Provincial Geologists Journal

Journal des géologues provinciaux

1994 - VOLUME 12

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

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ERRATA

PROVINCIAL GEOLOGISTS JOURNAL 1994 - VOLUME 12

Error in table page 20:

Footnote 3 reads: Alberta figures show coal and energy component in addition to the metallic minerals.

It should read: Alberta figures do not include the value of coal, oil and gas production.

Geological Survey Branch
Scientific Review Office
Victoria, British Columbia
June 1995

THE COMMITTEE OF PROVINCIAL GEOLOGISTS CHAIRPERSON'S REPORT, 1994

The Committee of Provincial Geologists was active during 1994. It met twice during the year: first at the Prospectors and Developers Conference in March, and then again at the Mines Ministers Conference in Victoria in September. In addition, regular communications are maintained using e-mail and fax.

During 1994 the work of the Committee focussed on:

- Advising on strategic change at the Geological Survey of Canada as it responds to changing priorities and the Federal Program Review.
- Sharing advice and experience in strategic planning between a provincial survey and the Geological Survey of Canada.
- Information exchange between surveys on mineral resource assessment methodologies, and on digital database standards for the geosciences. As part of these initiatives, and at the request of the Committee, British Columbia ran a two day workshop on mineral resource assessment methodology in March 1994.
- External Contacts:

  a) The Committee submitted a brief to the national Science and Technology Review on the importance of geoscience research to sustainable development in Canada.

  b) The Committee met with the Canadian Geoscience Council Review Committee on the *Future of the Geosciences in Canada*. Independently, most members also submitted written briefs to the CGC Committee.
- National Geological Surveys Committee:

  The Provincial and Territorial Geologists along with the Geological Survey of Canada constitute the National Geological Surveys Committee. This national committee is now playing a more active role in forging cooperation and in representing government geoscience. Budget pressures are compelling the surveys to better coordinate their efforts. The result of these ventures will ensure improved sharing of data and resources. This Committee met twice during the reporting period.

W.R. Smyth
Chair, Committee of Provincial Geologists, 1994-95

NOTES

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Compiled by the British Columbia Ministry of Energy, Mines and Petroleum Resources

Compilé par le Ministère de l'Énergie, des Mines et des Ressources Pétrole

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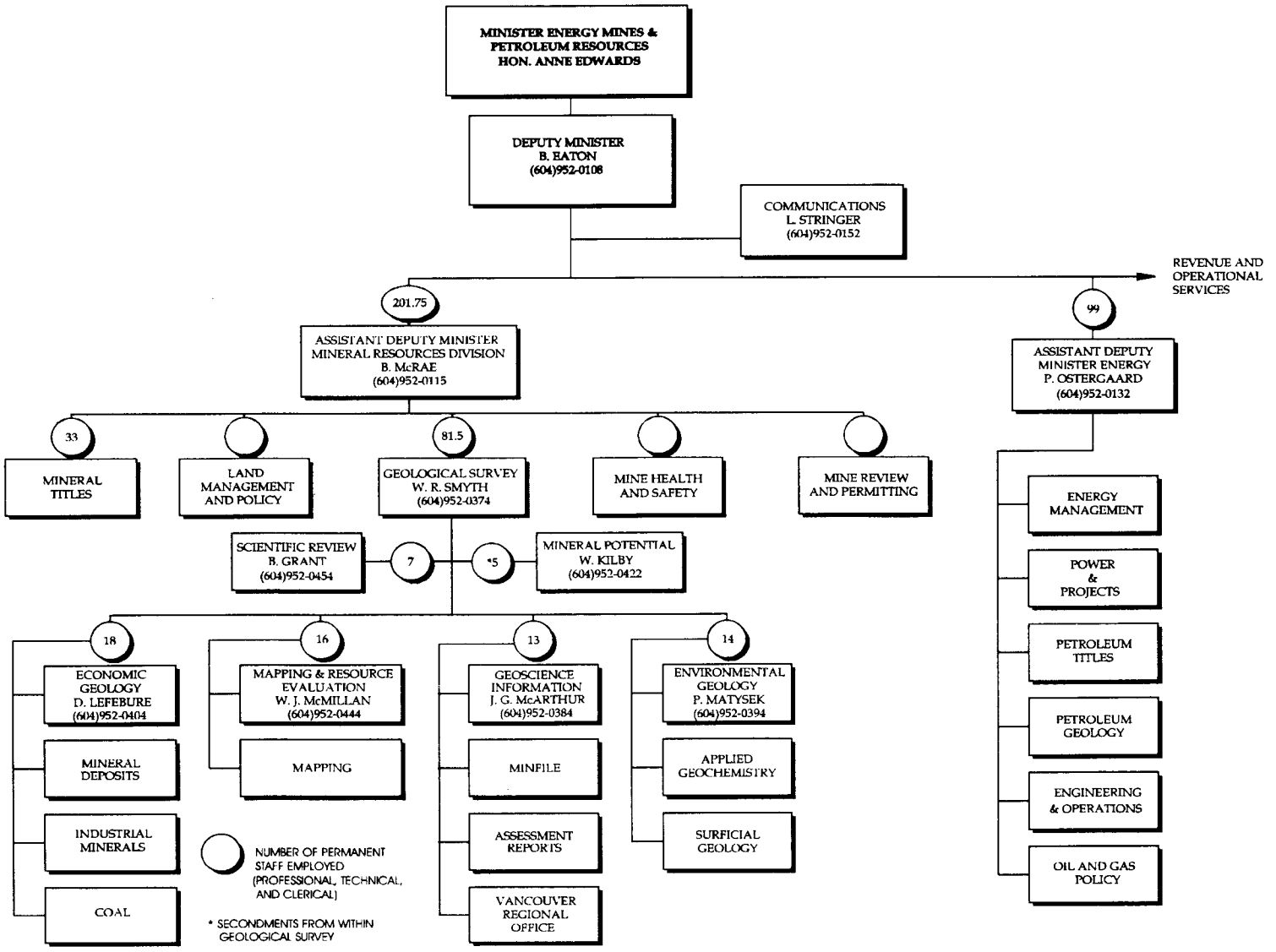
The Provincial Geologists Journal is available in each province and territory through the offices of the respective geological surveys listed at the back of the journal.

NOTES

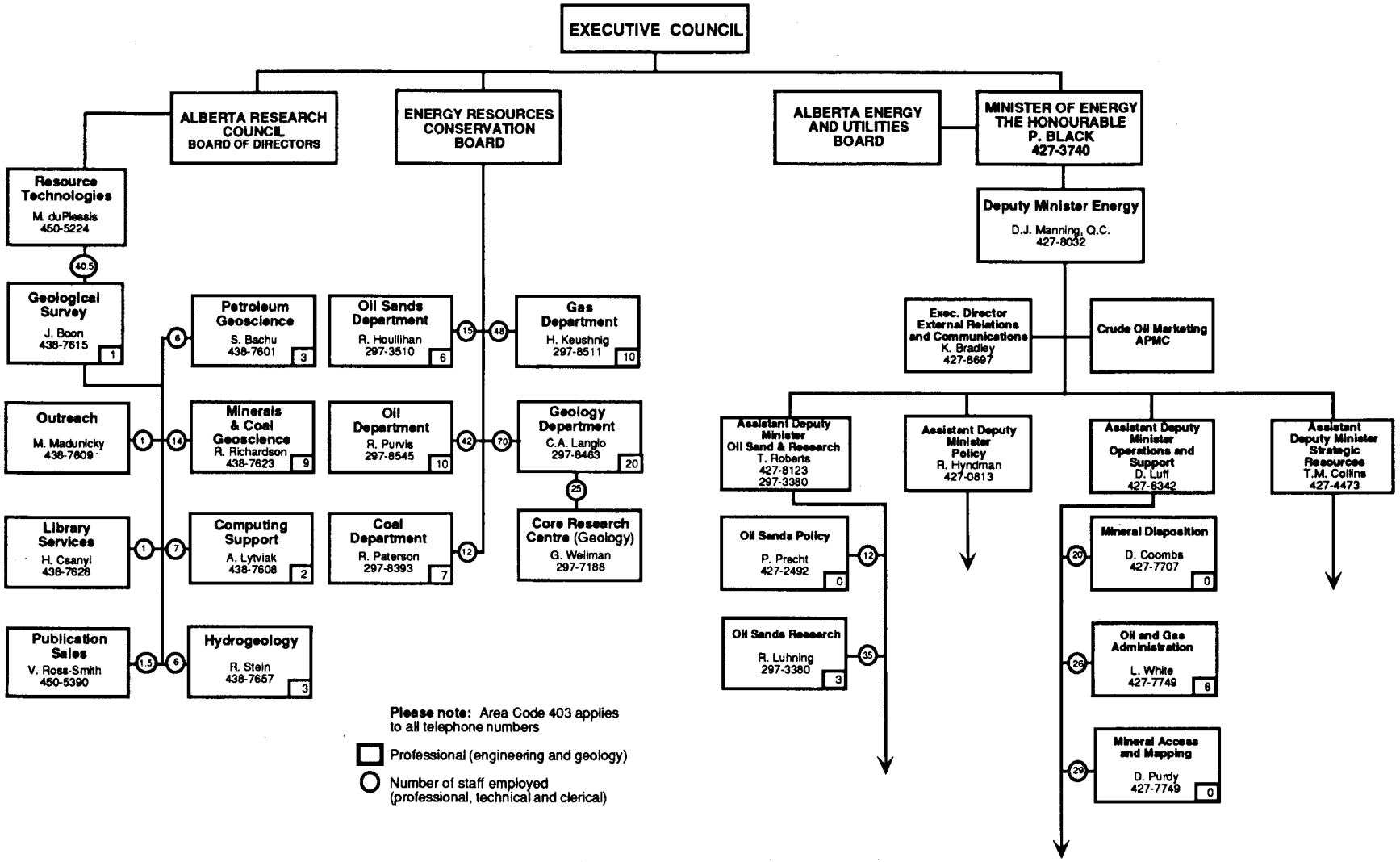
GEOSCIENCE ORGANIZATION CHARTS

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 (*e.g.*, Ontario 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 (*e.g.*, the British Columbia Ministry of Energy, Mines and Petroleum Resources is divided into a Mineral Resources Division and a Petroleum Resources Division, with the bulk of geological survey and research work conducted in the Geological Survey Branch of the Mineral Resources Division). The following organization charts are set out in standard format to help alleviate confusion amongst potential users of provincial geoscience services. The charts contain reference to the lines of reporting of the various units in each hierarchy, the manpower associated with each separate jurisdiction, and the names and telephone numbers of key individuals in each system.

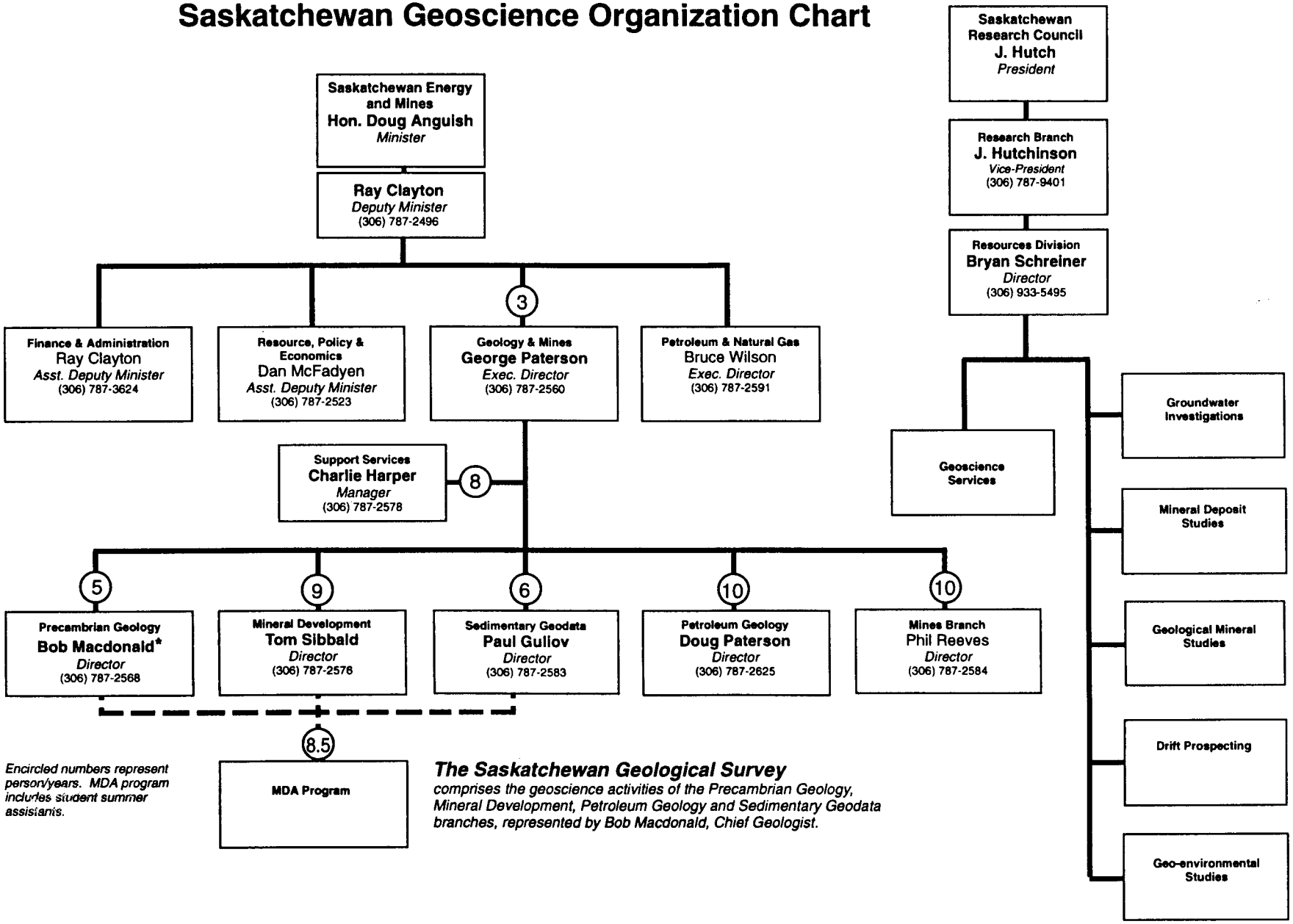
BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART, 93/94



ALBERTA GEOSCIENCE ORGANIZATION CHART



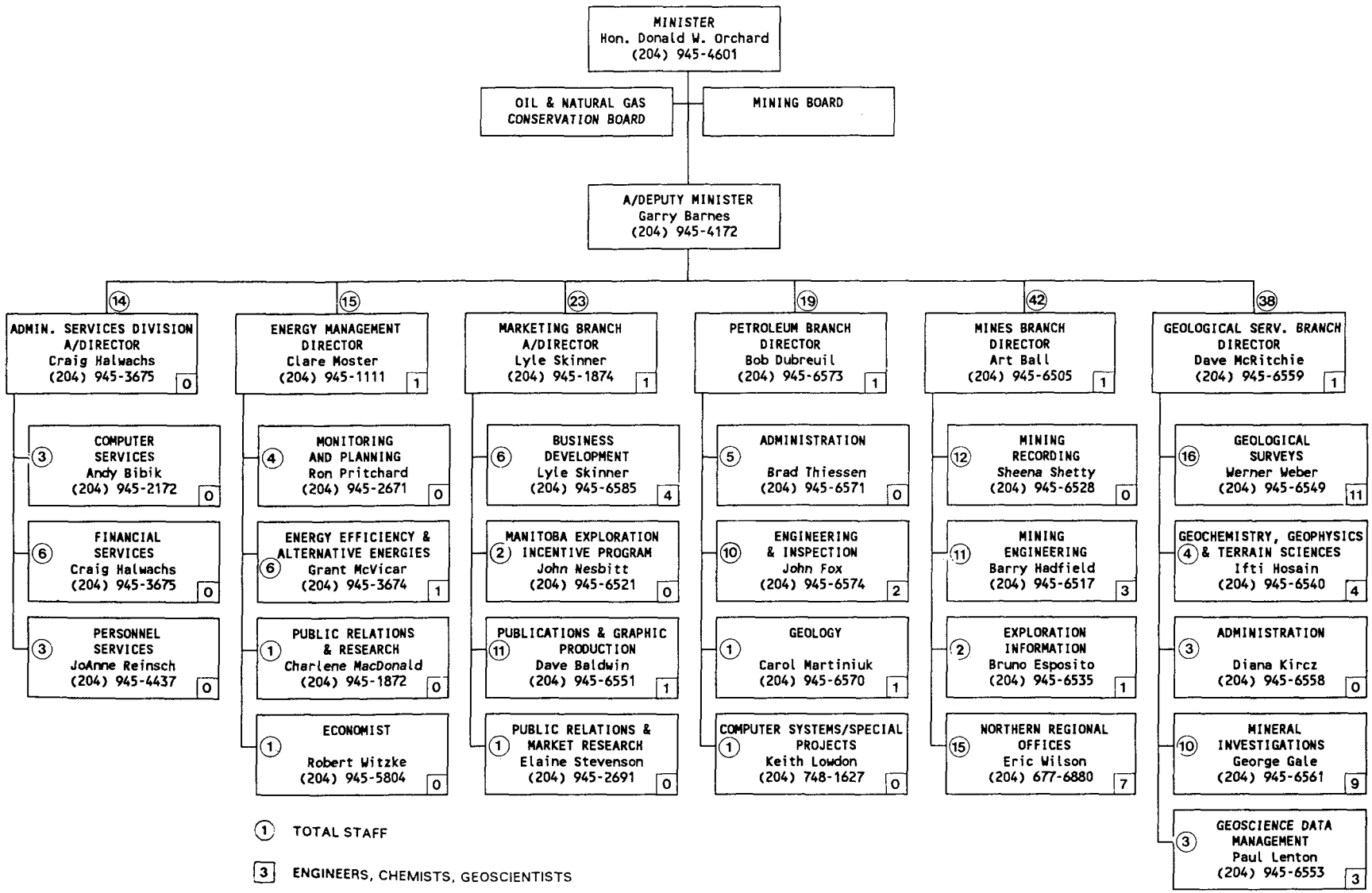
Saskatchewan Geoscience Organization Chart



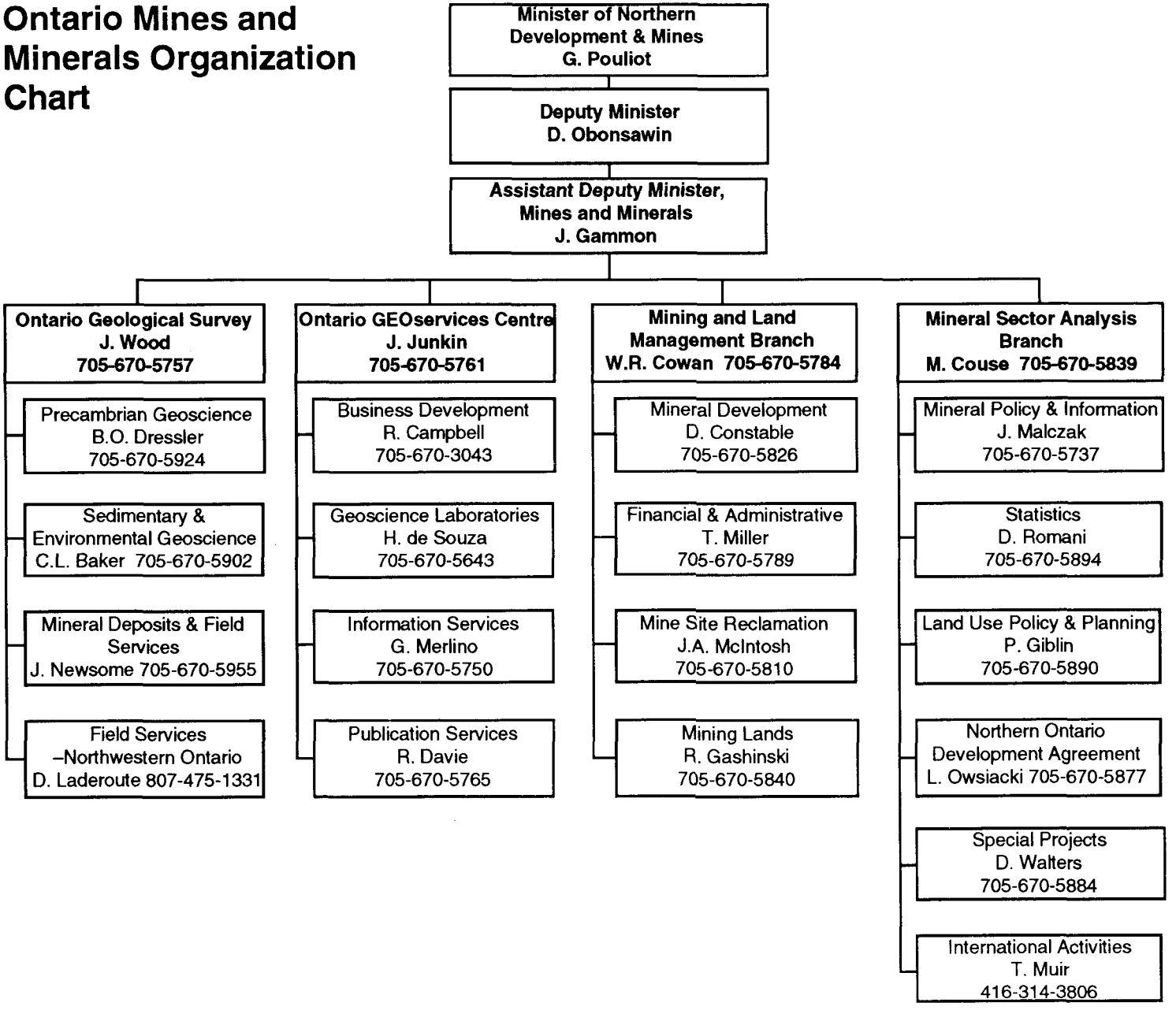
Encircled numbers represent person/years. MDA program includes student summer assistants.

The Saskatchewan Geological Survey
comprises the geoscience activities of the Precambrian Geology, Mineral Development, Petroleum Geology and Sedimentary Geodata branches, represented by Bob Macdonald, Chief Geologist.

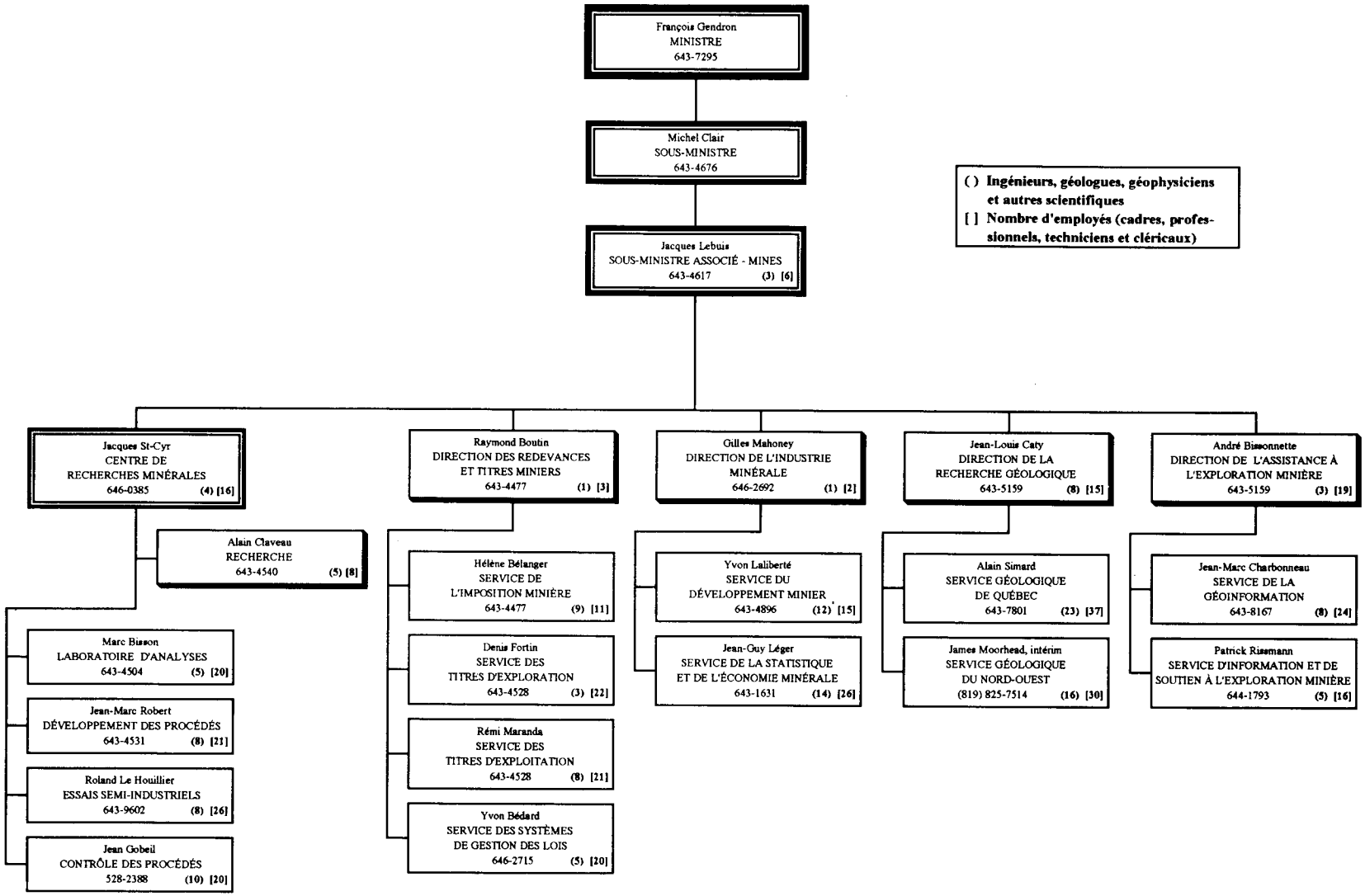
DEPARTMENT OF ENERGY AND MINES (MANITOBA)



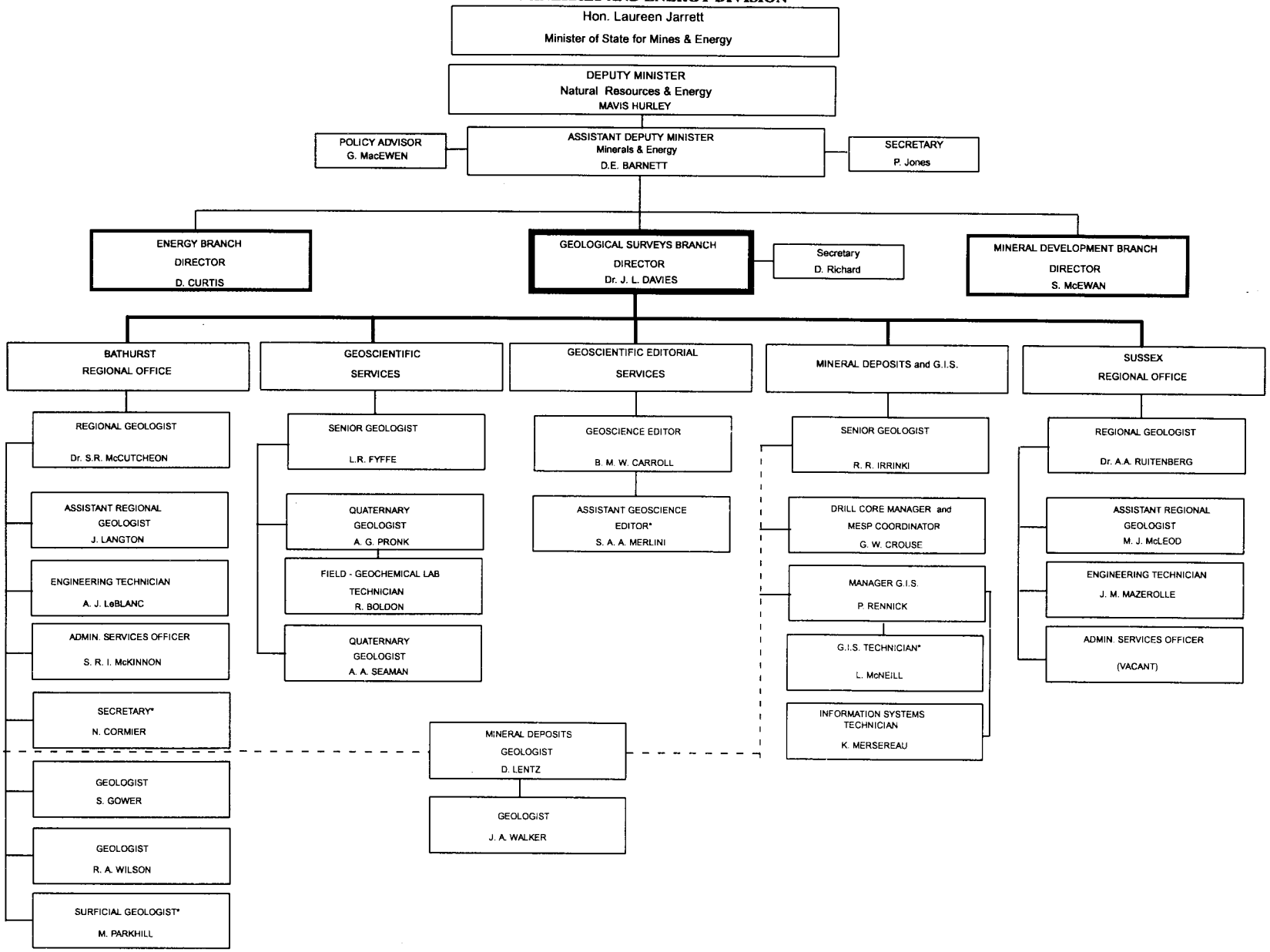
Ontario Mines and Minerals Organization Chart



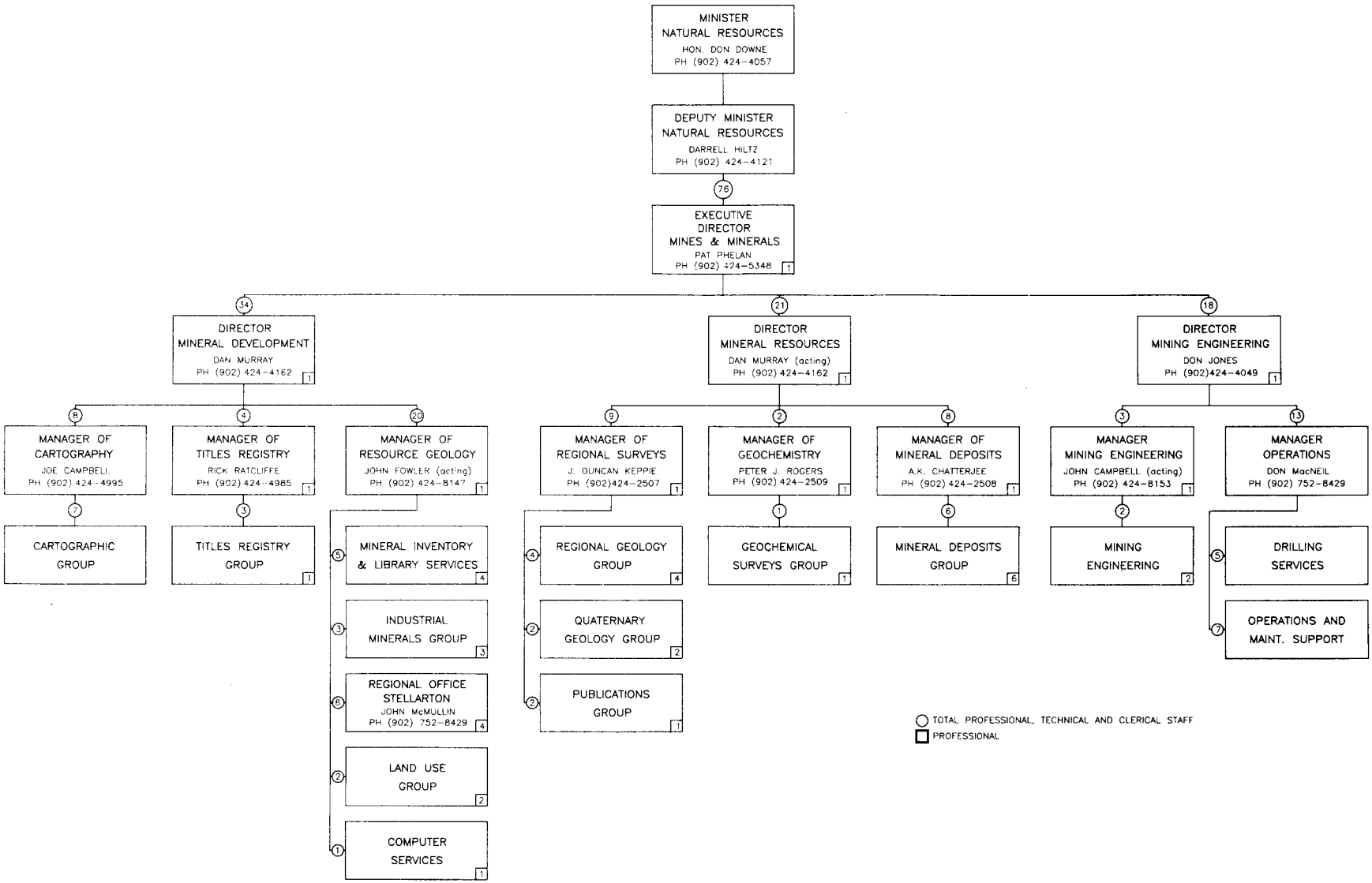
MINISTÈRE DES RESSOURCES NATURELLES - SECTEUR DES MINES



NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES AND ENERGY
MINERALS AND ENERGY DIVISION

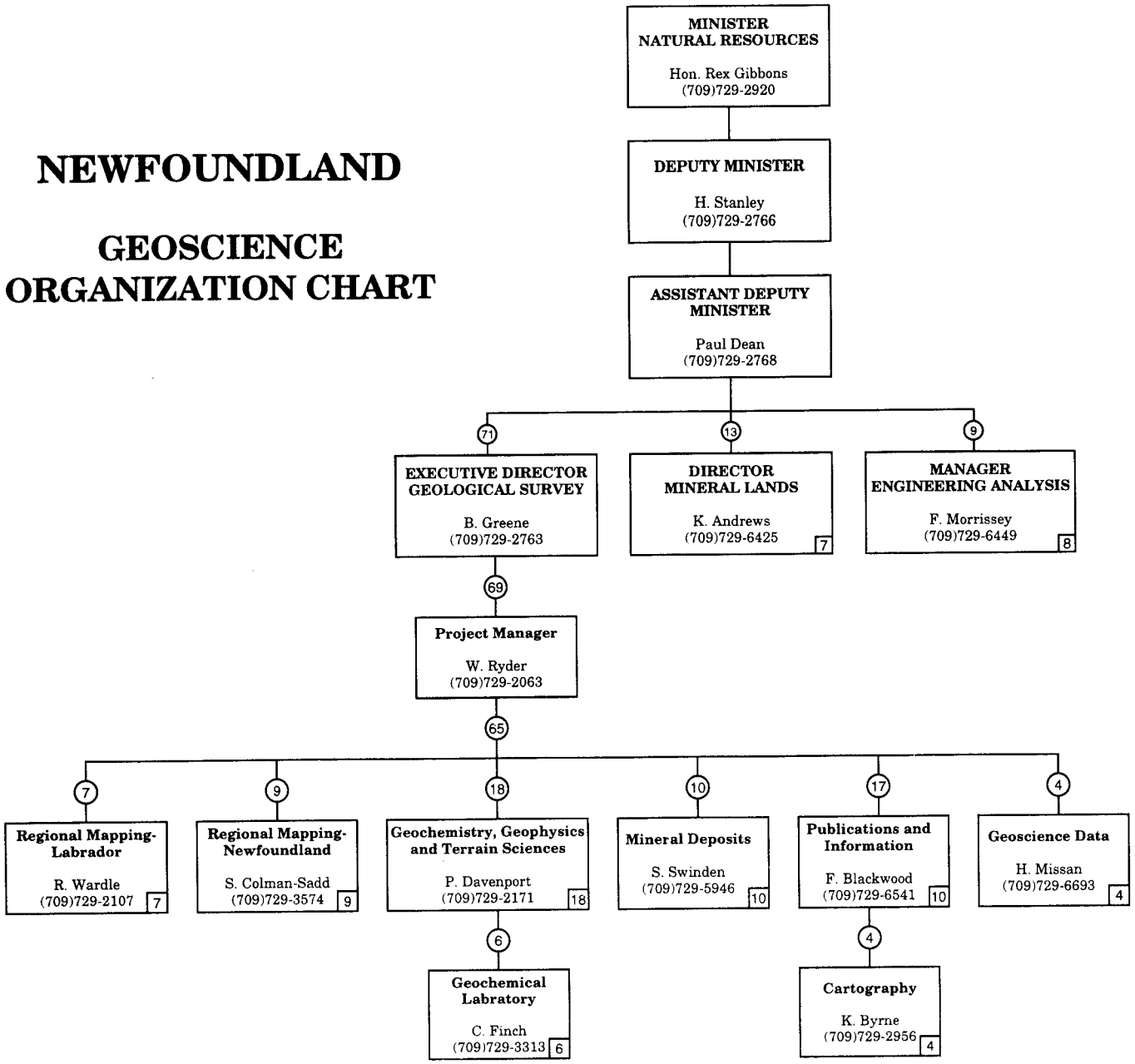


NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART

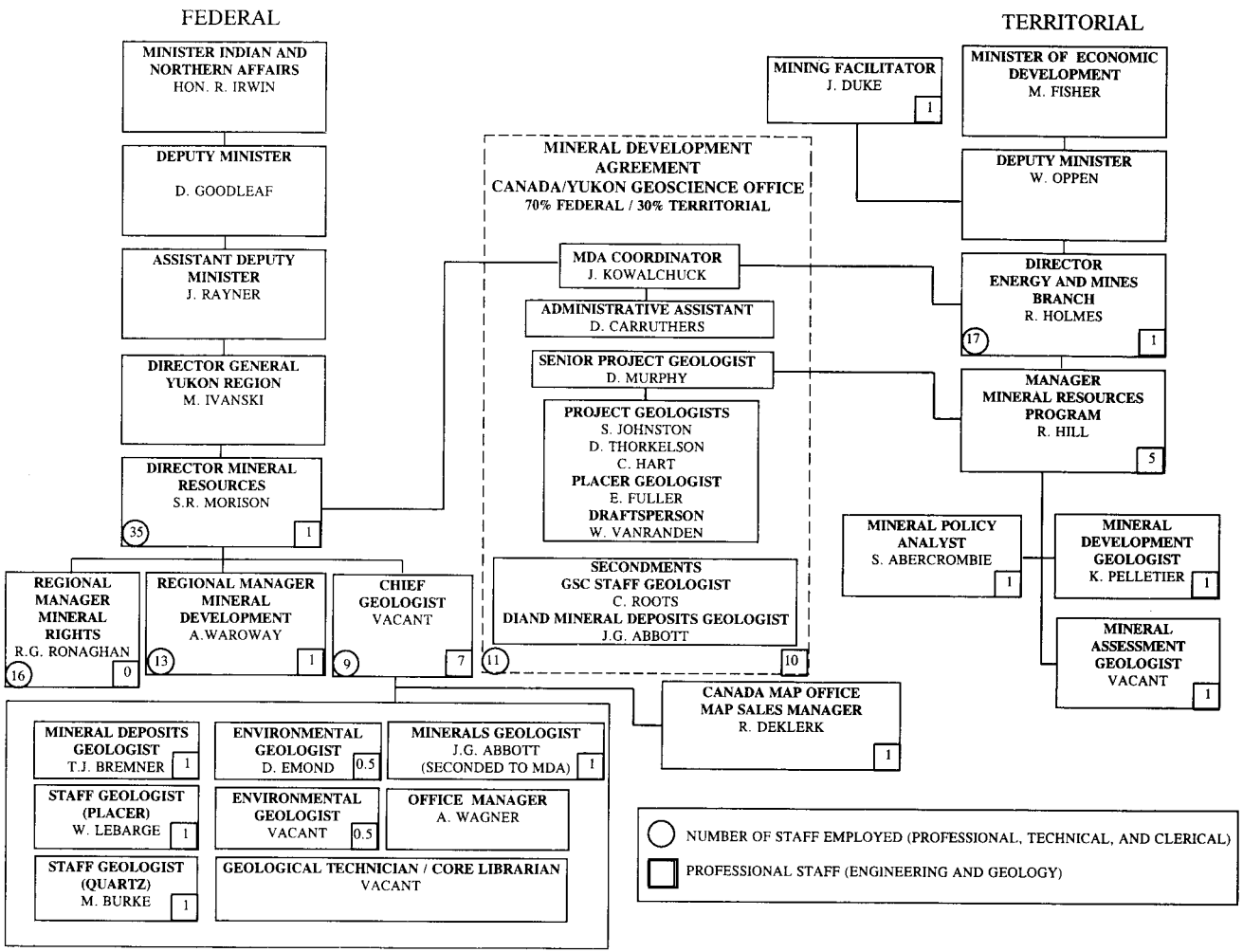


NEWFOUNDLAND

GEOSCIENCE ORGANIZATION CHART



YUKON GEOSCIENCE ORGANIZATION CHART



NOTES

PROVINCIAL GEOLOGICAL SURVEY
EXPENDITURES 1993-1994

PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES
1993-1994

PROVINCE/ TERRITORY	EXPENDITURES $x10^6$	% OF TOTAL	TOTAL 1993 VALUE OF PROVINCIAL MINERAL PRODUCTION (1) $ X 10^3	SURVEY EXP. AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA PROV/TER KM^2 X 10^3	SURVEY $ KM^2	POP 1991 X 10^3	SURVEY $ SPENT/ CAPITA
NEWFOUNDLAND	4.9	8.0	72,834	0.67	405	12.1	568	8.6
NOVA SCOTIA	2.9	4.7	397,869	0.73	55	-	900	3.2
PRINCE EDWARD ISLAND	-	-	1,700	-	6	-	130	-
NEW BRUNSWICK	2.3	3.7	781,663	0.29	73	31.5	724	3.2
QUEBEC	13.4	21.8	2,553,738	0.52	1,541	8.7	6,896	1.9
ONTARIO	14.5	23.6	4,391,768	0.33	1,069	13.6	10,085	1.4
MANITOBA	3.2	5.2	833,309	0.38	650	4.9	1,092	2.9
SASKATCHEWAN	4.4	7.2	1,361,639	0.32	652	6.7	989	4.4
ALBERTA	4.4	7.2	882,256	0.49	661	6.7	2,546	1.7
BRITISH COLUMBIA	6.1	9.9	2,413,797	0.25	948	6.4	3,282	1.9
YUKON	2.3	3.7	129,563	1.78	483	4.8	28	82.1
NORTHWEST TERRITORIES	3.0	4.9	402,868	0.74	3,380	0.9	58	51.7

1. Source: Energy, Mines and Resources Canada; Statistics Canada

***Note:**

[1]Comparisons between jurisdictions are difficult due to the variety of program/budget components and methods of reporting data.

[2]Expenditures column includes a total of A-base funds and MDA funds available to the geological surveys.

[3]Alberta figures show coal and energy component in addition to the metallic minerals.

PROVINCE: BRITISH COLUMBIA 1993-1994

PROGRAM	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS OR FACILITIES	PERMANENT SMY	CASUAL SMY	PERMANENT $	OPERATING EXPENDITURES $	TOTALS
Chief's Office	GSB/MRD	EMPR	-	8		514,000	261,000	775,000
Integrated Projects	GSB/MRD	EMPR	6	-	19	693,000	398,000	1,091,000
Environmental Geology	GSB/MRD	EMPR	see Integrated Proj.	8		494,000	85,000	579,000
Regional Mapping	GSB/MRD	EMPR	see Integrated Proj.	12		823,000	85,000	908,000
Mineral Deposits	GSB/MRD	EMPR	see Integrated Proj.	8		621,000	56,000	677,000
Coal Resources	GSB/MRD	EMPR	5	3		211,000	23,000	234,000
Industrial Minerals	GSB/MRD	EMPR	2	3		164,000	45,000	209,000
Mineral Deposit Inventory and Analysis	GSB/MRD	EMPR	3	9		523,000	147,000	670,000
Scientific Review/Publications	GSB/MRD	EMPR	-	6.5		308,000	179,000	487,000
Mineral Potential Initiative	GSB/MRD	CRII	7	5		221,000	248,000	469,000
Oil & Gas Inventory & Analysis	PGB/ERD	EMPR	-	5.5	1	574,000	96,000	670,000
Petroleum Subsurface Investigation	PGB/ERD	EMPR	-	1.5	-	125,000	21,000	146,000
TOTALS								
GSB (MRD)				62.5	19	4,351,000	1,279,000	5,630,000
MINERAL POTENTIAL INITIATIVE						221,000	248,000	469,000
PGB (ERD)						699,000	117,000	816,000

PROVINCE: ALBERTA - 1993-1994

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING	NO. OF PROJECTS	PERMANENT PY	CASUAL PY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTAL $
Chief's Office	ARC		3	1.13		175,189		29,493	204,682.00
Core Repositories	ARC	ADOE/Esso	2	0.33		29,672		10,873	40,545.00
Hydrogeological	ARC	*	6	2.46		223,792		217,251	441,043.00
Information/Education	ARC	WUSC	5	0.70		70,310		19,711	90,021.00
Laboratory	ARC		1	0.42		39,312		5,796	45,108.00
Mineral Analysis	ARC	**	18	11.13	0.91	1,066,707	35,315	627,931	1,729,953.00
Energy Resources	ARC		1	0.02		1,341		1,444	2,785.00
Petroleum	ARC	Petro Canada/Oil India Ltd.	2	0.56		54,243		46,239	100,482.00
Oil Sands	ARC	AOSTRA	9	3.13		315,005		121,310	436,315.00
Coal	ARC	***	8	1.57		141,371		167,313	308,684.00
Stratigraphy	ARC	ADOE/ISPG/AMOCO	2	2.76		248,294		129,759	378,053.00
Other	ARC	ADOE/Neill & Gunter	23/7	3.53	0.09	365,808	1,498	284,049	651,355.00
Totals			57	27.74	1.00	2,731,044	36,813	1,661,169	4,429,026.00

*ADOE/Institute of Sedimentary and Petroleum Geology/Environment Canada/PanCanadian/Petro Canada/Mobil/Norcen
**ADOE/Federal Government of Canada/Municipal District of Starland, Cameco/Alberta Environmental Protection
***ADOE/Environment Canada/BHP Petroleum/Trans Alta Utilities
ARC - Alberta Research Council
WUSC - World University Service of Canada
AOSTRA - Alberta Oil Sands Technical Research Authority
ADOE - Alberta Department of Energy

PROVINCE: SASKATCHEWAN - 1993-1994

GEOSCIENCE EXPENDITURES BY SASKATCHEWAN ENERGY AND MINES IN 1993-94

	FUNDING SOURCE	NUMBER OF PROJECTS	PERMANENT PY	CASUAL/ CONTRACT PY	PERMANENT SALARIES	CASUAL/ CONTRACT SALARIES*	OPERATING EXPENDITURES	TOTALS
Administration	SGS	N/A	6.00	0.50	329,599	8,500	61,000	399,000
Geological surveys, bedrock	MDA	6	2.50	4.00	152,000	204,200	118,700	474,900
Mineral deposit studies:	MDA	5	2.50	2.00	155,500	91,600	120,800	367,900
Mineral deposit inventory/compilation	MDA	2	3.25	2.00	113,900	30,400	19,900	164,200
Geophysical surveys	MDA	3	0.25	0.50	17,100	14,300	5,000	25,000
Geochemical surveys	MDA	1					22,000	22,000
Subsurface (stratigraphic) studies	SGS		5.00		175,000		5,000	180,000
Core and sample repositories	SGS/MDA		5.25	0.50	153,100	6,900	66,500	226,500
Laboratory analyses and studies	SGA/MDA	1	0.00	0.00			21,000	21,000
Resident Geologist offices	SGS	1	3.00		139,400		18,000	157,400
Publications/cartography/editorial	SGS		5.00		214,000	39,600	89,000	342,600
Computerization and GIS development	MDA	5	0.25	0.50	14,500	55,700	49,700	119,900
Information & education	MDA	1	1.00		65,300		8,800	74,100
TOTALS		25	29.00	10.00	1,354,300	451,200	600,400	2,394,500

*Includes contract geologists and student summer employment

SEM = Saskatchewan Energy and Mines; MDA = Saskatchewan component of the Partnership Agreement on Mineral Development 1990-95

Funds from collaborative projects with other agencies (e.g. Nat/Map, Lithoprobe) are not included.

Figures have been rounded to nearest $100 and are in some cases approximations for geoscience expenditures out of a total of $3.6 million for the Geology and Mines Division which is

GEOSCIENCE EXPENDITURES BY SASKATCHEWAN RESEARCH COUNCIL IN 1993-94

Administration	SRC	N/A	N/A		29,400		80,000	374,000
Geological surveys, surficial	SRC	2	2.00		72,000		35,000	107,000
Geochemical surveys (drift prospecting)	SRC	3	0.60		50,000		1,300	63,000
Geophysical surveys	SRC	1	1.00		21,000		7,000	28,000
Hydrogeological surveys	SRC	10	3.75		355,000		130,000	485,000
Metallic mineral/geological studies	SRC	5	3.00	0.50	200,000	30,000	70,000	3,000
Mineral deposit inventory/compilation	SRC	5	1.00	0.75	80,000	22,500	17,500	120,000
Subsurface (stratigraphic) studies	SRC	2	0.70		48,800		20,500	69,300
Water resource inventory & analysis	SRC	7	2.20		175,000		112,000	287,000
Laboratory analyses and studies	SRC	3	0.30		50,000		40,000	90,000
Publications/cartography	SRC							0
Computerization	SRC	2			25,000		17,500	42,500
TOTALS		40	14.55		1,370,800		542,500	1,965,800

*Most projects are in the public domain or become publicly available after a period of confidentiality. Some projects remain confidential at client's request.

PROVINCE: MANITOBA - 1993-1994

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS/OR FACILITIES	PERMANENT SMY	CASUAL/ TERM SMY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTAL
Core Repositories	MGS	MAN	4	.26	-	17800.00	0.00	17000.00	34800.00
Geochemical Surveys									
1)Bedrock	-	-	-	-	-	-	-	-	-
2)Soil	MGS	MAN	2	2.0	0.25	105000.00	8300.00	20500.00	133800.00
3)Vegetation	MGS	MAN	1	1.0	.13	57800.00	5600.00	18500.00	81900.00
Geological Surveys, Bedrock									
Precambrian									
1)Reconnaissance (1:100 000)	-	-	-	-	-	-	-	-	-
2)Detailed (1:50 000 and larger)	MGS	MAN	13	8	3.9	413500.00	41300.00	132400.00	587200.00
3)Phanerozoic	MGS	MAN	3	1.0	0.13	48000.00	3600.00	8000.00	59600.00
Geological Surveys, Surficial									
1)Reconnaissance (1:100 000)	-	-	-	-	-	-	-	-	-
2)Detailed	-	-	-	-	-	-	-	-	-
Geophysical Surveys									
1)Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
2)Airborne Magnetic, Gradiometer	MGS	MAN	2	1.0	-	55400.00	-	-	55400.00
3)Ground Magnetic	-	-	-	-	-	-	-	-	-
4)Gravity	-	-	-	-	-	-	-	-	-
5)Seismic	MGS	MAN	1	-	-	-	-	4000.00	4000.00
Hydrogeology	MWR	MAN	2	3.0	-	160000.00	-	92400.00	252400.00
Information, Education, Assessment									
Services and Compilation	MGS	MAN	2	1.26	-	66800.00	-	16900.00	83700.00
Laboratory Analysis	MGS	MAN	3	8	-	304000.00	-	34900.00	338900.00
Mineral Deposit Inventory and Analysis	MGS	MAN	6	3.26	1	186200.00	27100.00	48800.00	262100.00
Industrial Minerals	MGS	MAN	3	1.26	0.13	72700.00	3600.00	7000.00	83300.00
Oil, Gas Inventory and Analysis	MP	MAN	2	1	-	36600.00	-	4600.00	41200.00
Publications	MGS	MAN	-	-	-	-	-	-	0.00
Resident Geologist's Office	MGS	MAN	1	1	-	51100.00	-	-	51100.00
Subsurface Invest, Indust Min Drilling									
and Management	MGS	MAN	6	1	0.12	45200.00	7200.00	10400.00	62800.00
Water Resource Inventory and Analysis	MWR	MAN	2	8	-	344000.00	-	244500.00	588500.00
Other:									
1)Administration 1	MGS	MAN	11	7.0	-	289200.00	-	81900.00	371100.00
2)Drafting	MGS	MAN	-	-	-	-	-	-	0.00
3)Computerized Data Capture	MGS	MAN	1	2	-	92600.00	-	40800.00	133400.00
TOTALS	-	-	-	51	5.2	2345900.00	96700.00	782600.00	3225200.00

MGS - Manitoba Geological Services Branch; MP - Manitoba Petroleum Branch; MWR - Manitoba Water Resources
1 - Includes Field Equipment and Capital

PROVINCE: ONTARIO - 1993-1994

Programs	Funding Agency	No. of Projects (or Facilities)	Salaries Permanent $	Salaries Casual $	Operating Expenditures $	Totals $
Administration (Director's Office OGS)	MNDM	-	344.2	-	653.2	997.4
Precambrian:	MNDM	-	1217.5	171.6	510.5	1899.6
Mapping	MNDM	7				
Thematic	MNDM	4				
Mineral Deposits	MNDM	6	815.6	83.4	371.0	1270.0
Sedimentary and Environmental:	MNDM	-	1362.0	188.8	584.4	2135.2
Mapping	MNDM	7				
Geochemistry	MNDM	4				
Aggregate	MNDM	5				
Resident Geologists Office's	MNDM	13	2008.5	-	620.6	2629.1
Drill Core Libraries	MNDM	6	-	-	90.5	90.5
GEOservices:	MNDM					
Publications	MNDM	-	434.3	17.1	351.4	802.8
Information Serivces	MNDM	-	534.0	33.1	630.0	1197.1
Laboratory	MNDM	-	749.1	52.8	893.9	1695.8
Mines Library	MNDM	-	147.5	51.4	129.9	328.8
Geoscience Research Grants	MNDM	11	-	-	494.7	494.7
NODA	CAN/ONT	9	-	623.3	473.8	1097.1
TOTALS			7612.7	1221.5	5713.4	14547.6

MNDM - Ministry of Northern Development and Mines
NODA - Northern Ontario Mineral Development Agreement

PROVINCE: QUÉBEC - 1993-1994

PROGRAMMES	MAITRE D'OEUVRE	FINANCEMENT	NOMBRE DE PROJETS OU D'INSTALLATIONS	EMPLOYÉS PERMANENTS PERS.-ANNÉE C-P-A***	EMPLOYÉS OCCASIONNELS PERS.-ANNÉE	DÉPENSES $
Levés géologiques						
1) Côte-Nord et Nouveau-Québec	D.R.G.	MRN/RNC*	18	1A-8P-1A	2	705 450
2) Montréal-Laurentides	D.R.G.	MRN/RNC*	13	5P-3A	2	307 016
3) Gaspésie-Iles-de-la-Madeleine	D.R.G.	MRN/RNC*	8	5P-3A	1	425 946
4) Estrie-Laurentides	D.R.G.	MRN/RNC*	13	1C-6P-1A	2	569 829
5) Minéraux industriels du Québec	D.R.G.	MRN/RNC*	5	5P-2A	1	68 994
6) Rouyn-Noranda	D.R.G.	MRN/RNC*	11	6P-3A	2	530 469
7) Val-d'Or	D.R.G.	MRN/RNC*	11	6P-3A	3	438 862
8) Chibougamau	D.R.G.	MRN/RNC*	7	5P-3A	3	741 797
Bases de données	D.R.G.	MRN/RNC*	1	2A		160 000
Supervision et contrôle	D.R.G. - D.A.E.M.	MRN		2C-1P-4A		635 558
Gestion et planification	D.R.G. - D.A.E.M.	MRN		1C-3A	2	684 445
Opérations (équipement de terrain, etc.)	D.A.E.M.	MRN		1P-14A		495 141
Assistance financière	D.A.E.M.	MRN/RNC***	7	1P	1	3 704 517
Géoinformation	D.A.E.M.	MRN/RNC**		2C-8P-14A		2 863 839
Information géoscientifique	D.A.E.M.	MRN		1C-2P-14A		753 636
Gestion interne	D.R.G. - D.A.E.M.	MRN		1C-1A		259 935
Communication	D.R.G. - D.A.E.M.	MRN		1A		26 100
TOTAUX			94	9C-59P-72A	19	13 371 534

D.R.G. - Direction de la recherche géologique, D.A.E.M. - Direction de l'assistance à lexploration minière.
MRN - Ministère des Ressources naturelles
RNC - Ressources naturelles Canada
* - Entente auxiliaire Canada-Québec sur les activités géoscientifiques (entente 11)
**- Entente auxiliaire Canada-Québec sur le systèeme d'information géominière SIGÉOM (entente 12)
*** - Entente auxiliaire Canada-Québec sur la prospection et exploration minière (entente 13)
*** C = cadre, P = professionnel, A = autre

PROVINCE: NEW BRUNSWICK - 1993-1994
Geoscience Expenditures 1993-94

PROGRAMS	AGENCY	NO. OF PROJECTS	STAFF			SALARIES	OPERATING	TOTALS
			PERMANENT	CASUAL	CONTRACT			
Geophyics	GSB	1					$5,900	$5,900
Geological Surveys		-						
Bedrock	GSB	3	3.00	2.00		$169,102	$88,598	$257,700
Surficial	GSB	2	1.00	1.25		$50,179	$37,921	$88,100
Geochemical Surveys	GSB	-	3.00			$123,800	$42,500	$166,300
Till	GSB	2		2.00				
Drainage	GSB	1						
Mineral Deposits	GSB	2	1.50			$88,000	$71,600	$159,600
Regional Offices	GSB	2	6.00			$244,060	$85,400	$324,460
Geoscience Information System	GSB	-	0.50			$27,000	$50,000	$77,000
Diamond Drill Core Management	GSB	3	0.50	1.00		$50,174	$7,126	$57,300
Publications (Editorial)	GSB	1	1.00			$45,604	$24,496	$70,600
Grants to Prospectors	GSB	1	0.50				$15,400	$15,400
Prospecting Course	GSB	-						
Directors's Office	GSB	-	2.00			$89,393	$18,316	$107,718
Information, Education	PAB	3	5.00			$172,000	$89,000	$261,000
Industrial Minerals	MDB	3	2.00	1.00		$115,000	$42,000	$157,000
Peat Resources	MDB	1	1.00			$50,000	$9,427	$59,427
Coastal Zone	MDB	1	1.00	1.00		$36,000	$14,000	$50,000
Coal, Oil, Gas, Oil Shale	ERB	2	2.00			$46,000	$29,500	$72,500
Canada-New Brunswick Agreement	GSB	8		2.75	8.00	$305,000	$46,000	$351,000*
Totals		36	30	11	8	$1,608,312	$677,693	$2,286,005

GSB = Geological Surveys Branch;
MDB = Mineral Development Branch;
PAB = Policy and Administration Branch;
ERB = Energy Resources Branch
* $279,000 = Economic Diversification Agreement
$72,000 = Canada-New Brunswick Mineral Agreement

PROVINCE: NEWFOUNDLAND - 1993-1994

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT1 SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CONTRACT1 $	CASUAL $	OPERATING EXPENDITURES $
Director's Office	NDME	NDME/DEMR	4	7	-	242,291	65,611	-	62,749
Core Repositories	NDME	NDME	1	2	1	91,411	-	5,959	45,578
Geochemical Surveys:									
Bedrock	-	-	-	-	-	-	-	-	-
Drainage	NDME	NDME/DEMR	5	3	1	108,951	30,685	4,624	49,657
Soil	-	-	-	-	-	-	-	-	-
Geological Surveys, Bedrock:									
Reconnaissance (1:100 000)	NDME	NDME/DEMR	9	7	9	277,327	65,208	57,699	404,394
Detailed (1:50 000)	NDME	NDME/DEMR	14	10	8	114,850	186,537	69,561	169,913
Geological Surveys, Surficial:			-	-					
Reconnaissance (1:100 000)	-	-			-	-	-	-	-
Detailed (1:50 000)	NDME	NDME/DEMR	6	5	5	103,850	133,734	23,672	76,330
Geophysical Surveys:									
Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
Airborne Magnetic	-	-	-	-	-	-	-	-	-
Ground Magnetic	NDME	NDME/DEMR	2	2	-	-	82,923	-	14,137
Gravity	-	-	-	-	-	-	-	-	-
Seismic	-	-	-	-	-	-	-	-	-
Radiometric	-	-	-	-	-	-	-	-	-
Hydrogeological Surveys	-	-	-	-	-	-	-	-	-
Information and Education	NDME	NDME	6	17	1	192,240	127,517	-	167,099
Laboratory Analysis	NDME	NDME	2	7	-	215,398	13,075	-	77,704
Mineral Deposit Inventory and Analysis	NDME	NDME/DEMR	11	16	5	141,497	299,081	20,558	148,871
Publications	NDME	NDME	3	9	1	267,326	55,655	10,052	75,332
Resident Geologist's Office	-	-	-	-	-	-	-	-	-
Subsurface Investigations	-	-	-	-	-	-	-	-	-
Water Resource Inventory and Analysis	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
TOTALS	-	-	63	85	31	2,355,641	1,060,026	192,125	1,286,764
Grand Total	4,894,556								

1 includes long term temporary staff
NDME - Newfoundland Department of Mines and Energy
DEMR - Department of Energy, Mines and Resources, Canada

PROVINCE: NORTHWEST TERRITORIES - 1993-1994

DIAND[1] PROGRAMS	NO. OF PROJECTS/ FACILITIES	PERMANENT SMY	CASUAL SMY	PERMANENT $ x 1000	CASUAL/ TEMPORARY $ x 1000	OPERATING EXPENDITURES $ x 1000
Head Office (Administration,						
General Support)	1	4.9	0.0	260.0	0.0	115.0
Core Repositories	1	0.1	0.2	8.0	5.0	75.0
Geological Surveys:						
Bedrock (1:50 000)	4	1.3	2.0	110.0	55.0	140.0
Surficial (1:50 000)	1	0.0	0.0	0.0	0.0	0.0
Education		0.2	0.0	25.0	0.0	4.0
Laboratory Analysis		0.0	0.0	0.0	0.0	11.0
Mineral Deposit Inventory and Analysis		1.6	0.0	170.0	0.0	71.0
Computerized Mineral Showings Database*	1	0.2	0.0	35.0	0.0	20.0
Publications	17	2.2	0.0	46.7	25.0	10.0
Other:						
Prospectors' Assistance		0.4		45.0		2.0
Geological Contracts	7	0.1		8.0		56.0
TOTAL DIAND		11.0	2.2	707.7	60.0	504.0

MIO[2] PROGRAMS	PROJECTS/ FACILITIES	OPERATING EXPENDITURES
Administration	1	120.0
Bedrock Mapping (1:50 000)	5	918.0
Computerized Mineral Showings Database*	5	250.0
Prospectors Assistance	2	135.0
Information/Education	7	166.0
TOTAL MIO	-	1589.0

GSC[3]	14	862.0
GRAND TOTAL Geoscience Expenditures		2955.0

[1] Department of Indian Affairs and Northern Development
[2] Canada NWT Mineral Initiatives Office
[3] Geological Survey of Canada managed Mineral Initiatives Expenditures
*Database under joint development

PROVINCE: YUKON - 1993-1994

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERSON YEARS PERMANENT PY	PERSON YEARS CASUAL PY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $
Head Office								
(Administration, General Support)	INA	INA	1	2.75	0.00	120000	0.00	140600
Head Office								
(Administration, General Support)	MRCA	MRCA*	1	3.00	0.00	included	included	397515
Core Repositories	INA	INA	1	0.25	0.25	9000	8000	7000
Geological Surveys								
Bedrock (1:50 000)	INA	INA	2	1.25	0.25	63000	9000	20000
Bedrock (1:50 000)	MRCA	MRCA*	5	4.00	2.00	included	included	825170
Geological Surveys								
Surficial	INA	INA	1	0.50	0.25	25500	3000	5000
Surficial	MRCA	MRCA*	1	1.00	1.00	included	included	168740
Laboratory Analysis	INA	INA	1	0.00	0.00	0.00	0.00	0
Laboratory Analysis	MRCA	MRCA*	1	0.00	0.00	included	included	* 90000
Education								* included in geological survey costs
Public	INA	INA	3	0.25	0.00	13000	0.00	17000
Thesis	INA	INA	1	0.00	0.25	0.00	3000	7000
Yukon MINFILE	INA	INA	1	2.00	0.25	95000	3000	21000
Publications	INA	INA	7	1.00	0.25	52000	3000	27500
Other:								
Geoscience Element	MRCA	MRCA*	6	0.00	0.00	included	included	413000
Technology Element	MRCA	MRCA*	5	0.00	0.00	included	included	116000
Information Element	MRCA	MRCA*	6	0.00	0.00	included	included	146625
Subtotal - INA			18	8.00	1.50	377500	29000	245100
Subtotal - MRCA			25	8.00	3.00	included	included	2067050
Grand Total			43	16.00	4.50	377500	29000	2312150

INA - Indian and Northern Affairs Canada
MRCA - Mineral Resources Cooperation Agreement - Canada/Yukon Geoscience Office
MRCA* - Funding 70% INA, 30% Yukon Government

GEOLOGICAL PROGRAM HIGHLIGHTS

NOTES

BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES GEOLOGICAL SURVEY BRANCH

INTRODUCTION

In the 1994 Provincial budget the government announced a $100 million, five-year program to revitalize mineral exploration in British Columbia, to maintain international competitiveness, and to create new, value-added opportunities. A $1.0 million boost in the Geological Survey Branch's (GSB) field activities was an integral part of this new program. The new program also included reinstatement of exploration incentive grants to exploration and mining companies (Explore BC) , and grants to prospectors (Prospector Assistance Program) with a combined budget of $4.0 million. The GSB managed both of these programs. The mineral potential initiative begun in 1993 was continued with funding from the Government's Corporate Resource Inventory Initiative. By 1996 the entire province will be covered by 1:250 000-scale mineral potential maps.

British Columbia experienced a significant upswing in mining and exploration activities during 1994. Buoyed in part by improved prices for copper and gold, four mines have reopened and two new mines are under construction: Eskay Creek Au-Ag, and QR Au-Cu. Exploration expenditures are expected to be in the $100 million range, a 30% increase over 1993.

BUDGET

The 1994/95 base budget for the Branch was $ 5.5 million. This was supplemented by $1.0 million from the Canada-BC Mineral Development Agreement (MDA), $337,500 from the Corporate Resource Inventory Initiative, and $60,000 from the inter Ministry Resource Inventory Initiative Committee, to prepare provincial geological mapping standards. The total budget was $6.935 million.

PROGRAM HIGHLIGHTS

ECONOMIC DEVELOPMENT PROGRAM

The Branch's economic development field surveys continued to be focused on regions where existing mines are forecast to close over the next few years (northern Vancouver Island, East Kootenays and northern Selkirks), areas with significant development potential (Tulsequah, Gataga, Tatogga) and one in the areally extensive, heavily drift covered, and under explored Interior Plateau region. The Gataga project was initiated in 1994 in partnership with the GSC.

The Industrial Mineral Promotion program that began in 1993 in Partnership with BC Trade and Development Corporation was continued and expanded in 1994. The Ministry of Employment and Investment also joined the partnership. Highlights for 1994 included publication of a quarterly newsletter "Focus on Industrial Minerals", a major marketing effort at the Japan Stone Fair, and an expanded field program. The field work was focused on andalusite family minerals, industrial mineral bearing skarns, *e.g.* wollastonite, and on diatomite and natural pozzolan.

A program to inventory sand and gravel resources of rapidly expanding urban areas of the Province was begun in 1994 after a 10 year hiatus. BC is experiencing the fastest population growth in Canada and this is increasing pressure to identify and protect aggregate supplies from alienation.

The coal program was decreased again in 1994. 1.5 person years are now devoted to coal geology. Mine scale studies were undertaken in the Northeast and Southeast coal fields and at the Quinsam coal mine on Vancouver Island.

RESOURCE MANAGEMENT PROGRAM

The Resource Management Program continued to focus on the preparation of 1:250 000-scale mineral potential evaluations for land planning initiatives underway in the Province that are led by the Commission on Resources and the Environment (CORE). In 1994 evaluations were completed for the Thompson-Okanagan, Mid Coast, and Skeena Nass regions and compilations were at an advanced stage for the Northeast region. This leaves only the important mining rich Northwest region to be completed in 1996.

Other Provinces and Territories have shown keen interest in the methodology and process used in British Columbia and in March 1994, at the request of the Committee of Provincial Geologists, the Branch ran a two day workshop and training course. The BC evaluation methodology relies heavily on two Branch databases: MINFILE and ARIS. MINFILE is our computerized mineral inventory and ARIS is an inven-

tory of exploration work completed by individuals and mining companies. Both databases were updated in 1994.

ENVIRONMENTAL PROGRAM

The nature, distribution and structure of rocks on the earth's surface determine not only mineral wealth but also the quality of soils and water, and potential hazards such as landslides and earthquakes. Most of the Branch's geoscience databases were created to aid and stimulate economic activity but in recent years, as sustainable development and protection of the environment have become important provincial issues, we are applying these databases in these areas. For example, the Regional Geochemical database was devised to detect geochemical anomalies as a guide to locating mineral deposits. However, this database is also one of the most comprehensive in the Province for documenting geochemical baseline characteristics of drainage and can be used to measure the impacts of human activities on the environment. In 1994 the Branch initiated a project to prepare earthquake hazard maps for populated areas in the Lower Mainland - Vancouver Island region. A pilot microzonation map of the Fraser-Cheam District will be completed in 1995.

JOINT PLANNING WITH THE GEOLOGICAL SURVEY OF CANADA

The GSC is a key partner in providing geoscience data in British Columbia. For much of their history, GSC programs in the province have been national in scope and regional in scale and have documented the broad, fundamental geoscience framework for the Province. In recent years, more GSC programs have been directed toward serving Provincial priorities. Declining budgets for geoscience work encouraged both surveys to work more closely together and to jointly plan to ensure effective use of scarce resources to meet Provincial priorities. In March, 1994 a joint strategic planning meeting was held to identify BC's geoscience needs. The draft plan developed is serving as a blueprint for prioritizing new projects and for allocation of resources. The plan is overseen by a Joint Co-operation Committee that reports to the Assistant Deputy Ministers of each organization.

MINISTER'S TECHNICAL LIAISON COMMITTEE

The Minister's Technical Liaison Committee to the Geological Survey Branch continued through 1994/95. The Committee reviewed and endorsed the joint GSB-GSC Strategic Plan.

ALBERTA GEOLOGICAL SURVEY AND ALBERTA DEPARTMENT OF ENERGY

INTRODUCTION

1994 saw the beginning of a number of major changes. The Alberta Research Council decided to phase out the Alberta Geological Survey (AGS), discontinuing an affiliation that had been in place for almost three quarters of a century. Negotiations were begun to transfer AGS to the Alberta Department of Energy, which has co-managed the Survey since 1990.

Geological library and publications sales, functions that until this year were provided by the Alberta Research Council, were transferred to AGS, as was the hydrogeology business unit of the Council's Environmental Research and Engineering Department. The resulting AGS structure is shown as part of the Alberta Geoscience Organization Chart found elsewhere in this Journal.

The Alberta Department of Energy assumed sole responsibility for program direction, and the existing program is now being viewed as maintaining a geoscience information base and providing support to exploration and development, land use planning, and environmental management. Also, the geologists now attached to the Department's Mineral Resources Branch will become part of the AGS. They will continue to support the mineral rights management activities of the Department. These changes will be reflected in next year's AGS organization chart.

In spite of the addition of the geology library, publications sales and hydrogeology unit, the total number of staff did not change much, mainly because of attrition during the year.

A significant part of the 1994 geoscience program was focussed on the Mineral Development Agreement. A major accomplishment was the publication of the Geological Atlas of the Western Canada Sedimentary Basin, jointly with the Canadian Society of Petroleum Geologists. The Alberta Geological Survey played a lead role in the Atlas project, which was also sponsored by the Geological Survey of Canada and the Alberta Department of Energy. In addition, British Columbia, Saskatchewan and Manitoba provided strong support. This federal-provincial cooperative project is featured in a separate write-up elsewhere in this Journal.

1994 highlights are described in detail in the sections that follow.

ALBERTA GEOLOGICAL SURVEY

MINERAL EXPLORATION AND DEVELOPMENT SUPPORT

In May, 1994 the Management Committee of the Canada-Alberta Partnership on Minerals (hereafter referred to as the Canada-Alberta MDA) approved a total of 23 projects for fiscal year 1994-95 under the Geoscience Component. Ten of these projects are funded by Alberta and are being delivered by the Alberta Geological Survey. The other 13 projects are funded by the federal government and are being delivered by the

TABLE 1
PROJECTS APPROVED FOR FISCAL 1994-95 UNDER THE GEOSCIENCE COMPONENT OF THE CANADA-ALBERTA MDA: ONGOING PROJECTS BEING DELIVERED BY THE ALBERTA GEOLOGICAL SURVEY

IDENTIFIER	PROJECT LEADER(S)	PROJECT NAME
MINERAL INFORMATION SUBPROGRAM		
M92-04-005	B.A. Rottenfusser	Mineral Information System
MAPPING AND SAMPLING SUBPROGRAM		
M92-04-006	M.M. Fenton	Reconnaissance mineral and geochemical survey of Northern Alberta tills
M92-04-007	W. Langenberg (includes a contribution by Joranex Resources Inc.)	Evaluation of mineralization potential of selected areas of northeastern Alberta
M94-04-008	W.A.D. Edwards	Mapping and resources exploration of the Tertiary formations of Alberta
M93-04-035	M.M. Fenton (includes contributions by two Ph.D. candidates at the Univ. of Alberta	Surficial geology mapping and Quaternary stratigraphy of the Peace River (W1/2) and Winagami (W1/2) map areas of northwestern Alberta
INDUSTRIAL MINERALS SUBPROGRAM		
M92-04-011	S. Bachu	Potential for the recovery of industrial minerals from Alberta brines
M92-04-013	W.M. Hamilton	Mineral resource mapping of mountain corridors
M92-04-014	W.M. Hamilton	Regional study of industrial limestones in Alberta
M93-04-036	W.A.D. Edwards	Mineral aggregate commodity analysis
COORDINATION		
M92-04-012	R. Richardson R. Olson (APEX Geoscience Ltd.)	Geoscience coordination, public open houses and final publications

Geological Survey of Canada (GSC).

The provincially funded projects are listed in Table 1 and the 13 federally funded projects are listed in Table 2.

Some technical highlights, for example, from M92-04-006 project, Reconnaissance Mineral and Geochemical Survey of Northern Alberta Tills, include information on the surficial geology and Quaternary stratigraphy. Field work focused on northeast Alberta. Multiple till sections were sampled east of the Athabasca and north of Clearwater Rivers.

Field textural data indicate surface till is very sandy (80% sand) east of Athabasca and north of Clearwater Rivers and less sandy (20-40%) to the west and south. Less sandy till was found at depth below the very sandy till. Unusual float includes: 1) carbonate slabs containing pebbles and cobbles of coarse igneous rock, and 2) conglomerate cobbles with a fine grained, slightly calcareous, reddish brown groundmass and clasts of granitic and dark fine grained rock.

In Report M92-04-011 on Industrial Mineral Potential of Alberta Formation Waters, specific areas and stratigraphic intervals with economic potential for calcium, magnesium, potassium, lithium, iodine and bromine extraction from formation waters were identified in the Alberta basin. Calcium, magnesium, potassium and bromine in high concentrations are found, depending on location, between 1240 and 2600 metres depth, in lower Elk Point Group strata in two areas in central-eastern Alberta, and in six areas in Beaverhill Lake Group strata in southern Alberta. Resources vary between 25 and 760 kg/m^2 for calcium, 2 and 136 kg/m^2 for magnesium, up to 116 kg/m^2 for potassium and up to 10 kg/m^2 for bromine. Lithium in high concentrations is found in west-central Alberta in reefal and platform carbonates of the Woodbend and Beaverhill Lake groups, at depths between 2700 m and 4000 metres. Resources vary between 0.01 and 0.57 kg/m^2. Iodine in concentrations above the regional exploration threshold is found in Viking and Belly River strata in localized areas in south-central Alberta, at depths between 650 and 950 metres. Resources vary between 0.2 and 1.8 kg/m^2.

TABLE 2
PROJECTS APPROVED FOR FISCAL 1994-95
UNDER THE GEOSCIENCE COMPONENT OF THE
CANADA-ALBERTA MDA:
ONGOING PROJECTS BEING DELIVERED BY THE
GEOLOGICAL SURVEY OF CANADA

IDENTIFIER	PROJECT LEADER(S)	PROJECT NAME
C1.1: NORTHEASTERN MINERALS SUBPROGRAM		
C1.11	M. McDonough	Tectonic evolution of Precambrian shield of northeastern Alberta
C1:12	V. Ruzicka	Metallogenic studies for U-Polymetallic mineralization of the Athabasca basin
C1.13	J. Bednarsky	Quaternary geology and till geochemistry, shield margin
C1.14	B.W. Charbonneau	Airborne gamma-ray spectrometer-magnetic-VLF survey in northeastern Alberta
C1.15	P.W.B. Friske	Geochemical lake sediment and water surveys in northeastern Alberta
C1.16	C.F. Chung	Integration of GSC data from northeastern Alberta
C1.2: SOUTHWESTERN MINERALS SUBPROGRAM		
C1.21	T.D. Peterson	Mineral potential, metamorphism, and petrogenesis of the Crowsnest volcanics
C1.3: DIAMONDS SUBPROGRAM		
C1.31	B.A. Kjarsgaard	Kimberlite mineralogy, petrology, geochemistry in Alberta
C1.32	L.H. Thorleifson	Geochemical and mineralogical reconnaissance in south and central Alberta
C1.33	P.E. Stone; D.J. Tesky	Aeromagnetic surveys in southern Alberta
C1.4: INDUSTRIAL MINERALS SUBPROGRAM		
C1.41	H.J. Abercrombie	Brine Resources of Alberta
C1.5: GENERAL SUBPROGRAM		
c1.51	S.B. Ballantyne	Orientation studies in heavy mineral concentrates and ground penetrating radar
C1.6 COORDINATION		
C1.61	R.W. Macqueen	Coordination and publications

GEOSCIENCE INFORMATION BASE

During the past year, the Alberta Geological Survey Computing Support Group has undertaken two major new initiatives: (1) establishing a presence on the Internet; and (2) migration to new computing platforms.

The Alberta Geological Survey has established an experimental server to the World Wide Web (W3). The server has not been widely advertised as it is being used to gauge the amount of effort and complexity involved in making current digital documents available on the Internet. It is expected that next year the Alberta Geological Survey will establish and publicize a staff list, an Alberta Geological Survey's publications list, a number of digital documents, as well as more detailed metadata describing its holdings.

The introduction of the new AXP-based processors has given the AGS an opportunity to simplify its current facility by replacing multiple VAX-based processors with a smaller number of AXP-based units. This change introduces the opportunity to maintain or increase the currently available computing resources at a decreased cost.

ATHABASCA OIL SANDS DATA BASE

The Alberta Geological Survey has carried out a series of resource characterization studies in the Athabasca Oil Sands Area. The McMurray/Wabiskaw Oil Sands Deposit contains approximately 142 x 109 m^3 of bitumen, making it the largest oil sands deposit in Alberta and in the world. From project inception, it was intended to acquire and store data electronically to facilitate data manipulation, generate maps and cross sections and ultimately, for release to the public.

The electronic database is one of the most significant products of the resource characterization studies and is now available to the public. The database contains information on about 2200 wells and consists of formation picks and markers, the results of log analysis (lithology, bitumen saturation, water saturation, volume of shale, porosity and water resistivity), and the raw well log digits.

Where possible, four wells per township were used for the studies. Wells were selected on the basis of geographic distribution, quality of the geophysical logs (gamma ray, resistivity and porosity), and the availability of cores and core analysis. Regional correlations were established using a network of interlocking stratigraphic cross sections and picks were verified by examining selected cores.

ALBERTA DEPARTMENT OF ENERGY, MINERAL RESOURCES BRANCH

GEOLOGY GROUP

The Geology Group continued to provide technical support for the Ministry in the area of mineral tenure management, specifically petroleum and natural gas lease continuation and sales. With the loss of two professionals early in the year, staffing was reduced to six geologists and one technologist. This untimely reduction occurred during one of the busiest years for the oil industry in the past decade. Oil and gas exploration activity increased dramatically in the province during the past year, and land sales and drilling activity were correspondingly brisk. Geological evaluation of lease continuation applications, land sale requests, and unitization proposals remained the primary role of the Geology Group. Continuation applications were on the rise, with many continuations granted over the expiry of the lease while wells were drilled. Rig availability became a major concern in the industry this year, often impacting on continuations. The role of the Geology Group in resource evaluation continued to increase, as the Ministry attempts to avoid any possible sterilization of resources on Crown lands by other interest groups in the province.

MINERAL AGREEMENT GROUP

For the one-year period September 1993 to August 1994, Alberta received 767 Metallic and Industrial Mineral Permit applications, on an area of 6.9 million hectares. This compares with 3247 permit applications on 28.9 million hectares for the same period in 1992-93. While this is a significant decrease, this was the second busiest year ever. The province has 50.6 million hectares of Crown minerals available, and as of September 1, 1994, had 4330 active permits on 37.39 million hectares.

In addition to the permits issued by direct application, the province also disposed of some permits through competitive tender. In 1990, the Department had withdrawn the minerals in that area of the Athabasca oil sands deposit which can be surface mined. When the decision was made to make these minerals available once again, a number of parties expressed interest. To make the acquisition of permits fair, the government offered 105 000 hectares in 16 permits through a 1994 public tendering, raising $35 000.

Although the large amount of permit filing in 1992-93 was for diamonds, news from any exploration activity has been remarkably scarce. The majority of assessment reports for the diamond staking is due in the spring of 1995, so if real discoveries have been made information will not be available until then.

Exploration work continues on the gold-copper-platinum play in the area north of Ft. McMurray. Lac Minerals, Tintina Mines and Focal Resources are all working in the area, mostly at an early exploration stage. The American Barrick takeover of Lac has led to a reduction of Lac's continuing exploration of the area.

The red granite deposit north of Ft. Chipewyan has been the subject of some development work this year. There has been a problem with fracturing in the initial work, and no commercial extraction has yet commenced.

GEOLOGICAL ATLAS OF THE WESTERN CANADA SEDIMENTARY BASIN RELEASED

Grant D. Mossop
Geological Survey of Canada
Institute of Sedimentary and Petroleum Geology
Calgary

The 1988 issue of the Provincial Geologists Journal, volume six, contained a summary article on the objectives, scope and progress to date of a large multi-institutional, multi-disciplinary project to compile a new Geological Atlas of the Western Canada Sedimentary Basin (Mossop, 1989). This brief report is intended as a sequel to the earlier summary.

The goal of the Atlas project was always stated thus - "as a community of geologists in Western Canada, to compile and produce a new atlas of the subsurface geology of the Western Canada Sedimentary Basin". The two output objectives were - "(1) to establish and release an electronic database of consistently interpreted subsurface information; and (2) to produce a printed volume..." Both of these objectives were fulfilled in 1994. The Atlas volume (Mossop and Shetsen, 1994) was released during the annual convention in Calgary of the Canadian Society of Petroleum Geologists (CSPG), May 10-12, 1994.

The atlas digital database of stratigraphic control for all of the compilation's contour maps was prepared shortly thereafter. Public release is awaiting the return and compilation of questionnaires and order forms from those that purchased a printed volume. This feedback will be used to determine the format in which the data will be made available. It will be available at a price of $100 CAN from the Alberta Geological Survey (AGS) or as an adjunct to the purchase of an Atlas volume (also from the AGS, for a nominal $10 CAN fee). The Atlas volume itself sells for $185 CAN (plus GST and shipping) and is available from the Calgary offices of the CSPG, the Edmonton offices of the AGS and the ISPG Bookstore at the Geological Survey of Canada's Calgary office.

The Atlas is a weighty tome, more than 12 kilograms, and physically challenging to handle and store - cover dimensions 44 cm high, 58 cm wide (accommodating the 1:5 000 000-scale base map of Western Canada on a full page), 4.5 cm thick. There are 510 pages, three-quarters given over to illustrations and the rest to text and references. Most of the illustrations are in full colour. There are 35 chapters, with 19 devoted to prescribed stratigraphic intervals and 16 to "themes" such as heat flow and petroleum resources. As one would expect, maps dominate - almost 500 in total (some overprinted on one another or inset):

- 55 index maps;
- 43 domain maps, depicting geological provinces or paleophysiography;
- 13 tectonic maps;
- 5 potential field maps;
- 23 structure contour maps;
- 38 isopach maps of large major stratigraphic divisions;
- 70 sub-division isopach maps;
- 70 lithofacies maps;
- 54 paleogeography maps;
- 18 petroleum systems maps;
- 25 resource maps - oil and gas fields, mineral and coal deposits;
- 13 geotechnical maps on stress distribution and thermal regime;
- 32 sub-regional and local maps;•30 or so specialized maps.

Cross sections are also featured - over 200 of them:

- 66 regional 'master' sections, along transects common to all chapters;
- 67 regional discretionary sections;
- 42 schematic sections;
- 53 sub-regional and local sections;
- 6 seismic sections.

There are also:

- 30 correlation charts;
- 84 reference logs;
- 49 depositional models;
- 57 data tables on oil and gas resources;
- 33 data tables on specialized topics;
- 21 photographs.

Finally, there are of the order of 70 specialized figures and tables, dealing with organic geochemistry and petrology, mineral and coal resources, and a host of related geophysical, petrophysical and geotechnical parameters.

When the Atlas project was initiated in 1985 it was planned as a seven year undertaking: two years of feasibility work (1985-1987); four years of compilation (1987-1991); and one year of production (1991-1992). In the end, the project took over nine years to complete. Most of the delay resulted from miscalculation of the production time required to publish the printed volume after original manuscripts were prepared - almost three years instead of one.

Four Project Sponsors funded the Atlas compilation, and, through the Atlas Management Committee, oversaw all aspects of the project's development - the AGS (project headquarters and home to all project staff), the Alberta Department of Energy (AE, co-manager of the AGS), the CSPG (scientific home to virtually all of the authors and contributors), and the Geological Survey of Canada (GSC, through the work of the Institute of Sedimentary and Petroleum Geology). Data Donors, whose gratis contribution of original databases made the project manageable in digital terms, included government departments and agencies in Alberta, Saskatchewan, Manitoba and British Columbia, and a number of private sector firms. Authors, some 102 in total, hailed from 21 different energy industry companies, six provincial agencies and boards in Alberta, Saskatchewan and Manitoba, the federal government through the GSC, and academics from seven Western Canada universities. A number of independent and retired geologists also served as authors and contributors.

So, the Atlas is complete. It will be subject to all of the tests of time - for completeness, accuracy, integrity and of course ultimately utility. It is expected to have a long shelf life, serving our collective need for basic regional geoscientific information and insight, in support of sustainable development, for years to come. In these days of cutbacks in geoscientific endeavour in practically all sectors of Canadian society, the Geological Atlas of the Western Canada Sedimentary Basin stands as a sterling example of what can be achieved through the good will and enlightened vision of the collective - industry, government and academia -working together for a common goal.

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NOTES

MANITOBA GEOLOGICAL SERVICES

In 1994 the operations of the Geological Services Branch (GSB) were augmented once again with support from the Geological Survey of Canada (GSC) through the NATMAP Shield Margin and Southern Prairies programs. The four main objectives of the Survey programming continue to be: (1) generating baseline data supporting exploration for copper and zinc in the region feeding the Flin Flon smelter, (2) cooperative investigations with industry along the Thompson Nickel Belt and its southwest extension, (3) evaluation of new domestic commodities in conjunction with the Marketing Branch, and (4) generating information and guidelines supporting diamond and precious metal exploration in Manitoba. In addition, a federal/provincial cooperative study of Lake Winnipeg sediments was implemented, and Phase III of the LITHOPROBE Trans-Hudson Transect involved VIBROSEIS reflection seismic profiles in the Lynn Lake region and across the Thompson Nickel Belt extension in the Easterville region.

Provincial A-base activities were augmented by funding provided under the Canada/Manitoba Partnership Agreement on Mineral Development (PAMD). Of the 12 provincial (PAMD) Sector A projects active during 1994/95, eight had field components focussed on the Flin Flon/Snow Lake region, three entail completion of reports and maps stemming from earlier work, and one is developing computer databases, compilations and minerals-oriented GIS for the NATMAP Shield Margin program.

GSC contributions encompassed 16 projects (9 funded by PAMD), eight with active field work focussed primarily in the Flin Flon/Snow Lake area, as well as projects in the Thompson Belt, southeast Manitoba and on Lake Winnipeg.

Along with the rest of the Department, the GSB developed a new strategic plan early in the year; discussions are progressing to secure continued cooperation between the GSC and GSB over the next five years. Industry feedback to the Interim Evaluation of the Canada/Manitoba Partnership Agreement on Mineral Development will be a key factor in determining the level and focus of future GSB investigations.

Several new publications were released during the year. New insights into the geochemical makeup, origin and exploration potential of volcanic sequences in the Flin Flon/Snow Lake region were published in technical journals. New crustal models for this region blend the stratigraphic and structural relationships determined through mapping with new isotope data and seismic profiles from LITHOPROBE. Other publications included five Mineral Deposit Reports for the Leaf Rapids, Lynn Lake, Flin Flon and Bissett regions. Eleven reports include commodity studies on Dimension Stone (ER93-1) and magnesium dolomites (OF). New publications planned for release in November include nine new preliminary maps, two coloured NATMAP compilation maps that cover the Kisseynew domain south flank in Manitoba and Saskatchewan and the Snow Lake and File lakes area, and a 1:250 000-scale bedrock compilation for NTS 63P Sipiwesk Lake. A second, revised edition of the Geological Highway Map is also scheduled for release in November. Important new panels illustrate examples of sustainable development in the mineral sector. A report on the Netley Marsh area, released in June, provides new insights into modern geological processes, geomorphology and sedimentology along the south shore of Lake Winnipeg. The report is styled to appeal to land-use planners, scientists and the public.

The GSB is also committed to developing a minerals-related GIS system for the province, a capability which will benefit all client groups. A schema for a mineral deposit database is under development, with demonstration of a pilot industrial minerals database planned for the November convention. Further progress was also made on the Stratigraphic Database, a separate geologically focussed database that complements the Manitoba Oil and Gas database (MOGWIS), which is maintained by the Petroleum Branch. In cooperation with the GSC and the Saskatchewan Geological Survey (SGS), additional colour compilation maps were developed for the cross-border region of the Flin Flon area and for Snow Lake under the Federal/Provincial NATMAP Shield Margin project.

Land-use issues continue to require geological input in matters relating to the selection of Endangered Spaces candidate areas, aboriginal land claims, and proposals for creation of new potentially restrictive land-use designations such as ecological reserves, rezoning of provincial parks, and a national park in the Manitoba Lowlands.

Throughout the year GSB staff responded to numerous enquiries from industry clients, many of whom were responding to the new exploration incentives offered by the province. GSB staff gave several technical

presentations highlighting various aspects of Manitoba's mineral potential, including a wide variety of displays that summarize ongoing work and new products. Other educational initiatives included geological presentations in Whiteshell Provincial Park and in Winnipeg, as well as support for the EDGEO program for science teachers in cooperation with the Department of Geological Sciences, University of Manitoba.

The Atlas of the Western Canada Sedimentary Basin by the Canadian Society of Petroleum Geologists, GSC, Alberta Dept. of Energy and the Alberta Geological Survey was published this year. This benchmark tome includes several contributions from GSB staff dealing with relevant aspects of the Precambrian basement and overlying Paleozoic sequences in Manitoba.

The need for continued economies in Winnipeg led to relocation of the Department's offices to Suite 360, 1395 Ellice Avenue. All rock preparation functions, field equipment, publication storage, stratigraphic core and petroleum exploration core have been consolidated at 10 Midland Street. This building has been thoroughly renovated and now provides year-round facilities for examining petroleum core in a heated building, with on-site technical support. The Branch's x-ray laboratory was moved to the Analytical Laboratory on Logan Avenue. A dramatic increase in demand for services from the GSB Analytical Laboratory created temporary backlogs in sample processing. Total private sector assay submissions in the first eight months of 1994 (1375 samples) equalled the annual workload of earlier years.

The regional office at Thompson is now fully staffed with a regional manager (reporting to the Mines Branch), three geologists and cartographic support. The Thompson and Flin Flon offices are now fully operational and maintain a high level of interaction with explorationists in these areas.

FIELD OPERATIONS

FLIN FLON/SNOW LAKE

A wide range of geological mapping and mineral deposit investigations continues to focus on this region. Much of the work is coordinated through the Federal/Provincial NATMAP Shield Margin project.

Several cooperative investigations with industry were implemented on the Callinan copper-zinc deposit, the newly discovered Photo Lake copper-zinc deposit, sub-Paleozoic VMS deposits and the Thompson Nickel Belt. These agreements increase the level of information exchange between the private sector and the geological survey organizations, give a sharper and more immediate focus to GSB mapping, and allow companies more intensive access to the in-depth experience and insights of Survey geologists.

Field tours were given by GSB geologists in late May/early June for geologists from IETS, HBMS and the GSC, to apprise them of some of the new findings and concepts emerging from the work of the GSC and GSB. A series of field trips involving NATMAP participants from GSB, GSC, Saskatchewan Geological Survey (SGS) and the University of New Brunswick focussed on resolving problems of regional tectonostratigraphic and structural correlation that were identified in the development of the cross-border compilation maps.

144 till and humus samples were collected in the Flin Flon area (63K/13). A total of 956 samples have now been collected to provide information on glacial dispersion in the Flin Flon-Snow Lake region to base and precious metal explorationists. A three-day field demonstration in the Swan River area was given by GSB to GSC geoscientists working in the Flin Flon region, to provide insights into the ice-flow history, glacial stratigraphy, glacial deposition styles and post glacial Lake Agassiz history of west-central Manitoba and Saskatchewan.

A new project aimed at unravelling the structural geology of the Flin Flon area between Cliff Lake (Manitoba) and Hamel Lake (Saskatchewan) was initiated as an M.Sc. thesis at Queen's University. Preliminary results indicate the presence of a regional low-angle S1 cleavage related to F1 recumbent folding and early movement on the Club Lake and Railway thrust fault systems. These structures are folded by the F2 Hidden Lake synform and Beaver Road antiform and are cut by later high-angle shear zones and faults.

Joint GSC/GSB stratigraphic and structural mapping was undertaken along the West Arm, Inlet Arm and Northeast Arm of Schist Lake in order to document the complex tectonic relations between tectonostratigraphic assemblages in the Flin Flon area. Augmented by a geochronology and geochemistry program at GSC, the results of this project should highlight the long-lived history of shear zone deformation, metamorphism, sedimentation, volcanism and plutonism that characterizes each of these major tectonic corridors. Importantly, these concurrent tectonic processes occurred after early island arc and oceanic volcanism and associated Cu-Zn VMS mineralization (*i.e.*, after 1880 Ma).

The Callinan Mine project, is a cooperative project between the GSB, (SGS) and Hudson Bay Mining and Smelting Co. Ltd. Its objectives are to provide a definitive surface geology map of the Callinan-Flin Flon area and a three-dimensional interpretation of the geology and geochemistry of the Callinan Mine to assist exploration.

Mapping of the Baker Patton felsic volcanic complex at a scale of 1:5000 has been completed in digital form. Detailed structural studies on a portion of the area confirm major disruptions of the stratigraphy during brittle deformation. The geochemistry of the complex and alteration zones associated with VMS deposits can now be investigated using the established stratigraphy.

A reconnaissance study of deformed Ordovician limestones on Limestone Point Lake was initiated as part of an overall examination of Phanerozoic deformation and reactivation of Precambrian basement structures in the Flin Flon belt-Hanson Lake Block area (Concordia University).

1:10 000 and 1:5000-scale geological mapping continued in the Nokomis, Webb and Fay Lake regions on the northern flanks of the Flin Flon belt. The geological setting of the Nokomis gold deposit is now defined, and the interleaved thrust complexes in the Kisseynew Belt Transition Zone are better understood. The regional aspects of this work have been captured in the new NATMAP 1:100 000 Saskatchewan/Manitoba geological compilation that covers the south flank of the Kisseynew Domain between longitudes 100°15' and 102°45'.

A brief mapping project near Fay and Syme lakes included collection of geochemical samples to better delineate the extent and character of the mafic and ultramafic pillowed volcanic flows southeast and east of Ponton Lake.

Mapping at 1:10 000 scale has also been completed in the northern part of the North Star Lake area in digital format. Stratigraphic units previously identified in the southern part of the map area have been traced northwards to the Lon Zone copper-zinc occurrence.

GSC contributions defined tracer isotope characteristics of the supracrustal and plutonic rocks in the region; U/Pb dated selected geological units to establish a geochronological history; mapped the granites in the Elbow Lake region; and compiled geological maps for the sub-Paleozoic basement in the region to the south, based on potential field data and relogging of exploration drillcore. Several other projects provided new information on the structural evolution of the area, yielding new insights into the timing of deformational events that have complicated the key mineralized strata.

Field structural studies related to Ph.D. theses (University of New Brunswick), continued this summer in the Elbow Lake and Snow Lake areas. Structural mapping in the Elbow Lake area showed that the mafic volcanic rocks were the locus of protracted deformation throughout the entire interval of calcalkaline plutonism (1.88-1.84 Ga) to post-peak metamorphic ductile-brittle deformation (1.80 Ga). Although the older plutons are penetratively deformed (*e.g.*, 1876 Ma granodiorite of the Gants Lake batholith), deformation was consistently localized in the volcanic rocks. Strands of the Elbow Lake Shear Zone (ELSZ) are contiguous with shear zones in the Athapapuskow-Cranberry lakes area and Iskwasum Lake area.

This year a brief reconnaissance confirmed the existence of widespread ocean floor basalts and ultramafic lithologies in the Iskwasum Lake region, as well as encountering the southwest extension of the ELSZ, represented on Iskwasum Lake as a 900 metre wide zone of mafic mylonites and tectonites. The ELSZ appears to be a long-lived structure that may have initiated during early assembly of the Flin Flon tectonic collage, and was reactivated during subsequent plutonic events. The Iskwasum Lake mafic-ultramafic intrusive complex resembles other ocean-floor basalt-associated complexes at Elbow, Claw, and Athapapuskow lakes.

Mapping (1:50000) of plutonic rocks in the Iskwasum Lake area highlighted the intimate relationships between calcalkaline plutonism and shear zone deformation throughout the area, and will form the basis for an M.Sc. thesis on the plutonic rocks from the University of Ottawa.

In the Snow Lake area, structural relations between File Lake Formation turbidites, Missi Group sandstones and Amisk Group volcanic rocks were resolved through detailed mapping of the McLeod Road fault and its immediate hanging wall and footwall. The fault cuts an F2 synform of File Lake and Missi rocks but is itself syn-metamorphic, thus constraining it to part of the overall D2 event. Integrated structural-metamorphic studies are planned for File Lake rocks between Snow and Squall lakes to assess the structural relief and possibly the geometry of metamorphic isograds.

Field work was also completed for an integrated structural geology-geochronology project in the File Lake, Woosey Lake and east Wekusko Lake areas. A protracted history of south-directed thrusting, folding and cleavage development at File and Woosey lakes, and recognition of *ca.* 1835 Ma felsic-mafic volcanic rocks and associated fluviatile sandstones and conglomerate in the east Wekusko Lake area (Herb Lake) are documented. This subaerial volcano-sedimentary package is clearly younger than the classic Missi Group sedimentary rocks in the Flin Flon area (*ca.* 1845 Ma), and necessitates a revision in the stratigraphic nomenclature for the Flin Flon-Snow Lake Belt.

A cooperative mapping program between the GSB and Hudson Bay Exploration and Development Co. Ltd. was undertaken to accelerate development of a newly discovered copper-zinc deposit at Photo Lake. The investigation is designed to identify the geological setting of the deposit and map (1:5 000 scale) the favourable host rock stratigraphy. Map production is in digital format.

Outcrop stripping and 1:5000-scale mapping were used to trace extensions to the Osborne Cu-Zn deposit stratigraphy an additional 1.5 kilometres northeast of the deposit. The felsic volcanic host sequence has now been defined over an aggregate length of approximately 5.0 kilometres. Additional alteration zones characterized by veinlet and disseminated chalcopyrite, pyrite-pyrrhotite, silicification and sillimanite-garnet were documented. Three field trips in the region of the Osborne Cu-Zn deposit were given to industry explorationists.

1:20 000-mapping of volcanic rocks and turbidite sequences southwest of Wekusko Lake has led to a twofold subdivision into the Wekusko Lake and Hayward Creek structural domains. The structural history is consistent with that closer to Snow Lake. The volcanic rocks exhibit a flat REE profile with moderately enriched LREE typical of arc tholeiites elsewhere in the Snow Lake area. Extensive iron oxide stains along the southeast margin of the Wekusko Lake pluton appear to be due to contamination by adjacent mineralized (pyritic) greywacke/siltstone.

The sub-Phanerozoic mapping program completed drillcore examination, concentrating on the western half of NTS 63J and the easternmost portion of NTS 63K. The extension of tectonostratigraphic assemblages from the Snow Lake and Wekusko Lake areas was successfully mapped to at least 54°N, and a regional southwest increase in metamorphic grade was documented. A new 1:250 000-scale interpretive map for the buried Precambrian basement in NTS 63J and a revised version for NTS 63K are planned for release in 1995.

LYNN LAKE AND NORTHERN MANITOBA

A reconnaissance of recent burns in the Lynn Lake area targeted several areas in which detailed mapping is now warranted in tracts associated with known gold and base metal mineralization.

Preliminary results from a vegetation geochemical survey in the Eden Lake area indicate alder twigs are the preferred sampling medium for tracing light rare earth element-enriched allanite and britholite zones hosted by aegirine-augite syenite.

Geophysical data from assessment files, geological reports and computer modelling of aeromagnetic data were used to assess residual exploration potential of seven Endangered Spaces candidate areas in northern Manitoba. Short duration field examinations at Nueltin and Topp lakes confirmed a low mineral potential for the Topp Lake area, but discovered a narrow east-trending zone of mineralization in the southern sector of the Nueltin Lake Endangered Spaces candidate area that may warrant further investigation.

THOMPSON NICKEL BELT AND ITS SOUTHWEST EXTENSION

GSB staff led several field tours and demonstrations in the Thompson Nickel Belt for industry and university personnel, to demonstrate new insights into the Ospwagan Group stratigraphy associated with the nickel mineralization. Industry representation on the field tours included geologists from companies active in Manitoba, as well as delegates engaged in exploration for nickel in Finland, Australia and South Africa.

Drill core from the region was relogged as part of a major new geological compilation project aimed at updating the subdivision of Precambrian units in this important boundary zone, and correlating the basement geology from the exposed Shield to the William Lake area to the southwest. A GSC/GSB lithogeochemical and U-Pb geochronological sampling program was initiated to compare the ultramafic rocks of the Thompson nickel belt with those in the southwest extension towards Grand Rapids, and those of the circum-Superior belt in northern Quebec and Labrador.

Stratigraphic mapping and documentation in the Grand Rapids region improved delineation of Silurian dolostone formations east and west of Provincial High-

way 6, and discovered several new exposures containing *Virgiana decussata*, a key marker fossil near the base of the Silurian. Four additional holes were drilled to improve knowledge of the Paleozoic stratigraphy and better definite the boundary between the Superior Province and Thompson Nickel Belt extension. Several of the holes drilled this year and in earlier years were geophysically logged by the GSC, and static water level measurements were conducted on all drillholes in the area to expand the otherwise sparse documentation on groundwater conditions. The Precambrian intersects, along with data from relogged exploration core south of Snow Lake, will provide valuable incremental evidence on the nature of the basement, required for compilation maps for NTS areas 63J, 63K and 63G.

Stratigraphic studies and future production of isopach and depth-to-basement maps for the Thompson Nickel Belt extension will be facilitated, now that accurate locations and elevations have been determined for drillhole collars with GPS assistance from the Manitoba Land Information Centre (Surveys and Mapping Branch). An open file report based on logging of Paleozoic drillcore from the Falconbridge William Lake property and adjacent areas will be released this fall.

Follow-up investigations of carbonate megabreccia on Shoulderblade Island, South Moose Lake, revealed a doughnut-shaped configuration with inwardly dipping beds, isolated outcrops with sporadic anomalous Precambrian lithic fragments and unusually high amounts of biotite in the matrix carbonates of otherwise normal Silurian country rock (dolostone clasts). The origin of this anomalous association remains to be determined.

At Pipestone Lake detailed mapping, sampling and petrologic investigations of titanium and vanadium-bearing oxide rich zones in anorthositic gabbros were facilitated by improved access and exposures generated by concurrent exploration mounted by Gossan Resources and Cross Lake Mineral Exploration Ltd.

CENTRAL AND SOUTHERN MANITOBA

East of Lake Winnipeg a resource assessment of the Poplar River Endangered Spaces candidate area confirmed the dominantly granitoid nature of the bedrock, and concluded that the area has low base and precious metal mineral development potential. Industry has expressed concern that the region may have potential for diamond occurrences; accordingly consideration is being given to mounting kimberlite indicator mineral investigations.

The search for indications of Mississippi-Valley-Type (MVT) lead-zinc mineralization in the Interlake region focussed on geochemical sampling of spring waters in the Grand Rapids Uplands. Preliminary results suggest that the pH of the waters draining from the emergent points may be too high to carry metal solutes at detectable levels. Accordingly, the investigation was extended to include sampling of marly precipitates from fen pools associated with the springs. Again as part of ongoing interest in exploring new approaches to evaluate the MVT potential of the Paleozoic carbonates, the GSB supported a program by the departments of Agriculture, Environment and the provincial Water Resources Branch, to analyze groundwaters in the southern Interlake region.

The exploration for diamond pipes in the province was bolstered in 1993 with the discovery of numerous indicator minerals in basal till samples collected by the joint federal/provincial, low-density till sampling program. This year the sampling density in the Westlake Plain area between the Manitoba escarpment, Lakes Manitoba and Winnipegosis, and from the Pelican Rapids road south to Neepawa was increased by 182 till samples based on a randomly plotted 10 kilometres grid. 70 kilogram samples and a 3 kilogram split, collected at each sample site, will be processed for kimberlite indicator minerals and geochemistry, when funds are available.

In response to queries from industry, carbonate veins in the Precambrian granite inlier at Highrock Lake were sampled to determine their mode of origin. REE profiles for the carbonates are quite different from, yet overlap, those of calcite from kimberlite. Major and trace-element analyses of the veins closely resemble those of limestones in the neighbouring Red River Formation, suggesting a most likely origin through remobilization associated with the inferred meteor impact event.

Scientists from the GSC and GSB have completed the geophysical survey phase of a cooperative multidisciplinary geoscientific study of Lake Winnipeg. This study is the first of its kind in Manitoba and will provide a new understanding of Lake Winnipeg's geological architecture and the geological processes affecting its waters. Subsequent sampling and coring focussed on investigating the key features and sediment sequences on the lake bottom. This information will be critical for land-use planning and environmental management. The survey was conducted in co-

operation with the Canadian Coast Guard from its ship CCGS Namao. Funding partners include the Province of Manitoba, Manitoba Hydro, Fisheries and Oceans Canada and the GSC.

GSB staff responded to several Marketing Branch requests for dolomite, bentonite, kaolinitic clay, and silica sand samples required for beneficiation and chemical tests. Samples of black shales and associated encrustations at Black Island were collected to examine their potentially unique geochemistry.

SOUTHEAST AND SOUTHWEST MANITOBA

Geological mapping in the Bissett area was undertaken by GSC and GSB to complete gaps in previous coverage and resolve uncertainties of correlation for the PAMD-funded digital database for southeast Manitoba. Known occurrences of (older sequence) ultramafic flows in the Garner Lake area have been extended and previously unmapped hydrothermally altered intermediate-felsic volcanic rocks were identified. A new serpentinite belt was discovered northeast of Saxton Lake with the aid of recent gradiometer data.

A 3.0 Ga age was determined for a tonalite along the northern margin of the Rice Lake Belt. This is one of the oldest units in the region, although similar ages from detrital zircons in the Conley and Edmunds Lake formations imply that the tonalites may have been basement to the supracrustal greenstone assemblages.

A brief appraisal of the Broadleaf River area confirmed the need for additional geological mapping in the region immediately north of Wallace Lake, where mafic metavolcanic rocks appear to be more abundant than shown on previous maps. Large batholithic complexes dominate the less prospective region from Kosteck Lake north to Aikens Lake.

PAMD-funded Quaternary investigations by the GSC in the Rice Lake greenstone belt consisted of fill-in sampling in the eastern region and additional sampling and surveys in the west. Three sites with significantly high gold grain counts were identified.

Client requests were followed up by field examination of road-accessible serpentinites in the Manigotagan area for use in carving or as dimension stone. Several tours of industrial mineral sites were given for representatives of industry, the Museum of Man and Nature, and Natural Resources Canada. A visit to the west shores of Cedar Lake confirmed the existence of amber on beaches that have been regenerated since the lake levels were raised.

In southeast Manitoba the search for sources of high-purity lump-silica focussed on detailed mapping and sampling of quartz veins near Buffalo Lakes. Several veins appear to be sufficiently large and pure to warrant follow-up trenching and drilling.

Surficial deposits at approximately 2000 sites, in the east half of NTS 62H were mapped and described by the GSB as part of the Southern Prairies NATMAP initiative. Compilation of four 1:100 000-scale map sheets will be conducted this winter, along with development of a digital database containing descriptive data from previous surveys and this summer's work. Results will have direct application to the search for kimberlite pipes in this region.

In the Virden area, exploration for diamonds and petroleum was boosted as the GSC completed Phase IV of their airborne magnetic surveys. This year the program was funded in part through contributions from two mining companies. Exclusivity rights will permit release of the data into the public domain in the fall of 1995.

ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES
MINES AND MINERALS DIVISION
ONTARIO GEOLOGICAL SURVEY

INTRODUCTION

1994 was a period of consolidation after the significant changes of 1993 for the Mines and Minerals Division of the Ministry of Northern Development and Mines, including the Ontario Geological Survey (OGS).

1994 was, geologically, another exciting year for the Survey. Many of the projects undertaken by the OGS were co-operative projects with other agencies, multidisciplinary, or both. This trend is expected to develop significantly in the coming years.

RESIDENT GEOLOGIST PROGRAM

The Resident Geologist Program (RGP) of the Ontario Geological Survey is delivered through a network of 13 district offices. The Resident Geologist Program is the client service arm of the OGS, structured primarily to serve and assist the mineral exploration and mining industry. In addition to the 13 district offices, the Mines and Minerals Information Centre (MMIC) in Toronto also acts as a centre for providing front line services to clients.

The Resident Geologist Program is delivered through the four sections of the current OGS structure. This provides greater integration across section and program areas, and provides communication between Sudbury-based central operations and the district offices. Responsibility for program delivery is subdivided geographically as follows:

- Northwestern Ontario
  Field Services Section - Northwest
- Northeastern Ontario
  Mineral Deposits Section
- Central & Eastern Ontario
  Precambrian Geoscience Section
- Southwestern Ontario & Greater Toronto
  Sedimentary & Environmental
  Geoscience Section

The focus of the Resident Geologist Program is to monitor and stimulate mineral exploration, development and production throughout Ontario. Staff of the RGP provide consultative services and technology transfer to clients, including: exploration and mining sector educational institutions, municipal and land use planners, clients internal to MNDM, other ministries and agencies, and the public. They provide drill core library services; conduct exploration property examinations and field trips; maintain legally mandated assessment files and other data bases; provide prospector classes and other educational forums; and input into local and provincial-scale land use planning issues. Under the supervision of the Field Services Section - Northwest, the program also employs a native lecturer who delivers prospecting classes to northern Ontario First Nation communities.

MINERAL DEPOSITS SECTION

In 1994, staff of the OGS Mineral Deposits Section conducted 7 field and laboratory projects on a variety of mineral deposit types and settings. Brief summaries of these projects are outlined below.

PROVINCIAL KIMBERLITE STUDY

Dr. Ron Sage continued the documentation of kimberlite occurrences in Ontario, including pipes in the Attawapiskat-James Bay Lowlands area and within the Timiskaming Structural Zone in the Cobalt-Kirkland Lake area. Mr. Ray Zalnieriunas is collaborating with Dr. Sage in constructing a provincial kimberlite "metallogenic" map that illustrates the distribution of kimberlite pipes and kimberlite fields, as well as crustal structures that may have influenced their emplacement.

SHEBANDOWAN GREENSTONE BELT

Dr. Catharine Farrow has recently concluded her investigation and documentation of intrusion-hosted, stratigraphic and shear-controlled base metal mineralization in the Shebandowan greenstone belt west of Thunder Bay. Dr. Farrow's work complements regional bedrock mapping conducted by Mr. Ike Osmani (OGS Precambrian Geoscience Section). Insight gained from this study of base metal occurrences and deposits, including the past producing North Coldstream Mine, will advance understanding of the controls on base metal mineralization within Archean greenstone terrains.

WERNER-GORDON-REX LAKES METALLOTECT

Dr. Gary Beakhouse and Mr. Jack Parker have completed their evaluation of this anomalously metal-rich sector of the English River Subprovince, as part of a regional investigation of the Umfreville-Separation Lakes area. New insights, although provisional, document the complex geological settings in which Cu-Ni-PGE and Cu-Co mineralization occur. Their work shed new light on the metallogeny of metasedimentary terrains within the Superior Province of Ontario.

GRANITE-RELATED RARE-ELEMENT MINERALIZATION

Dr. Fred Breaks continued his study on rare-element pegmatites in northwestern Ontario, as part of the provincial mandate to investigate and document granite-related, economic mineralization within the Superior Province of Ontario. The presence of highly evolved pegmatites in the Separation Rapids pegmatite field, east of the world famous Tanco pegmatite in Manitoba, is demonstrated by the presence of complex tin, lithium and tantantalum-bearing minerals. Dr. Breaks has delineated a potentially economically significant area for this type and style of mineralization, as well as documenting a possible new mineral species -ferrotitanowodginite. The description of these complex minerals, critical to the evaluation of the mineral potential, is on-going through collaboration with A.G. Tindle, (The Open University, United Kingdom).

GEOCHEMISTRY OF THE SUDBURY IGNEOUS COMPLEX

Investigations on the geology and geochemistry of Sublayer rocks and Offset dikes of the Sudbury Igneous Complex (SIC) were continued by Dr. Peter Lightfoot during 1994. The study's primary goal is to find a geochemical method of distinguishing between barren and mineralised Sublayer environments, and to determine the source of the Sublayer magma and inclusions. Samples of matrix and inclusion material are analysed for their major and trace element composition. Major element oxides are used as indicies of fractionation and contamination, and trace element ratios as well as Strontium plus Neodymium isotopes are used to compare and contrast different groups of samples. Results to date have shown that there are at least two geochemically distinct types of Sublayer and Offset rock types, and that geochemical similarities exist between the Sublayer rocks' matrix and unltramafic inclusions, suggesting a common parental magma.

The project also affords a vehicle for research being conducted by three MSc. candidates at Laurentian University under the joint supervision of Dr. Lightfoot and Dr. Reid Keays. The students are working through the auspices of the recently initiated Laurentian University-OGS Mapping School Program. Their theses topics include:

- The Source of Ultramafic Inclusions at Whistle Mine - by Keith Farrell;
- The Origin of Footwall Ultramafic Bodies at Fraser and Levack Mines - by Michelle Moore; and
- The Evolution of the Offset Dikes: a Case Study of the Totten Mine Section, Worthington Offset - by Dean Pekeski.

WESTERN ABITIBI GREENSTONE BELT

Dr. Stewart Fumerton has completed his third and final year of investigating and documenting metallic and industrial mineral occurrences and deposits in the western part of the Abitibi Greenstone belt commonly referred to as the Swayze greenstone belt. This project, funded through the Canada-Ontario Northern Ontario Development Agreement (NODA), has generated a digital data base that includes information on 437 different mineral occurrences from within the 182 townships study area.

PRECAMBRIAN GEOSCIENCE SECTION

In 1994 staff of the Precambrian Geoscience Section conducted 19 field and laboratory projects. Four of this year's projects were funded under NODA, a subsidiary agreement to the Economic and Regional Development Agreement signed by the government of Canada and Ontario. Three thematic studies represent joint research with non-government organizations.

MAPPING PROGRAM

Of the 19 Precambrian geoscience projects, 10 comprise the Section's contribution to the systematic and ongoing mapping program of the Ontario Geological Survey. Due to the 650 000 km^2 size of the Precambrian Shield in Ontario, current work focuses on areas of high mineral potential.

D. Stone completed a 5-year regional mapping program in the Berens Rivers area, north of Red Lake in northwestern Ontario. The 35 000 km^2 project area is largely underlain by felsic plutonic rocks. This year's contribution emphasized the regional tectonic

setting and Berens River magmatism and their implications on the tectonic evolution of the northwestern Superior Province of the Canadian Shield. Samples (collected in 1993) in the western Berens River area were analyzed for heavy minerals and kimberlite indicators with some positive results.

In the Sioux Lookout area, J. Devaney investigated the stratigraphy and sedimentology of several metasedimentary and metavolcanic units of the Abram, Patara and Neepawa groups and of the Botham Bay Volcanics. Recent discovery of gold in the Dayohessarah Lake greenstone belt north of White River encouraged the remapping of the belt at a scale of 1:20 000 by G. Stott. Newly discovered komatiitic flows should attract prospecting for nickel and platinum group elements. I. Osmani completed the fourth year of a 4-year NODA-funded mapping program of the west-central Shebandowan greenstone belt west of Thunder Bay. S.L. Jackson began work on a 3-year compilation at a scale of 1:50 000 of 6 NTS sheets underlain mainly by rocks of the Huronian Supergroup and centred on Elliot Lake. Garson and Blezard townships, just north of the City of Sudbury, are the subject of a 1:20 000-scale mapping project by G. Johns. Two detailed mapping surveys at a scale of 1:20 000 were carried out by B. Berger and T. Muir in the Abitibi Greenstone Belt northeast of Timmins. Geophysical data were used to interpret the limited geological information available. A. MacTavish mapped Belford and Montcalm townships northwest of Timmins at a scale of 1:20 000 during the second year of the 2-year NODA funded program. The greenstone belt has copper, nickel and possibly gold potential.

THEMATIC INVESTIGATIONS

As in past years, several thematic investigations were conducted or initiated by staff of the Section. Three of these projects constitute research initiatives undertaken or planned in co-operation with non-government research institutions, one is industry-government co-operative project funded by NODA.

The Grenville Province in Ontario is not known for its VMS potential. New insight and the geochemical identification of metavolcanic rocks similar to F111 rhyolites from the Superior Province by M. Easton and J. Ayer, however, indicate a VMS potential. P. Kingston and C. Papertzian of the Tweed Resident Geologist's office investigated 2 building stone quarries operating in southeastern Ontario and made recommendations for exploration. B. Gates of the Sudbury Resident Geologist's office completed economic potential evaluation of industrial minerals on Manitoulin Island. Several rock units were investigated as a source for concrete and asphalt aggregate. M. Easton and R. Hildebrand, in a joint Geological Survey of Canada-Ontario Geological Survey investigation, studied the Sharbot Lake-Frontenac terrane boundary in the Carleton Place area and believe it represents a sequence repeated through folding and cut by a shear zone.

K. J. Tomlinson, R. P. Hall, D. J. Hughes and P. C. Thurston are working on a joint multi-year, geochemical research project of the Department of Geology of the University of Portsmouth, United Kingdom, and the Precambrian Geoscience Section. The 1994 research focussed on the Beardmore-Geraldton greenstone belt and demonstrates that the 3 volcanic units of the belt differ significantly and therefore it is very unlikely that they represent disrupted members of an originally coherent part of oceanic crust. V. L. Sharpton and B. Schuraytz of the Lunar and Planetary Institute, Houston, Texas, and B.O. Dressler and J. Scott of the Ontario Geological Survey investigated the Slate Island meteorite impact structure in Lake Superior. The Ontario Geological Survey and the Ontario Geoscience Centre of the Ministry of Northern Development and Mines, the Lunar and Planetary Institute, UNAM (Universidad Nacional Autónoma de México) and several other international geoscience departments are planning to jointly investigate the Chicxulub impact structure in Yucatan, Mexico. This 65 Ma crater is the source of ejecta distributed worldwide at the Cretaceous-Tertiary (K-T) boundary and the Chicxulub impact is believed to be the cause of a major paleontological extinction event.

M. Rogers developed a qualitative methodology for mineral potential evaluation for the Ontario Geological Survey. It will help in the decision making process in a variety of land use and land use conflict issues. A project jointly funded by NODA and the Mining Industry Technology Council of Canada (MITEC) will focus on research and development of forward modelling, inversion and imaging tools for electromagnetic methods and constitutes an example of government-industry cooperation. Digital geological map production is replacing traditional cartographic methods and staff of the Section over the years have been at the forefront of developing digital methods for recording, publication and dissemination of geological data. As a further step in the full implementation and standardization of digital mapping, S.L. Jackson, T. Muir, and colleagues have compiled a digital symbol library.

SEDIMENTARY AND ENVIRONMENTAL GEOSCIENCE SECTION

The mandate of the Sedimentary and Environmental Geoscience Section (SEGS) includes the investigation of Phanerozoic rocks within Ontario. Activities include the mapping of Paleozoic rocks and Quaternary sediments; assessment of the mineral resource potential contained therein (such as sand and gravel, limestone, salt, gypsum, *etc.*); investigation of geological processes which affect the occupation and use of the land; and defining the physical properties or geochemical signature of the landscape.

QUATERNARY AND PALEOZOIC STUDIES

Numerous Quaternary and Paleozoic studies were undertaken during 1994. Several of these are conducted in cooperation with other federal and provincial government agencies.

P.J. Barnett continued his studies of the Oak Ridges moraine of southern Ontario. Barnett's detailed Quaternary mapping and sedimentological studies provide the basis for stratigraphic and groundwater studies being carried out by the Geological Survey of Canada as part of a joint federal-provincial NATMAP program. Fieldwork during 1994 concentrated on the northern flank of the moraine and the area immediately north.

A.F. Bajc completed field investigations along the north and east ranges of the Sudbury basin. This study is in cooperation with the Geological Survey of Canada as part of their mineral deposits studies of the Sudbury mining camp funded under NODA. This project will evaluate the geochemical response of surficial media to Cu-Ni-PGE mineralization. As this area has been strongly affected by atmospheric fallout, an important goal of the project is to evaluate various media types and analytical procedures in an attempt to best characterize the geochemical signatures of surficial media for environmental and mineral exploration applications.

M.A. Bernier completed a Quaternary mapping and surface till sampling program over the southeastern portion of the Swayze greenstone belt. This project is NODA funded and complements work undertaken by both the Geological Survey of Canada and the Ontario Geological Survey to evaluate the mineral potential of this large greenstone belt. The objective of this 4 year program is to augment the regional Quaternary database to assist and stimulate drift-based exploration in the area. This was accomplished in part by characterizing the dispersal of mineralized rock from known deposits and applying the patterns observed to the regional sampling program undertaken as part of the study.

M.J. Ford continued work on a multidisciplinary project in the Rinker Lake area of northeastern Ontario. This project is in conjunction with the Canadian Forestry Service (CFS) which receives much of its funding for this project under NODA. Quaternary geology and soil texture maps along with vegetational cover maps developed from satellite imagery are used in concert with a detailed digital elevation model in a GIS environment to help model forest site attributes such as soil moisture regime. Modelling will include major nutrient and trace element geochemistry when these data become available.

Quaternary geology investigations continued in the Separation Lake area of northwestern Ontario under the direction of T.F. Morris. This completes fieldwork initiated during the summer of 1992. The project is part of a multidisciplinary study which involves Precambrian mapping, mineral deposit studies and geophysics over the Separation Lake greenstone belt. One of the major objectives of this project is to characterize the compositional variability of surficial materials to provide base line information for environmental and mineral exploration applications. High density sampling programs were carried out over both base metal showings as well as over pegmatites host to rare earth elements to document their down-ice dispersion in surficial media.

Following the reported recovery of alluvial diamonds in the Wawa area in 1993, the OGS initiated a surficial materials sampling and Quaternary geology mapping program in the Michipicoten River-Wawa area. The primary objective of the study was to provide regional information on the types and distribution of kimberlite indicator heavy minerals. Heavy mineral assemblages were also examined for placer gold. High density sampling was conducted at selected sites to identify factors controlling the transport and dispersal of materials through local fluvial systems.

D.K. Armstrong of the OGS was invited to participate in 2 projects investigating the Devonian biostratigraphy of the Moose River basin. The first project is in cooperation with the Geological Survey of Canada and involves the conodont biostratigraphy of Middle and Upper Devonian strata intersected in OGS drill hole Onakawana B (OGS 85D). Sampling of the 3 members of the Long Rapids Formation and the lower member of the Williams Island Formation was con-

ducted to fill in gaps in the biostratigraphic zonation derived from previous studies. The second project is part of ongoing investigations into the trilobite biostratigraphy of the Middle Devonian Kwataboahegan Formation by the Royal Ontario Museum and the Department of Geological Sciences of Brock University. Sections were examined and sampled along the Abitibi River, near Coral rapids as well as at the Labelle quarry south of Moosonee and at Rabbit Ridge, 11 kilometres southeast of Moosonee.

Armstrong also continued work on a multi-year mapping project of the Middle Ordovician limestones of the Lake Simcoe area. This project uses lithostratigraphic mapping, new depositional models and subsurface data to determine geological controls on bedrock resources, especially with respect to alkali-reactivity.

GEOCHEMICAL PROJECTS

Fieldwork for a geochemical study of Shoal Lake was completed in 1994 by R. Dyer. Shoal Lake is approximately 40 kilometres southwest of the town of Kenora, adjacent to the Ontario/Manitoba border. The purpose of this survey is to characterize geochemical signatures for major and trace elements within lake sediments and waters, and to provide a baseline geochemical inventory for Shoal Lake. The identification of natural geochemical patterns versus anthropogenic geochemical patterns are a strong focus of this project.

A multi-media geochemical survey was completed over a portion of Butt Township located approximately 25 kilometres northeast of Burks Falls, and straddling the Algonquin Park boundary. A multidisciplinary team consisting of R. Dyer, A. Bajc and R. Jackson planned and initiated the study. The objectives of this project were to: determine the natural background geochemical conditions in the area; obtain baseline geochemical data over an undeveloped graphite deposit; and determine the geochemical impact of an existing graphite mining operation. The area hosts the Cal Graphite mine which went into production in 1990. This operation has recently been identified by the Ministry of Environment and Energy (MOEE) as a source, of uncertain severity, of acid drainage and elevated metal concentrations in water.

The second year of a 2 year multi-media geochemical study was conducted by R. Jackson at abandoned tailings sites at Gowganda, Matachewan and Kirkland Lake in northeastern Ontario. This study is concerned with the effect of increased water alkalinity on element mobility, metal partitioning between water and lake sediment and the long term effect of non-acid generating tailings. The major objective of this study is to understand and model element behaviour, in order to predict impacts of tailings deposition in different geological environments.

A multi-media geochemical study was initiated by R. Jackson and D. Stephenson at several sites in the Abitibi greenstone belt, where mineralization is covered by thick overburden. The objective was to determine if the dispersion of elements in groundwater near mineralization is sufficient to produce a detectable response in surficial media, including surface/shallow groundwater, organic rich sediment in drainage pathways and soils. Preliminary results include encouraging data using a patented enzyme leach analytical method which is selective to elements adsorbed onto manganese oxides which coat B-horizon soil grains.

AGGREGATE INVENTORIES

The Aggregate Resources Inventory Program supplies essential data concerning the location, quality and quantity of both sand and gravel, as well as bedrock aggregate resources throughout the province. During the past year 4 new aggregate projects were undertaken by Survey staff.

On Manitoulin Island several areas have a shortage of acceptable aggregates. An assessment of surficial deposits by M. Kunert identified potential aggregate sources. Most suitable aggregates are contained in glaciolacustrine beach, subaquatic fan and ice-contact deposits. One factor that limits the higher specification uses of many deposits is the presence of deleterious lithologies including, shale, chert, argillites and orthoquartzites.

The communities of Fort Albany-Kashechewan and Attawapiskat, in northeastern Ontario, are undertaking infrastructure projects that require suitable aggregate materials. A regional aggregate assessment by R. Kelly and D. Armstrong identified potentially suitable surficial and bedrock sources. Modern river bars and some inactive river channels appear to be the best sources of coarse, unconsolidated aggregate. Paleozoic bedrock sources appear suitable for many aggregate applications, however, durability and localized lithology problems may limit usage.

Aggregate resources in the eastern townships of Elgin County in southern Ontario are being rapidly depleted. An assessment of surficial materials by R. Kelly indicated that remaining sources of coarse aggregate are limited. The greatest potential for reserves,

of coarse aggregate is in buried deposits within a Late Wisconsinan moraine.

The eastern townships of Northumberland County in southeastern Ontario were assessed for potential bedrock and surficial aggregate resources by D. Rowell. Potential limestone and dolostone bedrock resources were identified in the northern part of the study area where glacial drift cover is thinnest. Some beds may have restricted use due to alkali reactivity problems. Most of the surficial aggregate resources in the area are concentrated in a series of eskers and glaciolacustrine beach deposits.

ONTARIO GEOSERVICES CENTRE

PUBLICATION SERVICES SECTION

A total of 118 geoscience publications, 1 digital data set, 1 index publication and 4 "popular" publications were released during the 1994 calendar year. In comparison, the totals were 154 geoscience publications, 14 digital data sets and 4 index publications in calendar 1993.

The heavy investment in computer technology for both text and map production due to relocation prompted us to begin changing the way we do business. We have been able to distribute publications in 3 ways: traditional offset printing, electronic distribution, and on-demand reproduction of hard-copy. The electronic text and map files will be sent directly to the Information Services Section for incorporation into the appropriate data-base in the Earth Resources and Land Information System (ERLIS).

Budget cuts will leave us with no funds for traditional offset printing of reports and maps after fiscal 1994-95. We are therefore investigating alternatives that will reduce costs to a minimum while maintaining quality and ensuring that the prices of digital and hard copy remain affordable for clients. The most viable alternative at this point, is distribution of electronic files on CD-ROM, backed up by on-demand reproduction of hard-copy reports and maps.

The opening of a Publication Sales Facility in the Willet Green Miller Centre in September 1993 marked the first time in recent memory that all Mines and Minerals Division documents were available from one facility. An over-the-counter sales outlet was combined with an on-demand reproduction facility to complete the one-window approach to client service, the aim of the Minstry's move to new premises in Sudbury. The move of the publication warehouse to a new facility in Sudbury in September 1994 signalled completion of the seven-year relocation process.

The Ontario Government's non-tax revenue initiative is the driving force behind a rejuvenated "popular" publications program. A new editorial policy is dedicated exclusively to the creation and production of bilingual reports, maps and other materials aimed at the interested public, tourists and educational institutions. the first product, ROCK ONtario, is a layperson's guide to the geology of Ontario. Currently in production and planning are a number of regional guides to geology and scenery plus a revised and improved geological highway map.

INFORMATION SERVICES SECTION

A major competitive advantage for Ontario, and other Canadian jurisdictions, is the wealth of information publicly available on the geology, mining, minerals exploration and land tenure. In Ontario, one source of data are assessment work submissions made to government under the provisions of the Mining Act. In addition, Resident Geologist offices throughout the province solicit voluntary submissions of data and drill cores; finally, the Ontario Geological Survey has compiled and produced over 8000 maps and 2500 geological reports. The exploration industry has therefore access to $3-$4 billion worth of previous exploration work and government data on which to build further work.

As the volume of information expands, traditional methods of access are no longer effective. The Earth Resources and Land Information System (ERLIS) is a computerized information environment, which supports the timely integration of information that is captured in the field by using computers. It also supports the production of digitized geological maps and reports. Finally, it serves as a repository for all digital data, and makes it accessible through powerful search methods.

A major effort is underway to convert to a digital form, hardcopy files, reports and maps collected over 100 years. To date $21 million of capital funding has been procured through several provincial and federal initiatives. Some 1.5 million pages of documents and 120 000 maps have already been converted to digital form. Geographic and attribute indices have also been built for some 36 000 mineral assessment files, 27 500 exploration work reports and 18 000 mineral deposit records. Concurrently, procedures are being put in place to collect new data in a digital form.

The first implementation will make the ERLIS environment available at four locations across the Province.

ERLIS is an evolving collection of computerized thematic databases, integrated by spatial references. Its basic components are:

- geoscientific and land-use thematic databases;
- data and software management systems which allow data to be stored, retrieved, viewed, modified, updated, added or deleted. Included is a geographic information system (GIS);
- a user interface which permits easy and consistent access to the information without requiring expert computer knowledge;
- computer hardware which supports the databases and allows input and output of data in hard-copy and digital form.

Currently the following databases are present or planned as part of ERLIS:

- mineral assessment reports;
- high resolution airborne magnetic and electromagnetic surveys;
- published government geology maps;
- published government geological reports;
- diamond drill core data (*i.e.*, data from boreholes drilled in bedrock);
- geotechnical drill hole data (*i.e.*, data from boreholes drilled in surficial media);
- lithogeochemical data;
- surficial or regional geochemical data;
- information relating to mining claims;
- mineral deposit information;
- natural features, including topographic bases upon which the other databases can be portrayed;
- administrative features, including boundaries of mining divisions, townships, *etc.*;
- abandoned mines information.

One of the most important aspects of ERLIS is that new data or databases can be added. As long as geographic information is available for the attributes defining them, data can be simply "plugged into" the system.

As ERLIS takes shape over the next decade, the following benefits will accrue to the clients of the Mines and Minerals Division:

- Rapid and flexible automated searches and integration of large and complex geoscience databases will be possible.
- Ability to integrate data in ways not currently possible with large collections of cumbersome hardcopy records, and draw out never-before detected features and relationships which may, in turn, lead to the discovery of new mineral wealth in the Province.
- Access to the same data on demand and in a timely manner throughout the Province *i.e.*, the data can come to the user, rather than the reverse.
- The Division's entire collection of databases will be easier to manage and update cost effectively.
- The Division's entire collection of databases will be more secure.

Early users of the system at the Toronto and Sudbury test facilities confirm the benefits of the powerful search capabilities. Searches which involved several days of work can now be performed in matters of hours. Compilations and lists which were impractical in the past are now conveniently produced and printed out in minutes. In addition to traditional exploration maps, plots can now be produced showing areas of mineral potential and can be used to aid decisions in land use planning.

The end result of the ERLIS program will be an important enhancement to the competitive position of Ontario in the global minerals market-place.

GEOSCIENCE LABORATORIES

Three themes characterize the Geoscience Laboratories activities over the past year: improvements in customer service, development of new specialty services.

Efforts are underway to improve service delivery. At the most basic level all Laboratories staff are improving work flow in the Labs. Most precious metal assay results are completed within a week of scheduling and results are now immediately faxed to geologists after approval for release. Data is also provided on disk in popular spreadsheet program formats.

Sample preparation or dissolution will always remain a bottleneck for most analytical methods, but by increasing the number of elements determined from a single preparation, overall efficiency can be improved. This process has been most evident in the XRF unit which has developed methods,developed by J. Morri-

son, for the determination of Ba, Cr, Pb, As, Sn, and Ga using the same pressed pellet used for the T3 package. The first 4 of these elements were previously determined by atomic absorption spectroscopy; for samples high in Ba and Cr a separate time consuming fusion step was also required. The new procedures will thus save time spent in sample preparation.

Another development in the XRF unit is a 14 element prospectors package by energy dispersive XRF created by A. Martin.

Other development projects include a sensitive method for U and Th by ICP-MS by S. Beneteau and one for Au, Pt and Pd using a high resolution ICP-OES by G. Henri and P. Prince. Although limits of detection of the latter instrument are not as low as those achieved by graphite furnace atomic absorption techniques, it offers greater dynamic range and automation.

Over the last 18 months validations for 29 methods have been completed. These validations are to the highest international standards as was evident in the presentation on this topic by J. Richardson at Geoanalysis 94 and in the feedback from the Laboratories' participation in round robin certifications for 4 new geological reference materials GTS-2, ZW-C, WS-E, and PM-S.

An important contribution in improving our services will be implementation of a Laboratory Information management system. The system is being modified by lab staff for the specific needs of the Laboratories. Work on configuring the LIMS has been progressing well. Implementation of the LIMS is being accomplished in stages to minimise disruptions to the normal work flow in the Laboratories. The XRF lab was designated as the "Pilot Lab" for the system and implementation of the LIMS in this lab should be completed shortly. The data base reporting programs to automate information retrieval and reporting for clients and internal staff are near completion. Programs have also been completed to capture electronic data directly from four different instruments in the XRF lab.

The formation of the Laboratories' Advisory Board with representation from the OGS and externally, provides a higher level forum to discuss service delivery issues and to advise on method development priorities. As a first step, the Geoscience Laboratories is attempting to define its analytical capacity so that this can be used in the planning of geological projects and in developing realistic schedules.

Growth of specialty analytical services are key to the Laboratories' future as a reference centre in geoanalysis. M. Moore and P. C. Lightfoot have developed methods for highly precise determination of strontium and neodymiun isotopic ratios. As part of an OGS initiative, the electron microprobe laboratory has been involved in the analysis of indicator minerals from a number of Ontario kimberlite pipes (over 12). This work has involved 4 mineral groups including garnet, chromite, picroilmenite and chrome diopside. Other notable activities include major and trace element (nickel and cobalt) investigations of olivine and pyroxene from the sublayer of the Sudbury structure in order to evaluate new exploration models, and an extensive geobarometric study of the Berens River area using aluminum concentrations in amphibole.

The SEM laboratory is currently investigating new approaches to modal analysis of granites using a backscattered electron/image analysis technique developed by D. Crabtree. This study is part of an ongoing investigation of techniques (such quantitative XRD and optical image analysis) for automated modal analysis as an alternative to point counting methods. A paper comparing results from different techniques was presented at Geoanalysis 94. Other activities include the establishment of quantitative analytical routines for minerals using Energy Dispersive X-ray spectrometry.

Among other specialty services is the development of geological reference materials. Certified Ontario Reference Materials or CORM is the new name for marketing reference materials under this program and will include reference materials produced by other Ontario Government Laboratories. Three new geostandards have been collected over the past year and one of these has been processed, bottled and is now being tested for homogeneity. Homogeneity testing has already been completed for a Nipissing diabase standard NPD-1. A poster describing this program was displayed at Geoanalysis 94 by J. Richardson and was very well received by the geoanalytical community.

A highlight of the year was the signing of the access agreement between the Ministry and Laurentian University to provide access to the Laboratories' services for University students and staff. Other such access agreements are under negotiation. Joint projects for the development of an ICP-MS method for the determination of low-level PGEs and one for the determination of total organic carbon using the anion analyser are underway. A joint Laurentian University/Falconbridge experiment conducted in the Laboratories on the effect of composted organic wastes on

acid-generating tailings was completed during the year.

The Laboratories, in concert with other Government labs in northeastern Ontario and Science North, organized a successful exhibit at Science North in October 1993. The object of this exhibit was to raise public awareness of the type of testing work carried out in Ontario Government labs and to demonstrate some of the scientific principles involved. The logo and Laboratories name developed for this exhibit have been adopted for the exhibit being held at the Science Centre in Toronto this year.

NODA

Provincially funded NODA projects were concentrated in the Geoscience and Industrial Minerals and Economic Development programs. There was also significant activity in the Mining and Minerals Technology, and the Administration, Communications and Evaluation Programs. Most projects under the Geoscience Program are being completed and in future, the principal activities will be in technology related programs.

Under the Geoscience Program, there were 9 active projects, many which were completed this year. One new mapping project in the Timmins area was started, following discussions with the Ontario Mineral Exploration Federation.

At the start of the year, 8 Mining and Minerals Technology projects were approved. However, 2 of these were cancelled by the industry partner and 1 was postponed until 1994-95. The remaining 5 projects continue to progress well.

Eight projects were approved under the Exploration Technology Program. A mechanism to deliver projects under the borehole research and technology development umbrella was established. Under this umbrella, the first 2 joint industry-government research projects with MITEC were started this year.

Under the Industrial Minerals and Economic Development Program, 8 projects were approved. One project, to evaluate the rare earth content of Elliot Lake mine tailings, was completed early as the initial results were disappointed. One new project, which includes production of Dimension Stone Guidebooks, was started.

Ontario funded 3 projects under the Administration, Communications and Evaluation Program. One project is the management of provincial program activities. The remaining 2 projects involving Communications and Native Liaison, complement similar activities carried out by the federal government.

NOTES

MINISTÈRE DES RESSOURCES NATURELLES
GOUVERNEMENT DU QUÉBEC
SECTEUR DES MINES

LE RÔLE ET LA MISSION DU SECTEUR DES MINES

Le Secteur des mines a pour mission d'appuyer et de promouvoir le développement d'une industrie minérale innovatrice et concurrentielle à l'échelle mondiale et de contribuer, ainsi, au développement économique du Québec.

Plus particulièrement, sa fonction est :

- de faire l'inventaire des ressources minérales et d'acquérir la connaissance géologique du territoire;
- de développer et d'optimiser des procédés d'exploitation et de traitement de substances minérales;
- d'administrer les lois minières;
- d'administrer des programmes d'assistance financière et d'assistance technique;
- d'analyser le contexte économique et réglementaire dans lesquels évolue le secteur minéral;
- d'élaborer des politiques et des programmes.

Le Secteur des mines est le principal interlocuteur de l'industrie minérale au sein du gouvernement. Il contribue à ce qu'elle dispose d'une main-d'oeuvre compétente et de capitaux nécessaires à la réalisation de projets qui sont compatibles avec le développement durable.

LA DIRECTION DE L'INDUSTRIE MINÉRALE (DIM)

La Direction de l'industrie minérale tient à jour les connaissances relatives au contexte fiscal, économique et réglementaire dans lequel évolue le secteur minéral et elle favorise la mise en valeur, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec dans une perspective de développement durable.

LE SERVICE DE LA STATISTIQUE ET DE L'ÉCONOMIE MINÉRALE (SSEM)

Au sein de la Direction de l'industrie minérale, le Service de la statistique et de l'économie minérale est chargé de tenir à jour les connaissances économiques propres aux activités de l'industrie minière québécoise ou reliées au contexte dans lequel elle évolue.

De plus, il collabore financièrement aux activités de promotion du secteur minier par l'industrie auprès des clientèles cibles. Il publie des périodiques, informe les agents économiques des performances et des perspectives de l'industrie.

Enfin, il participe à la recension et à l'élaboration des politiques qui guident l'action gouvernementale en vue de favoriser l'exploration minière, la mise en valeur, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec par l'industrie dans une perspective de développement durable.

De façon plus spécifique, le Service de la statistique et de l'économie minérale :

- recueille, vérifie, traite et publie des données statistiques sur les activités des compagnies minières et des agents d'exploration au Québec;
- propose à ses partenaires et clients fédéraux (Statistique Canada, Ressources naturelles Canada) et québécois (B.S.Q., A.M.Q., A.P.Q., etc.) une rationalisation des activités de recensement qu'il administre;
- répond aux besoins d'information des autorités ministérielles;
- publie et diffuse des périodiques présentant des données non confidentielles sur les activités de compagnies minières et les agents d'exploration au Québec. Informe les agents économiques des performances et des perspectives de l'industrie minérale et fournit, sur demande, des informations non confidentielles;
- soutient les efforts de promotion du secteur minier par l'industrie auprès des clientèles cibles;
- analyse l'évolution des marchés nationaux et internationaux des divers secteurs de l'industrie minière présents au Québec en contact avec les principaux acteurs du domaine afin de dégager des perspectives d'avenir;

- collabore au recensement et à l'élaboration des politiques gouvernementales, participe à l'orientation de la planification stratégique du Secteur des mines et propose des interventions appropriées;
- participe au suivi de l'évolution des politiques gouvernementales, des activités et de la réglementation des principaux organismes ayant une incidence directe sur l'industrie minière afin de proposer des interventions susceptibles d'en favoriser la croissance;
- formule des avis à l'intention des autorités du ministère des Ressources naturelles et d'autres organismes gouvernementaux.

En 1994-1995, le SSEM prévoit produire, outre les publications périodiques (La ressource minérale, L'industrie minérale du Québec, Statistiques sur l'industrie minérale, production et investissement, Répertoire des établissements, Bilan et Faits saillants, perspectives) diverses études portant, notamment, sur l'économique de l'exploration, l'impact de la fiscalité sur l'industrie minière, la productivité de la main-d'oeuvre minière, le financement de l'industrie. Le service poursuivra également ses activités de support aux efforts de promotion réalisés par l'industrie auprès des clientèles cibles.

LE SERVICE DU DÉVELOPPEMENT MINIER (SDM)

Le SDM a comme principaux mandats de :

- promouvoir la réalisation de projets d'investissements pouvant contribuer au développement durable de l'industrie minérale, notamment en proposant des interventions gouvernementales appropriées et en administrant certains programmes d'assistance financière;
- suivre et analyser les activités des intervenants industriels dans chaque secteur de l'industrie minérale du Québec; fournir à la direction du ministère et à ses gestionnaires des informations et avis sur l'état de la situation et les perspectives de ces intervenants; contribuer à la planification stratégique des activités du Secteur des mines du ministère et suggérer des interventions ou des politiques sectorielles appropriées;
- suivre et analyser les politiques gouvernementales et les mesures législatives des principaux organismes ayant une incidence directe sur les activités de l'industrie minière, afin d'en mesurer les impacts et de proposer des interventions ou des orientations susceptibles de contribuer au mieux-être de l'industrie.

En 1994-1995, le SDM est notamment actif dans la mise en oeuvre des programmes d'assistance financière inscrits à l'Entente auxiliaire Canada-Québec sur le développement minéral (EADM) qui sont sous sa responsabilité : études technico-économiques et travaux d'expérimentation, infrastructures de développement minéral, industrie de l'amiante, exploitations minières en difficulté, recherche d'opportunités et promotion ainsi que soutien aux entreprises.

De plus, il collabore à la mise en oeuvre du volet «R et D précompétitifs» de l'EADM. Il met également en application les diverses mesures touchant le secteur minier incluses dans le programme de soutien de l'économie et la création d'emplois mise de l'avant par le gouvernement à l'automne 1993. Il poursuit aussi ses activités dans les dossiers suivants : la sous-grappe minière de la grappe industrielle de transformation des métaux et des minéraux, la mise en oeuvre du programme de soutien du secteur minier de la région Chapais/Chibougamau et les études et essais de restauration des parcs à résidus miniers appartenant à la Couronne.

Enfin, il continue l'analyse des incidences économiques des politiques et des règlements touchant l'environnement dans le secteur minier et l'accessibilité au territoire; il produit des avis et des renseignements aux autorités du ministère concernant le développement minier, l'environnement minier et l'accessibilité au territoire.

ACTIONS ACCRÉDITIVES

Cette partie décrit brièvement les particularités du régime fiscal québécois relatif au financement par actions accréditives. Ce régime s'applique aux frais d'exploration engagés au Québec par des particuliers et pour des personnes qui, directement ou indirectement, n'exploitent pas une mine (essentiellement, ce sont les compagnies «juniors»). L'ensemble de ces mesures a été prolongé jusqu'au 31 décembre 1995 suite au Discours sur le budget du 20 mai 1993.

LE RÉGIME QUÉBÉCOIS A LES PARTICULARITÉS SUIVANTES PAR RAPPORT AU RÉGIME FÉDÉRAL ACTUEL :

- les frais d'exploration incluant les travaux souterrains d'exploration (galeries d'exploration ou forage sous terre) bénéficient d'une allocation additionnelle de 25 %;
- les frais d'exploration définis comme «frais de surface» sont admissibles à une allocation supplémentaire de 50 % (la déduction totale pour de tels frais est donc de 175 %);
- ces frais n'entrent pas au calcul des «pertes nettes cumulatives sur placements» (P.N.C.P.) au calcul de l'impôt du Québec;
- les investisseurs qui n'ont plus de solde à l'exemption des gains en capital peuvent diminuer leurs gains en capital sur la vente d'actions accréditives par la différence entre le prix de base rajusté des actions (qui est nul) et leur coût net d'acquisition;
- les frais d'émission, jusqu'à concurrence de 15 % du produit d'une émission d'actions accréditives, peuvent être déduits en une année au lieu de devoir être étalés sur cinq ans; ces frais d'émission n'entrent pas non plus au calcul des P.N.C.P.

L'ensemble de ces mesures fait en sorte que le prix de revente des actions accréditives peut être aussi bas que 34 % de leur coût d'acquisition, en tenant compte de l'impôt fédéral, avant que l'investisseur subisse une perte.

LA DIRECTION DES REDEVANCES ET DES TITRES MINIERS

La Direction des redevances et des titres miniers assure l'administration de la Loi sur les mines (L.R.Q., chapitre M-13.1) et de la Loi concernant les droits sur les mines (L.R.Q., chapitre D-15).

Dans ce contexte, elle octroie des titres miniers à l'industrie minérale de manière à favoriser la mise en valeur des richessses naturelles du sous-sol québécois, en tenant compte des autres priorités d'utilisation du territoire. De plus, elle veille au respect des diverses obligations et conditions relatives au maintien de ces titres ou à l'exercice de l'activité minière au Québec, notamment l'exécution des travaux d'exploration et d'exploitation dans une perspective de développement durable ainsi que la perception des droits et redevances.

Des modifications seront apportées en 1995 à la Loi concernant les droits sur les mines de façon à simplifier la réglementation et ramener l'équilibre dans le régime des droits miniers. Certaines déductions ont été abandonnées, au profit d'une réduction substantielle du taux d'imposition qui passe de 18 % à 12 %, soit le plus faible taux au Canada.

LE CENTRE DE RECHERCHES MINÉRALES (CRM)

Le Centre de recherches minérales (CRM) est une direction générale du Secteur des mines, de l'actuel ministère des Ressources naturelles. Il compte 110 employés permanents (chercheurs, techniciens, fonctionnaires et ouvriers) et une douzaine d'employés occasionnels. Il dispose, en 1994-1995, d'un budget annuel de 7,7 M$. Il est doté d'un Comité consultatif, dont les membres proviennent des milieux de la recherche et des entreprises du secteur minier et métallurgique.

En 1993-1994, la valeur des 63 projets réalisés pour le compte de clients industriels s'élève à 4,7 M$.

Sa clientèle se concentre dans le secteur minéral du Québec, qu'il s'agisse d'entreprises minières ou métallurgiques, de firmes «juniors» d'exploration, de firmes de génie-conseil, de laboratoires ou de centres de recherche engagés dans des domaines d'activité connexes. Il faut ajouter, à ce noyau d'une centaine d'entreprises ou organismes, plusieurs usines de transformation dont les procédés traitent ou utilisent des substances minérales. Tout compte fait, ce sont plus de 300 établissements qui peuvent faire appel aux services du CRM, plusieurs d'entre eux de façon régulière.

Le CRM dispose d'une expertise reconnue pour adapter, améliorer ou tester des procédés existants ou encore pour développer de nouveaux procédés de traitement ou de transformation des substances minérales. Autant à l'échelle du laboratoire qu'à sa station d'essais, son personnel et ses équipements lui permettent de réaliser une multitude de projets axés autant sur le développement que l'optimisation de procédés et de contribuer ainsi aux efforts des entreprises en matière de R&D.

En 1993-1994, les laboratoires d'analyses du CRM ont effectué l'analyse de quelque 29 000 échantillons, dont 47 % proviennent de la Direction de la recherche géologique du ministère.

La raison d'être du CRM est de contribuer au développement des entreprises québécoises qui oeuvrent dans les domaines de l'exploration, de l'exploitation,

du traitement et de l'utilisation des substances minérales.

Sa mission est de développer et optimiser les procédés d'exploitation et de traitement des susbtances minérales, tout en offrant des services d'analyse minérale.

Le CRM ne ménage pas les efforts pour offrir et rendre des services de qualité à ses clients à la fois dans des activités reliées plus spécifiquement au court terme, mais sans négliger le moyen et long terme qui comportent plus de risques autant sur le plan technologique que financier.

Le CRM entend maintenir sa position de leader dans un certain nombre de secteurs. En contrôle de procédés, le CRM fait des efforts pour devenir pour l'industrie minérale un centre d'excellence dans l'application aux opérations de l'automatique, de la simulation et d'instruments de mesure innovateurs. Également, le CRM entend s'impliquer encore davantage dans le développement de solutions aux problèmes environnementaux de l'industrie. Les technologies de la minéralurgie et de la métallurgie extractive offrent un potentiel prometteur pour le développement de procédés de traitement et de revalorisation des résidus et rejets, des usines de concentration et de traitement métallurgique des substances minérales.

Le CRM est déjà engagé dans l'élaboration de projets de nature précompétitive, c'est-à-dire des projets de nature plus générique, qui s'adressent à des problèmes communs à plusieurs intervenants et qui peuvent impliquer des collaborations d'autres équipes de recherches pour leur réalisation. Dans le secteur du fer entre autres, quatre projets de cette nature sont en voie de réalisation pour un montant global de 1,68 M$.

La place, qu'occupe le CRM dans le réseau de la R&D minérale, lui permet de mobiliser les expertises et les ressources disponibles au Québec ou ailleurs, de coordonner de tels projets en participation et de les mener à terme au bénéfice de toute l'industrie minérale.

LA DIRECTION DE LA RECHERCHE GÉOLOGIQUE (DRG)

La Direction de la recherche géologique (DRG) a pour mission de définir et de promouvoir le potentiel minéral des différentes régions du Québec. Elle le réalise essentiellement par un programme de levés et d'études géoscientifiques qu'elle a adapté aux besoins de sa clientèle minière. La mise en oeuvre de ce programme relève de deux services géologiques et de leurs sept bureaux régionaux. Elle nécessite aussi la contribution de spécialistes regroupés à l'intérieur de divisions. La DRG dispose, en 1994-1995, d'un budget annuel de 6,5 M$.

LE SERVICE GÉOLOGIQUE DE QUÉBEC (SGQ)

Le Service géologique de Québec dessert les deux tiers du territoire québécois dont les Appalaches, les Basses-Terres du Saint-Laurent, la majeure partie du Grenville et l'ensemble du territoire du Nouveau-Québec situé au nord du 55^{e} parallèle. Il gère quatre bureaux régionaux, animés chacun par un géologue résident qui agit à titre de responsable pour la programmation des travaux dans son district. Il est supporté en région et à Charlesbourg par des métallogénistes, des géologues régionaux, des géochimistes, un géophysicien et par le personnel de la Division des minéraux industriels.

Au cours de l'année 1994-1995, le Service géologique de Québec dispose d'un budget de 3,044 millions de dollars pour la réalisation de 21 projets.

Au niveau des faits saillants mentionnons la mise en oeuvre de trois levés géologiques importants. Dans le Grenville, le levé régional (1:50 000) du Haut-Plateau de Manicouagan a été complété alors que se poursuivait celui de la rivière Coulonge. Enfin, en Estrie, une autre phase du levé régional du synclinorium Connecticut Valley/Gaspé a été réalisée. Ajoutons qu'un important levé géochimique des fonds de lac a été complété dans le secteur Parent qui s'étend à l'ouest de La Tuque, au sud du réservoir Gouin.

Plusieurs études gîtologiques ont été réalisées au cours de l'été. Parmi les principales figurent celles du Complexe de Sept-Îles et du Haut-Plateau de Manicouagan ainsi que celle de Murdochville axée sur l'important gisement de cuivre de Noranda.

L'année 1994-1995 fut également marquée par l'amorce d'un projet pilote d'évaluation du potentiel minéral : la région évaluée est celle de Mont-Laurier (31 J).

Plusieurs projets d'inventaire (tourbières, granulats, pierre etc.) furent réalisés pour le compte du service par la Division des minéraux industriels en particulier en Estrie et sur la Côte-Nord.

Dans le cadre du programme Moyen-Nord annoncé en avril 1994, un projet de reconnaissance géologique a été réalisé dans le secteur de Mécatima sur la Côte-Nord.

Il faut noter que tous les projets géoscientifiques du programme 1994-1995 sont inscrits dans l'Entente auxiliaire sur le développement minéral.

LE SERVICE GÉOLOGIQUE DU NORD-OUEST (SGNO)

Le Service géologique du Nord-Ouest dessert tout le Nord-Ouest québécois. Les divisions de Rouyn-Noranda, de Val-d'Or et de Chibougamau, chacune animée par un géologue résident, sont logées dans les bureaux régionaux des mines. Le personnel de la direction du Service et quatre métallogénistes de la Division des gîtes minéraux sont regroupés dans le bureau de Val-d'Or. Un métallogéniste est basé au bureau de Chibougamau. Le Service compte également un géochimiste dans ses rangs.

Le SGNO dispose, pour l'année 1994-1995, d'un budget de 2,10 millions de dollars, ce qui représente une diminution d'environ de 10 % par rapport à l'année dernière. Cette année, le service réalisera 27 projets dont 17 sont des levés ou des études requérant des travaux de terrain. Au niveau des faits saillants, mentionnons le parachèvement d'un levé géologique détaillé (1:20 000) dans la région d'Amos et l'amorce d'un nouveau dans la région de Cléricy. Un levé géologique de reconnaissance (1:250 000) a également été complété dans le Grenville à l'est de Chibougamau (Poutrincourt). Ajoutons que le service a participé à la réalisation d'un levé géophysique (Guercheville) et d'un levé géochimique (32 G/10).

Les principales études ont été réalisées dans le domaine de la gîtologie et ont fait l'objet de cinq ententes de partenariat avec l'industrie (Cambior, Metall mining, Lac, Ressources Aur, SOQUEM, Ressources MSV) et les universités (UQAC, Polytechnique). À Chibougamau, les résultats d'un projet multidisciplinaire impliquant l'industrie, les universités ainsi que la CGC ont été spectaculaires, menant à révision en profondeur des modèles gîtologiques utilisés et à la définition de nouveaux métallotectes.

La mise en opération du SIGÉOM (Système d'information géominière du Québec) a forcé la réalisation de plusieurs projets de compilation. Cette année, l'accent a été mis sur la production de fonds géologiques.

Au niveau de l'évaluation du potentiel minéral, le fait saillant de l'année est l'amorce d'un projet pilote visant l'évaluation de la région couverte par le feuillet 32G (Chibougamau).

Enfin, la mise en oeuvre du programme de levés et études géoscientifiques du Moyen-Nord annoncé lors du dernier budget, nous a permis de réaliser deux projets préliminaires soit un projet de compilation (présynthèse) du territoire de la Baie-James, soit l'étude des conglomérats pyriteux uranifères archéens du lac Sakami.

Soulignons que la plupart des projets ci-haut mentionnés ont été réalisés dans le cadre de l'Entente auxiliaire sur le développement minéral, les autres étant issus du programme fédéral-provincial de soutien au secteur minier de Chapais/Chibougamau.

LA DIRECTION DE L'ASSISTANCE À L'EXPLORATION MINIÈRE (DAEM)

Le mandat de la Direction de l'assistance à l'exploration minière est de fournir une aide à l'industrie de l'exploration minière grâce au traitement, à la gestion et à la diffusion de l'information géoscientifique et grâce à la gestion de certains programmes d'assistance financière à la prospection et à l'exploration.

En 1994-1995, le Programme d'assistance financière à la prospection minière dans l'Est du Québec et le Programme de soutien du secteur minier de la région Chapais/Chibougamau bénéficient de l'Entente de développement économique des régions du Québec (EDERQ) intervenue entre Québec et Ottawa. Le projet de géomatique du ministère est financé en majeure partie par le gouvernement fédéral dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement minéral.

LE SERVICE DE LA GÉOINFORMATION

Le Service de la géoinformation a édité et préparé pour publication en 1993-1994, 96 nouveaux documents géoscientifiques faisant état des résultats de travaux géologiques, géochimiques et géophysiques réalisés par le ministère. Ces documents sont diffusés à la clientèle par le Service de l'information et du soutien à l'exploration minière.

Le Service a poursuivi l'implantation du SIGÉOM, un système intégré d'information géominière à référence spatiale. Cette information comprend la géologie, la géochimie, la géophysique, les gîtes minéraux, la localisation des travaux et des données issues des dossiers d'exploration minière.

Le développement des cibles 1 (cartes de localisation des travaux) et 2 (cartes de compilation des travaux géoscientifiques) du système est maintenant terminé selon l'échéancier prévu et à l'intérieur du budget autorisé.

Un contrat a été accordé à la firme DMR pour le développement, sur 2 ans, des cibles de développe-

ment 3 et 4 (gîtologie, géochimie, géophysique et géologie). Les travaux ont débuté en octobre 1993.

Les équipements informatiques prévus pour la cible 2 ont été acquis en vue de leur installation dans les bureaux de Québec, Montréal, Val-D'Or, Rouyn et Chibougamau.

La localisation des quelque 3 000 périmètres de travaux géoscientifiques réalisés par le ministère au cours des cinquante dernières années a été transformée en format numérique.

Cinq contrats de numérisation de forages miniers ont été accordés en 1993-1994 à cinq firmes de consultants géoscientifiques, pour un montant total de 250 K$; ces contrats fourniront les données numériques de quelque 23 000 forages répartis sur 42 cartes.

Deux contrats ont également été accordés, pour un montant de 87 K$, pour la numérisation de quelque 140 000 anomalies géophysiques. Par ailleurs, les données numériques de quelque 2 400 cartes géophysiques ont été retraitées en vue de leur intégration à SIGÉOM.

LE SERVICE D'INFORMATION ET DE SOUTIEN À L'EXPLORATION MINIÈRE (SISEM)

Le Service d'information et de soutien à l'exploration minière (SISEM) est constitué de la Division des données géoscientifiques et de la Division des programmes d'aide.

LA DIVISION DES DONNÉES GÉOSCIENTIFIQUES

La Division des données géoscientifiques regroupe les activités du Centre de diffusion, les activités ayant trait à la gestion d'une base de données documentaires (banque EXAMINE) et d'une base de données sur les gîtes minéraux (banque COGITE) ainsi que les travaux de l'équipe des cartes de localisation.

Au 31 mars 1994, la banque EXAMINE contenait 52 312 références de rapports d'exploration minière publiés, 3 482 références de publications de la direction générale et 1 701 références de thèses universitaires.

La Division des données géoscientifiques ne fait que diffuser la banque COGITE dans laquelle les indices répertoriés comprennent au-delà de 7 500 gîtes et indices minéralisés.

L'équipe des cartes de localisation possède maintenant deux postes de travail en mode production. Un premier poste sert à la numérisation des aires de levés et des levés ponctuels. À ce jour, 32F/05, 32F/12 et 32F/13 ont été complétés.

L'autre poste sert surtout à réaliser des projets ad hoc :

- la mise à jour et la génération de forages de 7 feuillets 1/50,000 ont été complétées (3 000 forages);
- à valider les fichiers de forages donnés à contrat, 13 fichiers ont été vérifiés (4 260 forages).

LA DIVISION DES PROGRAMMES D'AIDE

La Division des programmes d'aide a pour mandat de concevoir et d'administrer des programmes d'assistance financière à la prospection et à l'exploration minière.

Pour l'année financière 1994-1995, un budget de 3,6 M$ a été consacré à la mise en oeuvre de trois programmes d'aide. Deux de ces programmes s'inscrivent dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement économique des régions du Québec (EADRQ), soit :

- le Programme d'assistance financière à la prospection minière dans l'Est du Québec (Bas-Saint-Laurent et Gaspésie/Îles-de-la-Madeleine);
- le volet II (assistance à l'exploration) du Programme de soutien du secteur minier de la région de Chapais/Chibougamau.

Le troisième programme, qui s'adresse aux autres régions du Québec, fait partie de l'Entente auxiliaire Canada-Québec sur le développement minéral (EADM); il s'agit du volet III (assistance à la prospection et à l'exploration minière) du programme exploration géologique et minière.

L'assistance financière octroyée dans le cadre des trois programmes se répartit comme suit :

- 1,4 M$ à 325 prospecteurs pour quelque 250 projets de prospection;
- 1,8 M$ à 38 compagnies pour 44 projets d'exploration;
- 0,4 M$ à 3 fonds miniers régionaux (Bas-Saint-Laurent, Saguenay/Lac-Saint-Jean et Estrie/Chaudière/Appalaches).

Par ailleurs un nouveau programme, qui vise les territoires de la Baie James et de la Basse Côte-Nord, a été annoncé dans le Discours du budget du 12 mai 1994. Il s'agit du Programme d'exploration minière du Moyen-Nord dont l'objectif est de fournir aux compagnies minières de nouvelles cibles d'exploration en périphérie des camps miniers existants. Le programme

comporte deux volets (recherche géoscientifique et assistance financière). Le budget prévu pour les quatre premières années du programme (financé à 100 % par le Québec) est de 13,5 M$, dont 6,3 M$ pour le volet d'assistance financière. Ce volet va démarrer en janvier 1995.

NOTES

NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES AND ENERGY
MINERALS AND ENERGY DIVISION

VALUE OF MINERAL PRODUCTION

The preliminary value of New Brunswick mineral production for 1993 was $782 million, down approximately 14% from 1992. Continuing low base-metal prices, slow recovery of world economies, and the influx of minerals from the Commonwealth of Independent States were the main factors involved.

Metals accounted for 63% of the total value with zinc, lead, copper, and silver being the most important. Potash, peat, salt, and smelter gas contributed 28%. Fuel minerals, mainly coal, were valued at $3.8 million. Structural materials such as lime, stone, sand, and gravel made up 5% of the total value.

MINERAL EXPLORATION

In 1993, 82 companies spent approximately $15.3 million exploring for minerals in New Brunswick. About $7 million of this amount was reported as mineral claim assessment data. Brunswick Mining and Smelting Corporation Limited, Noranda Exploration Company, Teck Corporation Limited, and Rio Algom Exploration Inc. were the largest spenders. The focus of exploration continued to be base metals in the Bathurst Mining District (Figure 1) and adjacent terranes underlain by favourable younger rocks.

Noranda continued with the evaluation of the Half Mile Lake sulphide deposit (Figure 1). They estimate the reserves to be 7.8 million tonnes grading 10.5% Zn, 3.66% Pb, 0.09% Cu, and 4.4 g/t Ag. A decision regarding the development of this deposit is expected in mid-1994.

Rio Algom carried out a $1.2 million drilling program on the Key Anacon sulphide deposit (Figure 1). The work uncovered a new sulphide zone (termed the East Zone) on the property. Drill hole 93-42 yielded an 82.3 metre section grading 3.38% Zn, 1.35% Pb, 0.75% Cu, and 40.9 g/t Ag. However, Rio Algom dropped their option on the property late in 1993.

NovaGold Resources reported an *in situ* reserve of 385 650 tonnes grading 2.98% Cu in the Copper Zone of the Murray Brook massive sulphide deposit (Figure 1).

In southern New Brunswick, base and precious metals are also the primary targets of exploration, particularly in the Annidale-Shannon belt (Figure 1).

In 1993, 2350 new mineral claims were recorded, down 32% from 1992. At the end of the year, there were 16 000 claims, 6 coal agreements, 2 potash leases, and 16 mining leases in effect, representing 22 501 mineral claim equivalents (down 19% from 1992).

GEOSCIENCE PROGRAMS

The Geological Surveys Branch's (GSB) ordinary budget for 1994/95 was increased by $250 000. This money was used to hire three bedrock mapping geologists to complete the 1:20 000 mapping program in the Bathurst Mining Camp, and to increase the funds available to prospectors via the Mineral Exploration Stimulation Program (MESP). This increase was intended to offset the funding lost due to the termination of the Federal/Provincial Cooperation Agreement on Mineral Development (MDA). Also in 1994, David Lentz, former contract employee with the Geological Survey of Canada, was appointed Mineral Deposits Geologist for the GSB. The four new staff members are housed in the completely renovated Regional Office in Bathurst, under the management of S.R. McCutcheon. The office was officially re-opened on June 14, 1994 by the new Minister of State for Mines and Energy, the Honourable Laureen Jarrett. Paul Rennick was appointed to the position of Geoscience Information Manager in July 1994. He will be responsible for compiling geoscience data and managing geoscience digital databases to aid mineral exploration and development.

The 1994 geoscience program in northern N.B. entails detailed geological mapping of 610 km^2 of the Bathurst Mining Camp by S.R. McCutcheon, J.P. Langton, L.R. Fyffe, R.A. Wilson, and S. Gower, and the investigation of several mineral deposits by R.R. Irrinki, D.R. Lentz, and J.A. Walker. M.A. Parkhill caried out Quaternary mapping and boulder tracing in the eastern, northern, and central parts of the Bathurst Camp, near Key Anacon, Armstrong Brook, and the CNE sulphide deposits (Figure 1). The entire program in northern N.B. is the Provincial input to the Geological Survey of Canada's EXTECH II, whose main objective is to help the mineral industry find new base-metal reserves.

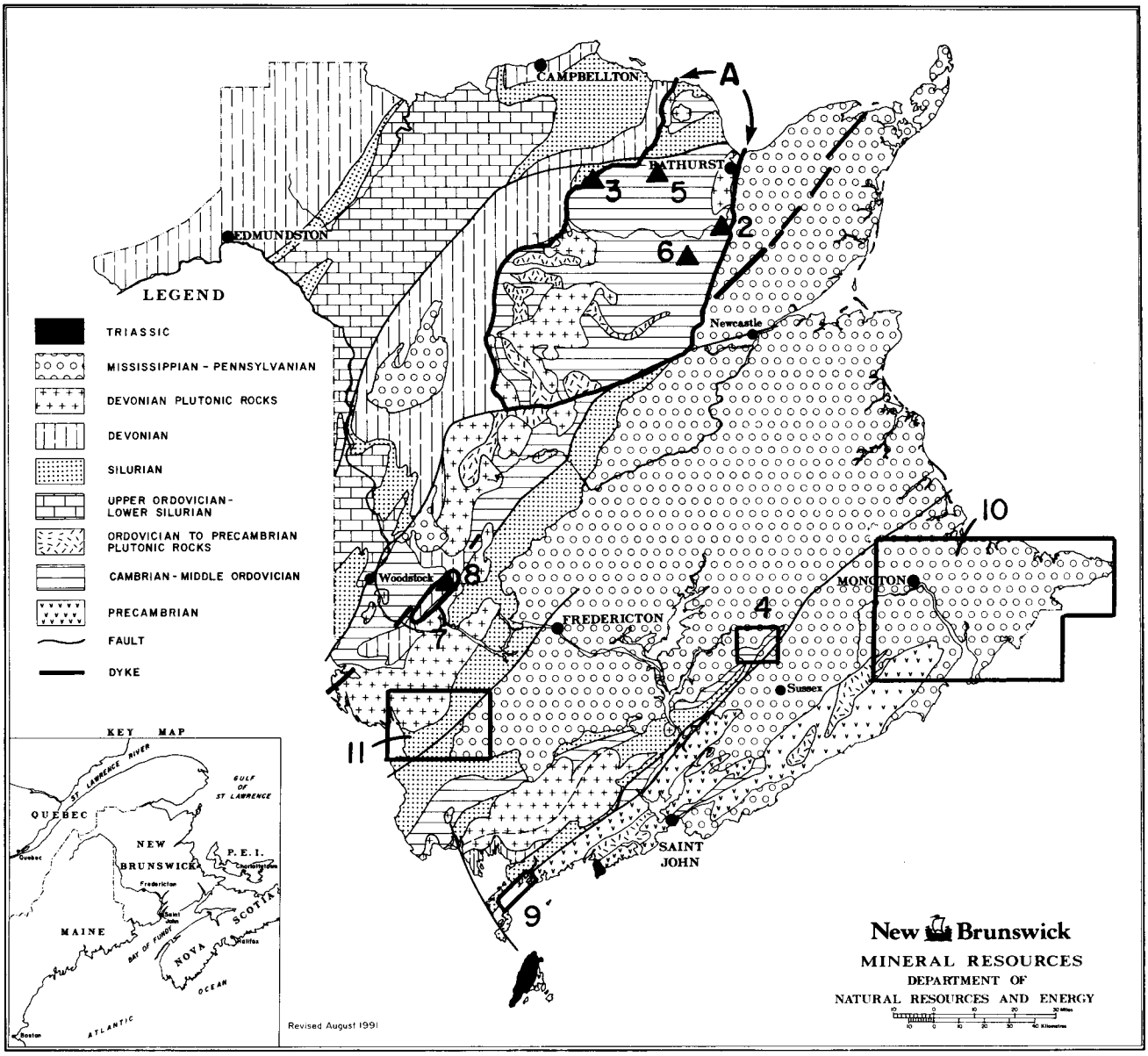


Figure 1. Mineral Exploration 1994.

A) Bathurst Minng District or Camp.
1) Half Mile Lake sulphide deposit.
2) Key Anacon sulphide deposit.
3) Murray Brook massive sulphide deposit.
4) Annidale-Shannon belt (21 H/12e, part of 21 H/9h).
5) Armstrong Brook sulphide deposit.
6) CNE sulphide deposit.
7) Millville belt.
8) Gravel Hill deposit.
9) New River belt (21 G/2, 21 B/15).
10) NATMAP (Magdalen Basin Project), southeastern N.B.
11) Pokiok Batholith, southern part.

In southern New Brunswick, A.A. Ruitenberg mapped and investigated the lithogeochemistry of Lower Devonian volcanic rocks with associated rhyolite domes in the Millville belt (21 J/3, Figure 1). It is suspected that this area has potential for stratabound base-metal deposits (*i.e.*, the Gravel Hill deposit). Ordovician volcanic rocks in this belt have also aroused exploration interest. Art Ruitenberg will retire in September 1994 after a long and distinguished career in New Brunswick geology.

Malcolm McLeod and Susan Johnson carried out 1:50 000 mapping in the Annidale-Shannon (21 H/12e and part of 21 G/9h) and New River belts (21 G/2, 21 B/15; Figure 1). Both terranes contain interesting occurrences of base and precious metals. Recent exploration in the Carboniferous cover of southern N.B. has renewed interest in stratabound copper sulphide deposits in the Windsor and Boss Point formations. Malcolm McLeod and Susan Johnson have begun detailed stratigraphic and metallogenic work in these rocks, as part of a large NATMAP project involving the Magdalen Basin (Figure 1).

Surficial mapping and till geochemistry are being carried out by A.A. Seaman on the southern part of the Pokiok Batholith, and by A.G. Pronk in the Annidale-Queen Brook belt (21 G/11, and 21 H/12e and part of 21 H/9h, respectively, Figure 1). Results of this work will help mineral explorationists interpret glacial dispersion of geochemical anomalies.

Diamond-drill-core collection is being maintained at approximately 20 000 metres per year. One acre of land was cleared at the Madran storage facility north of Bathurst, and several racks were built to accommodate the 1994 collection.

The Mineral Exploration Stimulation Program (MESP) budget was doubled in 1994 to $50 000. Twenty-eight grants were awarded to N.B. prospectors.

Editorial duties for the Minerals and Energy Division were carried out by Barbara M.W. Carroll and her assistant, Shasta A.A. Merlini.

T.C. Webb and D.V. Venugopal, Mineral Development Branch geologists, are involved in several projects, including dimension stone, evaluation of acid drainage along proposed provincial highways, and assessment of aggregate sources for road building.

J.J. Thibault, Mineral Development Branch, Bathurst, carried out several projects dealing with the promotion of peat, and Dominique Bérubé mapped the geomorphology of the New Brunswick coastal zone. Mr. Bérubé's work will be published in atlas form in 1995.

Clint St. Peter, geoscientist for the Energy Branch, is mapping the Carboniferous terrane of southeastern N.B. This entails assessment of the fuel mineral potential of the region, and is part of the Provincial contribution to the Magdalen Basin NATMAP project.

NOTES

NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES GEOSCIENCE ACTIVITIES

The Mines and Energy component of the Department of Natural Resources has a dual mandate to encourage research and development leading to enhanced documentation of mineral and energy resources and to promote their orderly regulation and use. Three divisions in the Department administer geoscience projects: Mineral Resources, and Mineral Development from the Mines and Minerals Branch, and Energy Resources from the Energy Branch. Nova Scotia is in the third year of a Canada-Nova Scotia Cooperation Agreement on Mineral Development. This agreement provides $10 million over three years (1993-1996) to encourage the economic development of the mineral industry in Nova Scotia.

GEOSCIENCE ACTIVITIES

A wide variety of geoscience activities are being undertaken by the staff of the Department. These programs can be categorized as follows: (l) energy resource studies; (2) regional bedrock mapping; (3) exploration geochemistry; (4) local Quaternary mapping; (5) metallic and non-metallic mineral resources and deposit studies; and (6) services to industry and the public. Most of these activities are supported by the complementary projects funded by the Cooperation Agreement.

Evaluation of the province's energy resources include geological research of coal and coalbed methane resources and development and monitoring of private sector geological exploration for petroleum and natural gas offshore. The Department, through the Energy Resources Division, is responsible for all petroleum and natural gas exploration monitoring and development activities onshore. It comes in conjunction with Canada-Nova Scotia Offshore petroleum board in administering Offshore petroleum resources.

Geological mapping continues as part of multidisciplinary projects (including mineral resource projects) in the central Meguma Zone. These projects are coordinated and integrated programs with the Geological Survey of Canada (including NATMAP) and funded in part by the Canada-Nova Scotia Cooperation Agreement on Mineral Development 1993-1996. The central Meguma project area includes mapping and aeromagnetic studies of the Cambro-Ordovician Meguma Group, the Musquodoboit Batholith mapping, mapping the Carboniferous Kennetcook (Windsor) Basin and Quaternary/Cretaceous Surface and sub-surface mapping (drilling, seismic). Aeromagnetic processing enhancement and ground-truthing with rock and magnetic susceptibility-mapping and sampling are being investigated in selected areas. Preliminary results indicate that it will be a valuable tool in mapping subdivisions of the Meguma Group which may be significant in the exploration for disseminated stratabound mineralization.

A report to accompany the *Surficial Geology Map of Nova Scotia* (1:500 000) is in preparation. Several reports were published including a Memoir on the Geology of the Cumberland Basin and a Paper on the surficial geology of the South Mountain Batholith.

The Exploration Geochemistry Section performs several roles as an aid to a varied client base including industry, government and the general public. Systematic geochemical mapping surveys of surface and interstitial waters, surface sediments, soils, glacial materials and vegetation are conducted to estimate and map the chemical environment of Nova Scotia. The Section also has GIS technology which is applied to geoscience data to better define additional mineral potential. The geochemical signature of known mineral deposits is also studied to refine anomaly recognition and develop new exploration methods. Baseline monitoring studies are conducted to estimate long term changes to the geochemical landscape. All of the information is maintained in a digital database on MSD and MS-WINDOWS and UNIX platforms.

During 1994 most effort was concentrated on Mineral development Agreement funded projects, Meguma Gold Potential, biogeochemistry and hydrogeochemistry in southwestern and central Nova Scotia in collaboration with the Geological Survey of Canada, Geochemistry Subdivision.

The biogeochemical survey collected about 1000 samples each of Red Spruce bark and Balsam Fir twigs from about 7000 km^2 of Queens, Annapolis and Lunenburg counties. Samples are analyzed for gold and related elements. The Meguma Gold Potential Project compiled data from 4500 sites along major anticlines. The data were released as an open file including location, till and soil, and clast information. Multi-media follow up studies on 3 anomalous areas were conducted to further refine the anomaly patterns found.

The commitment to applied GIS technology in the Section continued as work progressed on the development of a Visual Modelling System (VMS) using the latest AI technologies. Expert Assessment (EAM) and Intelligent Data Modelling (IDM) are encompassed in an MS Windows application linking to SPANS GIS (OS/2 version). Work also continued in support of the Meguma Gold Project Team with biogeochemical, soil and till sampling at Steeves Road and North Brookfield occurrences. Baseline monitoring studies continued in the Sackville River Watershed.

The section also made presentations on desktop GIS technology at the Prospectors and Developers Annual Convention in Toronto.

The mineral deposit investigations on base and precious metal deposits in the Meguma Terrane continues. A report on the Gays River Pb-Zn deposit was released as an open file and a final report on the deposit is expected in 1995-96. Papers were published on the Liscomb Complex in the Central Meguma Terrane, geochemistry of leucogranites within the Sough Mountain batholith, disseminated gold mineralization at North Brookfield and mineralogy of the Beaver Dam gold deposit. The placer potential for gold in Nova Scotia was investigated and a preliminary report is anticipated in 1995. A number of related presentations were made at various meetings and conferences. Work on describing the metallic and non-metallic mineral occurrences and deposits in Nova Scotia continues.

SERVICE TO INDUSTRY AND THE PUBLIC

LIBRARY SERVICES

Results of departmental geoscience projects are made available by means of published reports and maps, by open files and published papers and articles in external journals and other publications. The departmental library in Halifax provides access to all published and open file material and is the sales office for all geoscience publications of the department. Assessment reports submitted by industry are also available on microfiche. Limited library service is also provided in the Stellarton office. In addition, geoscience staff is available for individual consultation.

ELECTRONIC DATABASES

All departmental geoscience publications, maps, open files and assessment reports are indexed and input into the national GEOSCAN system. Searches of the GEOSCAN database are provided on request at no charge. Databases dedicated to mineral occurrences (both metallic and industrial), to drillholes and to geological and geophysical maps, have been developed and are also available for custom searching. Studies are underway to determine which desktop PC system to adopt for a departmental geoscience GIS.

DRILL CORE LIBRARY

The departmental core library is based in Stellarton and holds more than 500 000 metres of core from thousands of drillholes as well as many other geotechnical samples, such as chip samples from offshore hydrocarbon exploration, rock slabs, building stone samples and geochemical pulps. Much of the drillcore in the Core Library was obtained from drill programs carried out by the department's own diamond drilling section. Although in the past drilling was often done under contract to exploration companies, this activity is now exclusively restricted to departmental geoscience programs, both to assist in regional studies and to test mineral occurrences (coal, gypsum, building stone, aggregates, industrial minerals, metallic minerals, etc.). All core is maintained on a nonconfidential basis and may be accessed for study and sampling on request. The core library facilities are being expanded with the construction of an additional storage building under the Canada-Nova Scotia Cooperation Agreement on Mineral Development.

PROSPECTOR PROGRAM

The Prospectors Assistance Program is a Federally funded plan under the MDA that provides direct financial aid to individual bonafide prospectors and explorationists. The total allocation for grants for the period July 1993 to March 1996 is $400 000. Recipients of grants are required to submit reports and results of their activities to the department. In addition. several prospectors participated in the Annual Review of Activities.

The department organizes and sponsors a number of Prospecting Courses for the public at various locations throughout the Province. There has been an overwhelming response to these popular courses.

LAND USE AND RESOURCE MANAGEMENT

The Integrated Land Use project provides information needed to formulate policy to ensure the protection, conservation and management of energy and mineral resources. A Mineral Resource Land Use (NIRLU) map and reports are being compiled to pro-

vide input for all strategic land and resource planning in Nova Scotia. The intent is to promote multipurpose or sequential land use and to avoid sterilization of resources. The issue of setting aside large areas of land as protected wilderness before a comprehensive evaluation of the mineral potential is receiving attention. A procedure for Integrated Resource Management Planning on Crown Land has been developed and a pilot project is underway in Cumberland and Colchester Counties.

PUBLIC AWARENESS

Various publications, projects and displays targeted towards the general public and school children promote a greater appreciation for the mining industry and mineral development.

NOTES

DEPARTMENT OF NATURAL RESOURCES
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
GEOLOGICAL SURVEY

INTRODUCTION

The Geological Survey program for 1994-95 consisted of some 40 projects with a total budget of some $3.7 million. The program was funded under the provincial A-base ($3.3 million), the Canada-Newfoundland Cooperation Agreement on Mineral Development ($90,000), and a new Canada-Newfoundland Mineral Development Agreement, signed in June, 1994 ($250,000). This was the final year of the 1990-1994 Cooperation Agreement; the new Agreement will provide funding to March 31, 1996.

Many of the 1994-95 projects were in a report preparation phase, following four years of field work under the CNCAMD. There were, however, a number of field projects under A-base, and work was begun on two major new multidisciplinary projects under the 1994-1996 Agreement (Fig. 1).

MULTIDISCIPLINARY PROJECTS

Two new multidisciplinary projects were begun in 1994, one in the Kanairiktok mineral belt in Labrador, the other in the Buchans-Roberts Arm belt on the Island Of Newfoundland. The Kanairiktok project area includes a large part of the mid-Archean Hopedale Block (southern Nain craton), and its southern boundary with Proterozoic rocks of the Central Mineral Belt (parts of Makkovik and Grenville Provinces). The area has potential for a variety of currently attractive exploration targets, including base metals (Kambalda-type Ni, VMS Cu-Pb-Zn), mesothermal Au, and diamonds. The Buchans-Roberts Arm belt consists of a sequence of volcanic rocks, extending from Buchans in central Newfoundland to Pilleys Island in Notre Dame Bay. The belt is highly prospective for high-grade polymetallic base metal deposits.

Bedrock and surficial mapping, geochemical and geophysical surveys and mineral deposit studies will provide better understanding of mineralizing processes and exploration methods in each belt. The projects will produce comprehensive, integrated digital compilations of existing data in each belt, with new data in critical areas, to assist industry with the identification of new exploration targets.

Digital compilation of data in each project area was begun in 1994, and a surficial mapping/till geochemistry project was carried out in the northern part of the Buchans-Roberts Arm belt.

OTHER FIELD WORK

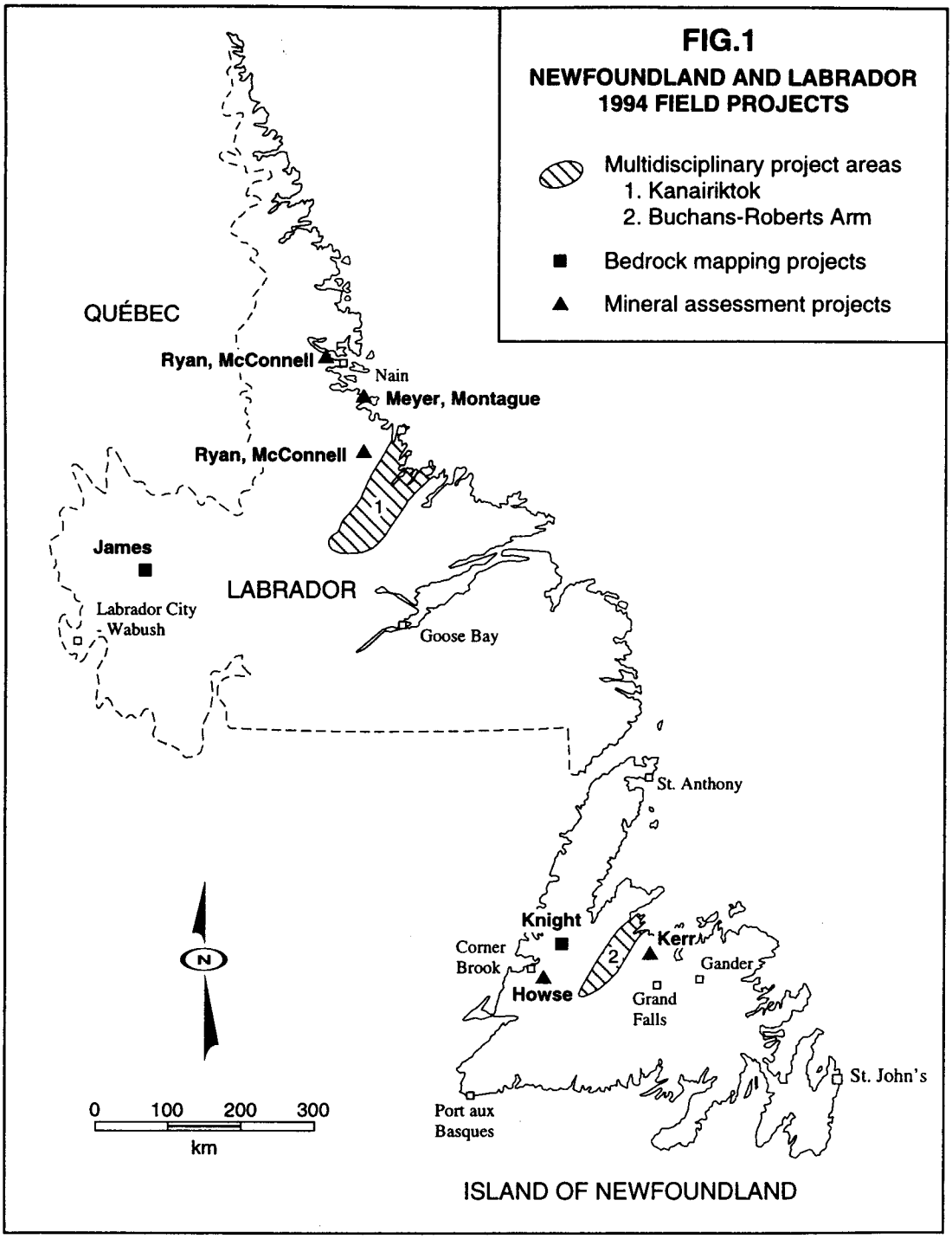
Ian Knight continued his long-term 1:50 000-scale bedrock mapping project in the Cambro-Ordovician carbonates on the west coast of the Island, concentrating his efforts in the Corner Brook area. Ian was seconded to the Energy Branch of the Department for part of 1993-94, assisting in efforts to promote the petroleum potential of the west coast. The first exploratory well is now being drilled in this area, on the Port au Port Peninsula.

Industrial minerals continued to attract a great deal of attention in Newfoundland in 1994. Andy Kerr, who carried out a preliminary assessment of the dimension stone potential of the Topsails granite in 1993, turned his attention to the Hodges Hill pluton, and was successful in location a number of potential quarry sites there. Jamie Meyer and Ed Montague carried out an assessment of soapstone deposits along the Labrador coast, and Jamie continued to assist the burgeoning dimension stone industry with site visits and promotions at various trade shows. Ambrose Howse carried out an assessment of kyanite-garnet-staurolite showings near Corner Brook, and sampled selected high-purity limestones for potential use in lithographic printing.

In Labrador, two projects were active, outside of the Kanairiktok project area. Don James completed 1:50 000-scale mapping of the Blueberry Lake Group, a sequence of felsic to intermediate volcanic and sedimentary rocks in western Labrador that was delineated by earlier reconnaissance mapping. The unit has potential for VMS base metal mineralization. Bruce Ryan and John McConnell carried out an assessment of the diamond potential of the Archean of the Nain craton in eastern Labrador, visiting and sampling known alkalic and ultramafic dikes, and collecting stream sediment, till, and heavy mineral concentrates to identify catchment basins that host unrecognized kimberlite/lamproite intrusions.

OFFICE-BASED PROJECTS

A great deal of the resources of the Survey in 1994-95 were spent on office-based projects, primarily re-



port preparation and preparation of digital databases. Projects that had been carried out under the Canada-Newfoundland Cooperation Agreement on Mineral Development were all in the report preparation phase. Reports required under a geoscience contract with NRCan were submitted in early March, 1994; reports in other projects are required by March 31, 1995.

The Survey continued a major effort to digitize data throughout 1994-95. A wide variety of digital databases are now available. These databases, and others to be developed in the future, will be integrated using CARIS Geographic Information System software, installed in the fall of 1994.

NWT GEOLOGICAL MAPPING DIVISION
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

NORTHWEST TERRITORIES REGION

The NWT Geological Mapping Division functions within the Operations Directorate, Department of Indian Affairs and Northern Development (DIAND) and under the NWT Act, which assigns to the Minister of DIAND responsibility for Science in the north.

The Division has been assigned responsibility under the Canada Mining Regulations(CMR) for the review evaluation and approval (acceptance) of assessment reports required to keep claims and prospecting permits in good standing. The Division maintains and provides public assess to an Archive of assessment reports and other pertinent geological reports and papers. It also prepares summaries of the assessment records to assist in the orderly and cost effective development of NWT mineral resources. The Division has also been assigned responsibility for monitoring diamond drilling including the review of drilling proposals and the issuance and monitoring of Drilling Authorities for drilling in non-Precambrian sedimentary basins which is controlled by the Canada Oil and Gas Act.

The Division has a primary role in fostering mineral development in the NWT. It provides information and geological advice to prospectors, explorationists, other government organizations, environmental and native groups, as well as the public, including media organizations who regularly seek first hand information on mineral developments in NWT. The C.S. Lord Core Library provides storage space for rocks, minerals and drill core representative of NWT deposits. It also has examination facilities including rock-cutting equipment, but it has not had a curator for many years.

DIVISION PROJECTS 1993 and 1994

W. A. PADGHAM-CHIEF GEOLOGIST

The Chief Geologist manages and coordinates Division activities and provides liaison with Mineral Initiatives which operates within the NWT Economic Development Agreement. Scientific activities have included preparation of 1:1 000 000-scale digitized geological, and metallogenic maps of the Slave Structural Province with W.K. Fyson, Univ. of Ottawa. Metallogenic, geochronological and sedimentological studies in the Slave Province are underway with W. Mueller, Univ. of Quebec at Chicoutimi and W. Compston, ANU and B. Baadsgaard, Univ. of Alberta. Geochronological and metallogenic work began in 1994 in the Queen Maud Block and continued in various parts of the Slave Province including Point Lake region and Acasta River gneisses all with S.A. Bowring of MIT. This is one of the least-mapped areas of NWT.

VALERIE A. JACKSON-PROJECT GEOLOGIST

The Project Geologist has been completing the mapping at 1:50 000 scale of the northwestern edge of the Slave Structural Province including the Napaktulik Lake (86/I) and Kikerk Lake (86/P) map areas. Ms. Jackson works out of the C.S. Lord Core Library.

STAFF GEOLOGIST-PAMELA STRAND

The Staff Geologist with the assistance of the Archives Geologist (Pattie Beales) manages the Archives and monitors geological developments at operating mines in the NWT. The Archives Geologist indexes assessment reports and open file reports on NWT and enters these into the GEOSCAN national database. Approximately 100 requests for technical data are filled through the Archives each month.

DISTRICT GEOLOGISTS

District Geologists monitor mineral exploration and development in their assigned districts and provide professional-level information and advice of the geology and mineral potential of their district. Steven Goff monitors mineral exploration in the Keewatin and has participated in gold deposit studies in the Meliadine River area, and geological studies in the Sandhill Lake area with students and professors from Laurentian University and the University of Western Ontario respectively. He is also studying gold deposits throughout the Rankin-Ennadai greenstone belt.

Jennifer Pell monitors diamond exploration throughout NWT and all exploration in the Arctic Islands. With John Brophy (currently on one years leave in Peru) she has been mapping (at 1:50 000 scale) the LaBrish Lake area (85N/9 & 16), one of many unmapped supracrustal belts on the west border of the Slave Structural Province.

Carol Ellis monitored non-diamond mineral exploration in the Slave, Bear and Cordilleran regions of NWT but left the Division in late September 1994 for a position as a Policy Officer in the Policy and Com-

CONTRACTOR STUDENT (degree)	AFFILIATION	LIAISON (Advisor)	PROJECT DESCRIPTION
W.R. Fyson	Univ. of Ottawa	W.A. Padgham	Update of 1:100 000 geological compilations of Slave Province geology and prep. of 1:500 000 Slave compilation
S.A. Bowring (Northrup	Mass. Institute of Technology	W.A. Padgham	Mapping geochronological and geochemical studies of the Acasta Gneisses and Queen Maud granulites; dating of rocks in the Slave Structural Province; study of the Keskarrah Bay area, Point Lake
W. Mueller (cocoran	Univ. of Quebec	W.A. Padgham	Sedimentological and tectonic studies of Jackson Lake and Beaulieu Rapids Formations
W. Compston B. Baadsgaard	Aust. Nat'l. Univ; Univ. of Alberta	W.A. Padgham	Dating and provenance studies of Slave Province conglomerates
L.B. Aspler	Consultant	W.A. Padgham	Prepare summaries of the geology of the Rankin-Ennadai belt in the southwestern part of Keewatin
L.A. Groat	Univ. of B.C.	W.A. Padgham	Study Cali/Lica rare element pegmatites north of Cantung, Cordillera
N.D. MacRae (Armitage A./Ph.D.)	Univ. of Western Ontario	S.P. Goff	Geological studies and mapping in the Sandhill massive sulphide, Keewatin
R.S. James (G. DeSchutter. M.Sc.)	Laurentian Univ.	S.P. Goff	Studies of Meliadine River iron-formation-hosted gold deposits

munications Directorate. Dorothy Atkinson monitored mineral exploration in the Cordillera and southern Slave Province until she resigned (after a one year leave of absence) in August 1994. She also worked on the NWT Computerized Mineral Showing Data Base with Velma Sterenberg of the Canada-NWT Mineral Initiatives Office where this NWT MINFILE is under development.

The Division has been short staffed for two years and as a result many projects are behind and services to the public are strained. The NWT Natural Resources Library with a staff of two was closed early in 1994 and responsibility for management of the geoscience holdings (65% of the library) transferred to the already challenged Geological Mapping Division.

COOPERATIVE PROJECTS

Geological Mapping Division staff participated in a number of projects that were partly funded by the Division through contracts or through provision of logistical support. These are listed in the following table.

In addition to the above projects John Brophy worked with John Kerswill of the GSC, on a partly Mineral Initiatives funded project, to study, evaluate and compare Precambrian iron formation-hosted gold deposits in NWT. Jennifer Pell collected xenoliths and other samples of NWT kimberlites for geochemical and metallogenic studies. Pell also conducted a study of carvingstone resources in the northern Baffin Island National Parks reserves in cooperation with Parks Canada.

Pamela Strand began mapping (1994) the Frame Lake hiking trail in order to prepare a geological guide to this popular trail in downtown Yellowknife.

RECENT PUBLICATIONS

Each year the Division produces an Exploration Overview detailing mining, exploration and geological investigations underway in NWT. In 1993, 11 open file maps and reports were produced, (5 are by staff of the Can.-NWT Mineral Initiative Office) and, as of November 1994, 14 open file reports had been issued, (5 by Mineral Initiatives staff).

OTHER DIAND MINERAL RELATED ACTIVITIES

Indian and Northern Affairs, NWT Region has undergone significant reorganization during the last year. Mining Lands has been moved into the Natural Resources and Environment Directorate where it has been merged with the pre-existing Lands Administration Division. Geology has been renamed NWT Geological Mapping and placed in the Operations

Directorate. The responsibility for resource development and strategic planning now rests with the Policy, Economic and Communications Directorate. The NWT Region Natural Resources Library has been closed and its holdings distributed to Divisions that need and use them. These changes pose some interesting challenges for the NWT Geological Mapping Division, and the mineral exploration community.

CANADA-NWT MINERAL INITIATIVES OFFICE

The Canada-NWT Mineral Initiatives Office operates from the Panda II Mall in Yellowknife. Five geologists conduct mainly 1:50 000 scale mapping in areas of significant mineral potential. In 1993 and 1994 four geologists worked in the Slave Structural Province: James Gebert mapped supracrustals in the northern Point Lake volcanic belt between the Hood 10 and Izok base metal deposits (86H/14, 15 and I/1, 2); Rob Johnstone mapped in the MacKay Lake Area (north central 75 M); Carolyn Relf mapped in the Anialik River area (Hepburn Island NW, 76 M); and Mike Stubley mapped in the northern half of the Carp Lakes area (85 P). Doug Irwin mapped in the Kaminak-Carr Lakes area of the Keewatin (55L/3, 4, 5, 6).

Data Base development geologist Velma Sterenberg continued work on NWT MINFILE. The Mineral Initiatives office was managed by Martin Irving.

NOTES

YUKON TERRITORY

In the Yukon Territory, government technical and financial assistance to the exploration and mining industry is administered through three programs. These are: Exploration and Geological Services Division, Northern Affairs Program, Indian and Northern Affairs Canada; Mineral Resources Program, Energy and Mines Branch, Department of Economic Development, Government of Yukon; and the Canada/Yukon Mineral Development Agreement. Each organization provides complementary services which together aim to provide a comprehensive geoscience data base and technical and financial support. Further assistance and information on mining and exploration in the Yukon can be obtained at the following addresses:

MINERAL RESOURCES DIRECTORATE,
NORTHERN AFFAIRS PROGRAM
345 - 300 Main St.
Whitehorse, Yukon
Y1A 2B5

Exploration and Geological Services Division
Tel: 403-667-3203
S.R. Morison, Acting Chief Geologist
Tel: 403-667-3204
Geoscience Information and Sales
FAX: 403-668-2176 FAX

Mineral Development Division
Tel: 403-667-3204
A. Waroway, Regional Manager
FAX: 403-667-6351 FAX

Mineral Rights Division
Tel: 403-667-3260
R. Ronagan, Regional Manager
FAX: 403-667-8601 FAX

ENERGY AND MINES BRANCH
Department of Economic Development
Government of Yukon
Box 2703
Whitehorse, Yukon
Y1A 2C6

Mineral Resources Program
R. Hill, Manager
305-211 Main Street
Tel: 403-667-5884
FAX: 403-667-8601

Canada/Yukon Geoscience Office
2099 Second Avenue
Tel: 403-667-8510
J. Kowalchuk, MDA Coordinator
Tel: 403-667-8516
D. Murphy, Senior Project Geologist
FAX: 403-667-7074

EXPLORATION AND GEOLOGICAL SERVICES DIVISION (EGSD), GOVERNMENT OF CANADA

Exploration and Geological Services Division (EGSD) is part of the Mineral Resources Directorate, Northern Affairs Program, Indian and Northern Affairs Canada. The Mineral Resources Directorate is responsible for administration of mineral rights through the Yukon Quartz Mining and Placer Mining Acts. The primary role of EGSD is to accumulate and disseminate geological information, and provide related services that assist the exploration, development, and management of mineral resources in Yukon. Functions include detailed studies of mineral deposits and their geological setting, monitoring and reporting industry activities, and approval of technical reports for assesment credit. EGSD maintains a geological library, core library, and a Geoscience Information and Map Sales Outlet.

STAFF ACTIVITIES

Staff presently includes T.J. Bremner (Mineral Deposits Geologist), J.G. Abbott (Minerals Geologist), D. Emond (Environmental Geologist), R. Deklerk (Manager, Map Sales), W.P. LeBarge and M. Burke (Staff Geologists), and A. Wagner (Office Manager). Beth Phillips retired as Map Sales manager in 1993 and will be greatly missed by industry and government people who had the pleasure of working with her.

Stephen Morison (Director, Mineral Resources), fulfilled a dual role in late 1993 as Chief Geologist and as Acting Director of Mineral Resources. He was appointed permanently to the position of Director of Mineral Resources in mid-1994. Among other duties,

Mr. Morison has been involved in the planning and implementation of the Geoscience Element of the Canada/Yukon Mineral Development Agreement as co-chair of the Geoscience Technical Committee. Grant Abbott (Minerals Geologist) is chiefly responsible for 1:50 000-scale mapping projects and in 1993 worked on Hart River 116 A/10 and 11 sheets. He is currently located at the MDA Geoscience office where he has taken on the role of scientific advisor. Trevor Bremner (Mineral Deposits Geologist) completed the YUKON MINFILE update in 1993 and carried out fieldwork on the Brewery Creek deposit (MINFILE #116B 160) east of Dawson. Mike Burke (Staff Geologist) is responsible for visiting mining properties and approving quartz assessment reports for all mining districts. William LeBarge (Staff Geologist) returned from completing his M.Sc. thesis, Sedimentology of Placer Gravels near Mt. Nansen, central Yukon Territory, and will be concentrating his efforts toward placer-related projects in Yukon. He is responsible for visiting active placer mining properties and approving placer assessment reports for all mining districts. Mike Burke continues to coordinate renovations to the H.S. Bostock Core Library which will improve the core logging, sampling and viewing areas as well as the laboratory facilities.

PUBLICATIONS

EGSD publishes its own technical reports, and those produced by the Canada/Yukon Mineral Development Agreement. The two main products of EGSD are Yukon Exploration and Geology, and Yukon Minfile, a database containing information on mineral occurrences in the Yukon. Yukon Exploration and Geology is published annually in late January or early February. YUKON MINFILE is updated annually and released in late spring. From time to time EGSD also publishes bulletins on geological studies undertaken by staff and colleagues. A complete publication list is available request.

YUKON MINFILE is currently available in hard copy or on diskette as a set of WordPerfect 5.1© text files. Occurrence locations are recorded on 38 maps which cover all of Yukon, mostly at a scale of 1:250 000. A second version of YUKON MINFILE consists of a DBase file with UTM coordinates for each location and several major search fields. This version allows mineral occurrence locations to be plotted by CAD and GIS programs. Final editing is in progress. A third version is modeled on B.C.'s MINFILE system. This version continued to be improved and is scheduled for release on diskette in 1995. Please contact Mike Burke (403-667-3202) for searches or for further information.

GEOSCIENCE INFORMATION AND MAP SALES

EGSD also manages the Yukon outlet of the Canada Map Office and sells topographic, geological (surficial and bedrock), aeromagnetic, aeronautical and land use maps. Geological and other relevant publications by EGSD, Canada/Yukon Mineral Development Agreement, Geological Survey of Canada, and Geological Association of Canada are also available.

LIBRARY

EGSD maintains a library of geological texts and journals and selected air photos covering Yukon south of 65°. The public is welcome to view these materials.

H.S. BOSTOCK CORE LIBRARY

The H.S. Bostock Core Library houses approximately 120 000 metres of diamond drill core from 179 Yukon properties. The facility is located across the street from the former Northern Affairs building on Range Road. The core is stored in its original boxes, with no sample reduction. Confidentiality is maintained on the same basis as mineral claim assessment reports; a letter of release from the company owning the property must accompany a request to view confidential core. Status of specific core can be checked and arrangements to view or submit new core can be made by contacting the core librarian at 667-3202. Diamond saws, a core splitter and microscopes are available for use in heated examination rooms.

MINERAL RESOURCES PROGRAM, ENERGY AND MINES BRANCH, GOVERNMENT OF YUKON

The Mineral Resources Program (MRP) is part of the Energy & Mines Branch whose primary objective is to encourage the development of Yukon's mineral and energy resources. MRP provides services in three main areas: Mining Programs, Mineral Policy, and the Canada/Yukon Mineral Development Agreement (MDA). The Yukon Mining Incentive Program (YMIP) promotes mining investment and mineral exploration in Yukon. MRP strives to increase public knowledge of the mining industry, and is available to advise companies and individuals on the relevant legislation and support programs for the industry.

R. Hill manages the Mineral Resources unit and the Canada/Yukon Geoscience Office, prepares briefings, and undertakes special projects at the request of the Minister or Deputy Minister. S. Abercrombie conducts mineral policy research projects relating to federal and territorial legislation and policies, and conducts economic and financial reviews of mining projects. K. Pelletier administers the YMIP program and provides advice to individuals and companies on the relevant legislation and other government programs.

YUKON MINING INCENTIVES PROGRAM

The Yukon Mining Incentives Program (YMIP) is designed to promote and enhance mineral prospecting, exploration and development activities in the Yukon. The program's function is to provide a portion of the risk capital required to locate and explore mineral deposits. Grassroots programs (Prospecting and Grubstake categories) are conducted on open ground (crown land) and Target Evaluation programs are conducted on undeveloped mineral claims. Technical assistance is offered to prospectors upon request.

Program funding for 1993/94 was $750 000. Two interest groups representing the mining industry were awarded grants to a total of $30 000 and an equal number of grants were allocated to each category, 28 in the Grassroots programs and 28 in the Target Evaluation Program. Approximately 60% of the total was allocated to placer gold exploration projects.

CANADA/YUKON MINERAL DEVELOPMENT AGREEMENT

The Mineral Development Agreement (MDA) is funded under the 1991-1996 Canada/Yukon Economic Development Agreement (EDA). The agreement includes three elements; 1)Geoscience, 2)Mining Technology, and 3)Information. The Energy and Mines Branch, Department of Economic Development, Government of Yukon administers the agreement. The Agreement is managed by a committee which includes representatives of Indian and Northern Affairs Canada, the Mining Sector of the Department of Natural Resources Canada, Government of Yukon, the Council for Yukon Indians, and the Yukon Chamber of Mines. Independent project proposals are considered under all elements. Enquiries should be directed to the MDA coordinator c/o the Canada/Yukon Geoscience Office.

1. GEOSCIENCE ELEMENT

The long term objective of the Geoscience Element is to promote an active and successful hardrock and placer exploration industry by accelerating the development of a comprehensive, modern geoscience information base. The main components of the program are geological mapping at 1:50 000 scale in more economically significant areas of the Yukon, and regional geophysical and geochemical surveys.

CANADA/YUKON GEOSCIENCE OFFICE

The Canada/Yukon Geoscience office has been established in order to develop locally-based expertise in the regional geological setting of Yukon mineral deposits. The project manager is Rod Hill and the scientific authority is Steve Morison. Geoscience Office staff include D. Murphy (Senior Geologist), E. Fuller (Placer Geologist), C. Hart (Project Geologist), S. Johnston (Project Geologist), D. Thorkelson(Project Geologist), J. Kowalchuk (coordinator), W. VanRanden (Draftsperson), and D. Carruthers (Administrative Assistant). Seasonal geological assistance was provided by F. Andersen, J. Timmerman, D. Brent, N. Hachey, D. Heon, J. Hunt, and C. Wallace. C. Roots from the Geological Survey of Canada, and G. Abbott from Exploration and Geological Services Division, Northern Affairs Program are being supported by the Geoscience Program.

Mapping programs in 1993 included:

- C. Hart and J. Hunt in the Whitehorse trough near Whitehorse (105D/14).
- S. Johnston and J. Timmerman in Yukon Tanana Terrane near Aishihik Lake (115H/6,7)
- D. Murphy and D. Heon in Western Selwyn Basin in the Clear Creek Area (115P/15).
- D. Thorkelson and C. Wallace in the Wernecke Supergroup and Pinguicula Group in map area 106/C/13.
- E. Fuller and F. Andersen in unglaciated surficial deposits in the Dawson Range (115I/13;115J/13,14,15,16; 115O/3,4,5,6,7,8,12; 115P/5,12).
- C. Roots and D. Brent began 125,000 scale mapping of Lansing map area (105N).
- G. Abbott in the Hart River area along the boundary between Mackenzie Platform and Selwyn Basin (completed) (116A/10,11).

REGIONAL SURVEYS

Regional geochemical and geophysical surveys are conducted by the Geological Survey of Canada. A combined radiometric, aeromagnetic and VLF Survey was flown in the Dawson Range (115J/9,10 and 115I/12E1/2) over the Casino Porphyry copper molybdenum deposit and nearby areas with high mineral potential. A regional stream sediment survey in Dezadeash map area(115A), and a lake sediment orientation survey in Watson Lake map area (105AW1/2) were completed.

OTHER GEOSCIENCE PROGRAMS

A limited number of independent research proposals are also funded under the Geoscience Element. Two completed projects are: 1) Fine Gold Literature Research and Orientation Survey - program submitted and administered by Gord MacKay and 2) Compilation of Placer Mining Activities and Exploration, Carmacks Map Sheet. This compilation was submitted and administered by Bernie Kreft.

2. TECHNOLOGY ELEMENT

The objective of the Technology Element is to increase the economic and environmental efficiency of Yukon placer and hardrock mining operations by encouraging innovative exploration, mining and processing technology, as well as projects aimed at reducing or mitigating environmental impacts. A technical report suitable for publication completes each project. Projects in 1993 included: (1)The Use of Ground Penetrating Radar for the Evaluation of Placer Gold Deposits submitted and administered by Amerok Geophysics, and (2) Evaluation of the use of Excavator and Floater Dredging in Permafrost, submitted and administered by Forty Mile Placers.

3. INFORMATION ELEMENT

The objective of the Information Element is to communicate information about the mining industry to Yukon residents and to encourage businesses to take advantage of economic opportunities in the industry. One aspect is to inform students of the realities of the mining industry. Programs approved and operated under the information element include: (1) Education, (2) History of the Whitehorse Copper Belt (administered by McBride Museum); and (3)Yukon Charlie Broadcasts by CKRW Radio.

SURVEY OF HARD ROCK DRILL-CORE PROGRAMS
1993-1994

NOTES

SURVEY OF HARD ROCK DRILL CORE PROGRAMS IN CANADA
FISCAL YEAR 1992-1993

PROVINCE	ONT	QUE.	NFLD & LAB	YUKON
No. of core facilities	6	5	6	1
Staff-Person Days Work	1189	40	590	190
Capital Cost	$598 300	N/A	$43 000	1125
Operating Cost	$185 000	$126 000	$40 000	7000
Core Collected and/or Delivered (in metres)	140 437.6	4174	5916	2838
Core Reduction*	nil	nil	nil	nil
Use of facilities person days (pd) visits (v)	1990(v)	45(pd)	311(pd)	50(pd)
Total Core in Storage (from all years) (in metres)	974 141	221 924	871 855	123 000
Total Exploration Drilling (in metres)	464 109	335 000	30 000	62 569

* Over last year
**There are no facilities for hard rock core in B.C.

NOTES

DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1993

NOTES

DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1993

PROVINCE: ONTARIO

Mine:	Lac Des Iles	Mine:	Hislop Gold
Discovery Technique:		Discover Technique:	General Prospecting
Discovery:	Old	Old	
Date of Original Discovery:		Date of Original Discovery:	1920
NTS:		NTS:	
Location:		Location:	2 miles north of Holtyre, Ontario
Discovered (reassessed) Reserves:		Discovered (reassessed) Reserves:	
Mining Type:	Open Pit	Mining Type:	Open Pit
Commodities:		Commodities:	Au
Deposit Classification:		Deposit Classification:	Vein System

Mine:	Garson	Mine:	Barwick Peat
Discovery Technique:	General Prospecting	Discovery Technique:	Ground Reconnaissance
Discovery:	Old	Discovery:	Old
Date of Original Discovery:	1891	Date of Original Discovery:	1983
NTS:	41I10	NTS:	52D/90NE
Location:	Garson Township	Location:	Carpenter, Ontario
Discovered (reassessed) Reserves:		Discovered (reassessed) Reserves:	6000 Bales @ 60 lb/bale
Mining Type:	Underground	Mining Type:	Surface
Commodities:	Ni, Cu, PGM	Commodities:	Peat
Deposit Classification:	Mafic Intrusive	Deposit Classification:	Peat/Bog

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COMMITTEE OF PROVINCIAL GEOLOGISTS

British Columbia:

Dr. W.R. Smyth — 604-952-0374
Director and Chief Geologist — Fax: 604-952-0371
Geological Survey Branch
Mineral Resources Division
Ministry of Energy, Mines and Petroleum Resources
5th Floor - 1810 Blanshard Avenue
VICTORIA, British Columbia
V8T 4J1

Alberta:

Dr. Jan Boon — 403-422-1927
Head, Alberta Geological Survey — Fax: 403-422-1449
Alberta Research Council
PO Box 8330, Station F
EDMONTON, Alberta
T6H 5X2

Saskatchewan:

Dr. Bob Macdonald — 306-787-2568
Chief Geologist — Fax: 306-787-7338
Saskatchewan Geological Survey — Fax: 306-787-2448
Saskatchewan Energy and Mines
1914 Hamilton Street
REGINA, Saskatchewan
S4P 4V4

Manitoba:

Dr. Dave McRitchie — 204-945-6559
Director, Geological Services Branch — Fax: 204-945-1406
Manitoba Energy and Mines
1395 Ellice Avenue
Suite 360
WINNIPEG, Manitoba
R3G 3P2

Ontario:

Dr. John Wood — 705-670-5757
Director — Fax: 705-670-5759
Ontario Geological Survey
Ministry of Northern Development and Mines
933 Ramsey Lake Road
SUDBURY, Ontario
P3E 6B5

Quebec:

Dr. Jean-Louis Caty — 418-643-5159
Directeur — Fax: 418-643-2816
Direction de la recherche géologique
Ministere de l'Energie et des Ressources
Gouvernement du Quebec
5700 4 avenue Quest, Local A-214
CHARLESBOURG, Quebec
G1H 6R1

New Brunswick:

Dr. J.L. Davies — 506-453-2206
Director, Geological Surveys Branch — Fax: 506-453-3671
N.B. Department of Natural Resources
and Energy
P.O. Box 6000
FREDRICTON, New Brunswick
E3B 5H1

Nova Scotia:

Dr. A.K. Chatterjee — 902-424-4162
Director, Mineral Resources — Fax: 902-424-7735
Nova Scotia Department of
Natural Resources
PO Box 698
HALIFAX, Nova Scotia
B3J 2T9

Prince Edward Island:

Mr. Wayne MacQuarrie — 902-368-5025
Director, Energy and Minerals — Fax: 902-368-5544
PO Box 2000
CHARLOTTETOWN, Prince Edward Island
C1A 7N9

Newfoundland:

Mr. B.A. Greene — 709-729-2763
Executive Director — Fax: 709-729-3493
Geological Survey — E.Mail: bag@zeppo.geosurv.gov.mf.ca
Department of Natural Resources
PO Box 8700
ST. JOHN'S, Newfoundland
A1B 4J6

Northwest Territories:

Dr. M.P. Cunnignham, P. Geol. — 403-920-3217
Mineral Policy Advisor — Fax: 403-873-0254
Energy, Mines & Petroleum Resources
Government of the Northwest Territories
PO Box 1320
YELLOWKNIFE, Northwest Territories
X1A 2L9

Dr. W.A. Padgham — 403-920-8211
Chief Geologist — Fax: 403-873-5763
NWT Geology Division
Northern Affairs Program
Department of Indian Affairs and Northern Development
PO Box 1500
YELLOWKNIFE, Northwest Territories
X1A 2R3

Yukon:

Mr. Steve Morrison — 403-667-3200
Chief Geologist — Fax: 403-668-2176
Department of Indian Affairs and
Northern Development
Exploration and Geological Services Division
200 Range Road
WHITEHORSE, Yukon Territory
Y1A 3V1

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