sheets 27B and 27C. Bedrock maps at 1:100 000 scale were released through the GSC publication system in 2002 (Open Files 3958, 3959, 3960, 3961, 4199, 4200, 4201), along with a detailed map of an area prospective for Broken Hill type mineralization (Open File 4482) and a 1:250 000-scale summary bedrock map and digital database (Open File 4168). Three new 1:100 000 scale bedrock maps for the Clyde River, Blanchfield Lake and Ikpik Bay areas were released in 2003 (Open Files 4432, 4433 and 4474 respectively). The Quaternary component of the Central Baffin Project produced 1:100 000 scale surficial geology maps that were released in 2002 (Open Files 4287, 4296, 1570, 1569, 1571, 1572), and 2003 (Open Files 4412, 4411, 4357, 4355, 4354, 1533). Reports on the various technical aspects of this project were published in the February 2003 volume of the GSC's Current Research.

NORTH BAFFIN PROJECT (C-NGO/GSC/INAC/DSD/PCSP)

At present, the C-NGO's North Baffin Quaternary project represents the only regional mapping program with active fieldwork in 2003. Within the study area (NTS 37E, F, G and H), Archean volcanic rocks of the Mary River Group are thought to have a high potential for Au, Ni, Zn, and PGEs; the kimberlite potential of the area is also considered significant. The complex and poorly understood glacial history of the area means that an improved regional surficial geoscience knowledge-base is a necessary prerequisite to effective mineral exploration in the region. This project is designed to evaluate the economic potential of northeastern Baffin Island by providing an improved understanding of the glacial history in this extensively drift-covered area. The North Baffin Project's drift prospecting survey, surficial materials mapping and ice-movement-chronology have the potential to identify new sources of Au, Ni, Zn and Ni-PGEs associated with supracrustal rocks, as well as kimberlite indicator-mineral trails. Regional ice dynamics will be analysed, and regional geochemical background values and source-rock petrology documented. Geochemical (till and whole-rock) and heavy mineral surveys will add significantly to the general geoscience knowledge of this area.



Figure 2. Society Cliffs Formation in the Alpha River Valley, near Tremblay Sound, NU.

North Baffin Project outputs will include the following: 1) contribution to digital northern geoscience data resources; 2) incorporation of remotely sensed data and contribution to new multi-thematic models (partnership with the GSC's Remote Predictive Mapping Project); 3) help to assess mineral potential within the study area and 4) promote increased community participation in exploration activities and geoscience resource development, through outreach activities. Results of the 2003 sampling programs (bedrock and till geochemistry; till gold-grain counts) will be published in spring, 2004 as GSC Open Files; surficial geology maps will be released as GSC Open Files. Reports on the technical aspects of this project will be published in GSC's Current Research.

**BOOTHIA PROJECT,
MAINLAND NUNAVUT
(C-NGO/INAC/GSC/PCSP)**

In collaboration with INAC and the GSC, the C-NGO is planning to initiate a new regional bedrock mapping program in 2004. This project will focus on evaluating the economic potential of, and upgrading the geoscience knowledge base for, the Boothia Mainland area, south of the community of Taloyoak and north of the Committee Bay Project (2000-2003). The core of the proposed study area contains crystalline rocks of Archean and possibly Paleoproterozoic age, which are presumably the continuation of comparable belts exposed in the Committee Bay area to the southeast. The only currently available bedrock maps for the region are at a small scale (1:500 000 and 1:250 000), and are considered inadequate for the facilitation of grass-roots mineral exploration. Moreover, appropriate complementary geoscience information is not presently available; the Boothia Mainland region remains a large data gap in our current understanding of the north-central Canadian Shield. The proposed 1:100 000-scale, bedrock mapping project will complement recent bedrock mapping in the Committee Bay region and contribute to stimulating mineral exploration in the region by helping to focus the investigations of our clients and stakeholders.

The Boothia Mainland project will contribute to framework mapping and geoscience knowledge in Nunavut through the following digital, web-based and paper outputs: 1) six new 1:100 000-scale geological maps; 2) digital compilation of all available geophysical and remotely sensed datasets; 3) digital release of all subsidiary datasets, including those derived from surficial, structural, petrological and geo-



Figure 3. Original Canada Nunavut Geoscience Office research team (2000-2003). From left to right: Drs. Hamish Sandeman, Dave Scott, Elizabeth Turner, Edward Little and Ross Sherlock. Taken during the 7th International Symposium on Mining in the Arctic held in Iqaluit, March, 2003. (Dave Scott currently resides at the GSC-Ottawa as the Northern Program Manager)

chronological studies; and 4) progress reports or presentations to be given at appropriate annual industry-governmental meetings. These outputs will directly address the immediate need for mineral exploration in Nunavut, and their timely release in digital format to northern communities, industry and government clients will appropriately enhance future land use planning and mineral activities in the region.

Thematic Studies

During 2003, the C-NGO engaged in a number of thematic geoscience studies. Staff continued detailed field studies of Northern Baffin's Borden Basin, focusing on stratigraphic and structural constraints on zinc-lead-silver mineralization. Investigations in collaboration with Miramar Mining Corp. also continued, focusing this year on the Boston deposit of the Hope Bay Volcanic Belt. In collaboration with Starfield Resources, Ni-Cu-PGE mineralization around Ferguson Lake was examined. Lastly, a new thematic project developed in conjunction with NTI was initiated in the Belcher Islands, with the intent of updating our understanding of the stratigraphy and metallogeny of the Belcher Group. Reports on these research endeavours will be published in forthcoming issues of the GSC's Current Research and as GSC Open Files.

ARCTIC ZINC PROJECT (C-NGO/GSC)

The Arctic Zinc Project, in collaboration with GSC-Calgary, completed the mapping and sampling component of its program, focused on the Cornwallis Zinc District in 2002. Geochemical and petrographic analyses on a regionally representative suite of sulphide minerals are nearly complete. New maps (1:50 000 scale) and regionally integrated structural interpretations of Little Cornwallis Island and part of western Cornwallis Island will be published in early 2004 (GSC Open File 1780). A summary and interpretation of the structural and stratigraphic controls on mineralization throughout the Cornwallis District, along with a preliminary synthesis of the district's structural history, was published in the GSC's Current Research (2004-B4). The project will culminate with a synthesis volume to be published as a GSC Bulletin in late 2004.

Outreach Programs

INUIT GIS INTERNSHIP FOR IHT PLACE NAMES PROGRAM (C-NGO/IHT/KA)

The C-NGO, in a partnership with Inuit Heritage Trust (IHT) and Kakivak Association (KA), has agreed to mentor two Inuit GIS interns in order to increase and sustain the map-making capacity of the Inuit Place Names Program. This program involves the collection of information about traditional Inuit place names from Inuit Elders and brings their knowledge of the land to people in communities through the use of maps (in Inuktitut). To this end, the C-NGO is providing GIS training, equipment, and workspace whereas IHT and the Kakivak Association jointly fund the positions for one year (start date: November 12th, 2003) with a possibility to extend to a second year. The ultimate goal is to train these Inuit interns to a GIS-skill level that allows them to successfully and independently work on any GIS-related project; in coming years, IHT hopes to expand their office to include a full-time GIS position. The C-NGO is proud to be a partner in this important, time-sensitive project.

NSERC NORTHERN STUDENT INTERNSHIP PROGRAM (C-NGO/NAC/ARI/UNIVERSITY OF ALBERTA/NSERC)

C-NGO staff in collaboration with Nunavut Arctic College, the Aurora Research Institute and the NSERC Northern Chair in environmental change in Arctic Canada, have been instrumental in the development and implementation of the new NSERC Northern Internships program. The main objective of the program is to encourage the next generation of researchers in Canada to pursue research in the North, and to help increase the capacity for northern research in a way that involves Northerners. In ad-

dition, successful candidates are required to be involved with scientific northern research and development activities throughout the tenure of the award; the C-NGO will contribute in-kind support (office space, hardware, etc.) to those conducting research in northern geoscience and environmental science. C-NGO's participation in this program will also help to strengthen ties with academic institutions such as Nunavut Arctic College.

For more information on this exciting new program, please go to the following URL:

www.nserc.ca/sf_e.asp?nav=sfnv&lbi=nri

GEOSCAPE NUNAVUT (C-NGO/GSC)

As part of the national GEOSCAPE project, the C-NGO has undertaken work on an initiative to relate the geology of the territory to its citizens. In contrast to other GEOSCAPE posters that focus on a single municipal area, ours will illustrate features from across Nunavut. Advanced drafts of the poster are now complete, and stakeholder consultation is ongoing.

COMPILATION OF BEDROCK GEOSCIENCE KNOWLEDGE (C-NGO/GSC)

This is an ongoing endeavour to produce NADM-compliant bedrock and surficial geoscience databases that will be the foundation for a new 1:1 000 000-scale, web-accessible digital compilation of existing knowledge. The databases are being populated using existing paper-based datasets as well as recently acquired digital information. We are working with the national CGKN initiative to ensure that these fundamental datasets will be web-enabled as expeditiously as possible.

SCIENCE IN THE CENTRES-CLIMATE CHANGE EXHIBIT (INAC/C-NGO/NRCAN/CASC)

The C-NGO is participating in NRCan's Science in the Centres project through the contribution of expert knowledge and resources. The C-NGO involvement in this national project, which strives to increase science and technology literacy of the Canadian public (especially Canadian youth), will help guide the project's northern content and ensure Nunavummiut are adequately represented in this new nation-wide project. The current project is an interactive Climate Change exhibition and is currently scheduled to be on display at the Nunatta Sunakkutaangit Museum in Iqaluit from March 6th to May 2nd, 2004.

MINERAL EXPLORATION FIELD ASSISTANT'S COURSE (DSD/NAC)

The Mineral Exploration Field Assistant's



Figure 4. Outreach activities at the Canada-Nunavut Geoscience Office

Course was first held in May of 2001 at the Nunavut Arctic College in Iqaluit. This collaborative effort, comprising eight weeks of training for employment, introduced 12 students to fundamental geologic fieldwork concepts and methods that are used in mineral exploration. This primer course introduced students to the business, scientific and technical nature of mineral exploration as a whole, and offered them the opportunity to pursue a career in the minerals industry. Due to the success of the pilot course, DSD is examining options for delivering this course on a regular basis.

PROSPECTOR DEVELOPMENT - NUNAVUT PROSPECTOR'S PROGRAM (DSD/C-NGO)

Initiated in 1999, the Nunavut Prospector's Program (NPP) provides financial and technical assistance to Nunavut-based prospectors. Several prospectors have made significant mineral discoveries over the past four years, culminating recently in three prospectors signing an option agreement for a property in the Baffin region. This year, 26 prospectors from across Nunavut received funding of up to \$5 000 through the program. A total of 12 NPP-supported prospectors hold mineral claims in Nunavut, with interesting gold, platinum, base metal, and gemstone (sapphire & diamond) prospects. As mentioned above, three prospectors have recently completed an option agreement with Vancouver-based True North Gems.

INTRODUCTORY PROSPECTING COURSE

A six-day Introductory Prospecting Course is delivered in communities throughout Nunavut every year. Since 2000, the courses have been offered in all communities in the territory, with over 350 graduates to date. Popular with prospectors and individuals with a general interest in mineral exploration and mining, the course is an introduction to rock and

mineral identification, map reading, sample collection and claim staking. The course is a steppingstone for people who want to pursue prospecting as a career and/or hobby, building on the Inuit traditional knowledge of the land. Many people who take the course subsequently find employment with exploration companies active in their areas. In September 2002, a 10-day intensive advanced prospector's course was held at the Lupin Mine. Nine prospectors from various communities attended and completed the course. DSD is looking into providing this advanced course again in the near future.

SUPPORTING LOCAL SCHOOLS (DSD/C-NGO/INAC)

DSD geologists gave a total of 15 lectures on geology and geological careers to students in grades 7-12 in Rankin Inlet, Arviat and Kugluktuk and participated in Mining Week activities and Career Fairs in various communities in Nunavut. School presentations and open house tours were also made by DSD, INAC, NTI and C-NGO geologists to Iqaluit students during the Nunavut Mining Symposium, held October 6-8, 2003. These presentations discussed geology, career options, and earth science education requirements. In April, 2002, DSD launched the High School Math and Science Awards Program. The program encourages and motivates high school students to pursue interests and careers in math, science and technology. The program recognizes exceptional performance in math and/or science through a cash award of \$175, \$275 and \$350 to a Grade 8, 10 and 12 student respectively.

OTHER ACTIVITIES (INAC)

In 2003, the Mining Recorder's Office issued 190 prospecting permits in February. Although most of these were issued for the Melville Peninsula, per-

mits were also issued for areas of Victoria Island and the mainland around Rankin Inlet and Wager Bay. As of mid November, the Mining Recorder's Office had also received 1927 applications to record claims. Finally, the Mining Recorder's Office is currently working with Mineral Resources Division staff on amendments to the Canadian Mining Regulations.

The Mineral Resources Division's district geologists visited 10 industry projects, primarily in the

Kitikmeot and Qikiqtani regions. In addition, staff and were involved in a number of collaborative field research programs in 2003 (see above), and are undertaking the production of a guide to Nunavut's regulatory environment for release in 2004. The Archives Department has now scanned 808 of its 3734 assessment reports, on an "as needed" basis and is currently working on the Mining Division's web site, with the goal of having it upgraded in time for the winter conference season.

GSC Program Contribution

Consolidating Canada's Geoscience Knowledge Program - Contributions to the Canadian Geoscience Knowledge Network

by E.C. Grunsky, J.D. Rupert and M.A. Williamson

INTRODUCTION

Two critical factors influence Canada's global competitiveness for mineral and energy exploration and the soundness of its sustainable development decisions. These include the nature and scope of partnerships it develops with the provinces and territories, industry, academia and the public; and access to its comprehensive resource geoscience knowledge base. The program, Consolidating Canada's Geoscience Knowledge (CCGK) contributes to these factors through establishing and promoting mechanisms for more efficient and effective discovery, access, delivery and management of the federal components of Canada's resource geoscience data, information and knowledge. As part of its mandate, the CCGK program is jointly developing an implementation plan for the Co-operative Geological Mapping Strategies (CGMS). The CGMS seeks to define new partnerships between federal, provincial and territorial agencies, industry and universities to jointly deliver geoscience knowledge as the basis for fact-based decision making which impact on social, economic, environmental and policy sector needs and priorities.

The Canadian Geoscience Knowledge Network (CGKN <http://cgkn.net>) is an initiative of the National Geological Surveys Committee (NGSC) that provides an Internet portal to Canadian geoscience information. The CGKN is based on the concepts of information discovery and access of geoscience information using protocols developed for access to information using the world wide web. The NGSC have

coordinated partnerships with the federal, provincial, and territorial government agencies, as well as private-sector organizations establishing a nationally comprehensive network in CGKN. The CGKN is partnered with GeoConnections, which is responsible for the Canadian Geospatial Data Infrastructure (CGDI). The CGDI defines the standards, protocols and infrastructure by which geospatial information is managed and delivered using the world wide web. Using the analogy of a motor vehicle highway, the CGDI has built the highway and written the traffic rules. The CCGK and CGKN are the transport trucks that use the highway to deliver the goods and inevitably need to operate using agreed to protocols and standards.

Both the CCGK program and the CGKN operate on the principles of providing access to geoscience information through a distributed network of internet servers. For the CCGK, the Geoscience Data Repository (GDR) suite of projects is the primary mechanism for delivering distributed data. Data standards and delivery protocols have been defined within the GDR and closely adhere to those established for the CGKN.

The early developments of the federal components of the CGKN were based on the initial success of the Canadian Geoscience Publications Directory. The Ressources GSC program (1998 to 2001) supported initial efforts to deliver geoscience data and information over the world wide web. During this early development the standards and tools used for the Ressources program were closely matched by those of the CGKN. Similar activities were being car-

ried out by other provinces including British Columbia, Ontario and Newfoundland. It was recognized early on, that a coordinated development of web sites from the provinces and territories and the federal government would provide maximum benefit to stakeholders and clients by minimizing gaps and obstacles when searching, querying and viewing geoscience data from a number of websites across several levels of government.

The primary goals of the CGKN are to:

- ✧ provide a single Internet portal for the discovery and evaluation of geoscience data,
- ✧ link the client to the data provider,
- ✧ provide the infrastructure, tools and standards for the integration and use of geoscience knowledge,
- ✧ establish national standards for terminology and exchange of geoscience data that are compatible with the Canadian Geospatial Data Infrastructure (CGDI) as defined by GeoConnections,
- ✧ allow agencies to exchange and access consistent, standardized information,
- ✧ provide national coverage of regional scales for key data types,
- ✧ allow access to NGSC data holdings through CGKN and CGDI services,
- ✧ enable NGSC members to deliver geoscience information independently or within CGKN,

A number of working groups have been established to meet these goals. The working groups are composed of provincial/territorial/federal representatives who are developing standards and tools for key geoscience data types. National coverage for these key data types include bedrock geology, surficial geology geochemistry, geophysics, geochronology, mineral deposits, a stratigraphic lexicon and a metadata catalogue. Access to these data will be provided through the CGKN portal. Federated data schemas are initially used to view several key data types for the whole of Canada. When a client requests to view key data at the provincial/territorial level, they are automatically directed to the provincial/territorial host server, which provides more detailed information.

Many of the activities underway in the CCGK therefore work toward the federal contribution to the CGKN. Current projects are aimed at updating information and providing web-based access to data and knowledge that complements the goals of the CGKN. Some current CCGK projects include:\

- ✧ Achieving appropriate levels of governmental geoscience through cooperative geological map-

ping. This is the project seeking to develop a joint implementation plan for the Cooperative Mapping Strategies.

- ✧ Energy Resources - Status of Knowledge and Consolidation and synthesis of mineral deposits knowledge. These two projects seek to establish and prioritize resource geoscience knowledge gaps.
- ✧ Co-ordination of the Geoscience Data Repository and the Earth Sciences Sector's contribution to the Canadian Geoscience Knowledge Network. This project and the 4 listed below are establishing the necessary infrastructure for the Geoscience Data Repository projects referred to earlier.
 - ✓ GDRIS for ESS Geophysical and Geochemical Data
 - ✓ Geoscience Information System for Energy and Mineral Resources
 - ✓ Geoscience Field-to-Curation Information Management System.
 - ✓ Integrated Information System for Bedrock, Surficial, Geochronological, Stratigraphic and Paleontological data

The investments made by the CCGK program towards providing effective and efficient access to federal geoscience data/information holdings should be viewed as a down payment toward an eventual system that will allow comprehensive integrated access. By March 2005, the CCGK Program anticipates the following to have been accomplished

- ✧ The Web services mentioned below (Web mapping and Z39.50) allow for the GDR information to be shared by other applications such as the GeoConnections Discovery portal and in the future the Atlas of Canada. This forms part of the federal contribution to the CGDI.
- ✧ A central portal to discover the information held within GDR databases and to direct clients to GDR applications and services,
- ✧ National Aeromagnetic Database - free on-line viewing and download of gridded datasets - Web mapping & Z39.50 services,
- ✧ National Gravity Database - free on-line viewing and download of gridded datasets - Web mapping & Z39.50 services,
- ✧ National Radiometric Database - free, on-line viewing and download of gridded datasets Web mapping & Z39.50 services,
- ✧ Access to Lithoprobe holdings. - Z39.50 services,
- ✧ Mirage - over 4000 geoscience map images available on-line for viewing and free download - Z39.50 service,
- ✧ On-line access to rock properties database,

- ✧ On-line internal publishing process for sign-off and metadata capture,
- ✧ On-line web access to consolidated energy data and information in BASIN and SWELLS and Coal inventory,
- ✧ On-line access to a database of well-studied Canadian deposits including information on deposit size range, quality, development footprints and life-span. This will provide a dynamic corporate data source that can be updated from minerals projects as new information is created and to support resource assessment,
- ✧ Direct database links to the Mines and Metals Sector databases of production and reserves to enhance classified deposits with the bases for value range analysis,
- ✧ A seamless CGKN view of provincial/territorial databases of mineral deposits and occurrences tailored for online discovery and interoperable access. ,
- ✧ Working version of Field Sample Data Capture Software (Quaternary),
- ✧ Working version of Field Sample Data Capture Software (Bedrock),
- ✧ Working version of LIMS field sample tracking system,
- ✧ Working version of field sample curatorial system,
- ✧ On line, Digital, spatially referenced indexes of bedrock and surficial geological maps published by the Geological Survey of Canada that will be searchable by author, scale, publication data, NTS sheet, geographic region, and a comprehensive indicators of the amount of information on each map,
- ✧ On line digital, spatially referenced index of the major Paleontological publications by the Geological Survey of Canada, and of previously lit-

tle known internal paleontological reports is being prepared for public Internet access. This index will be searchable by author, publication data, NTS sheet, geographic region, and comprehensive keyword sets of the type of information contained in each report (*e.g.*, major fossil group, stratigraphic units, time period),

- ✧ An on-line lexicon of Canadian geological units, compiled as a database from published and unpublished sources through the Canadian Geoscience Knowledge Network web site www.CGKN.net,
- ✧ Canadian Geochronological knowledgebase, about 95% complete for Canada

Canadian Paleontological knowledgebase, for selected areas of Canada where other Programs require this information,

- ✧ Extensive use by other Programs (such as GOM, NRD) of the GDR framework and capabilities to deliver maps and information sets,
- ✧ Recommendations to ESS management on the preferred options for ongoing development, operation and maintenance of the GDR as a multi-program IM tool and service.,
- ✧ Recommendations for ensuring ongoing Programs deliver consistently to GDR specifications.

Comprehensive review and recommendations of energy and mineral legacy data issues and priorities.

These projects all contribute to the goals of the CGKN and the requirement to provide public access to geoscience data and knowledge. An expected outcome for the CCGK will be the establishment of processes by which all federal resources geoscience information will be delivered using the principles set by the CGKN.

**Survey of Hard Rock Drill Core Programs
2002 – 2003**

SURVEY OF HARD ROCK DRILL CORE PROGRAMS IN CANADA

Fiscal Year 2002 - 2003

JURISDICTION	* *****									
	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Newfoundland and Labrador	PEI
No. of Facilities	n/a	1	2	5	5	n/a	6	3	6	n/a
Use of Facilities	n/a	132	43	40	304	n/a	155	180	155	n/a
Staff Person Days Worked	n/a	200	90	50	200	n/a	610	230	610	n/a
Capital Cost	n/a	n/a	n/a	n/a	n/a	n/a	n/a	\$25,000	n/a	n/a
Operating Cost	n/a	\$94,908	\$10,409	\$10,000	\$6,500	n/a	\$30,900	\$10,000	\$30,900	n/a
Core Collected or Delivered	n/a	4016	6274	5380	9098	n/a	9950	1895	9950	n/a
Core Reduction	n/a	NIL	NIL	500	NIL	n/a	NIL	NIL	NIL	n/a
Total Core in Storage (m)	n/a	56 664	95 063	257 500	1 712 268	n/a	1 057 513	673 000	1057513	n/a
Total Exploration Drilling	n/a	n/a	135,174	75,000	332,958	n/a	65,000	3,500	65,000	n/a

* B.C. has no facilities for minerals related, hard rock core

** Saskatchewan: not included are figures from Petroleum & Natural Gas Collection Subsurface Laboratory Region, which stores stratigraphic Athabasca Group core

*** Quebec facilities closed in 2000.

**** P.E.I. has no core storage program.

***** Nunavut has no core storage program

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