



**Provincial  
Geologists  
Journal**

**Journal des  
géologues  
provinciaux**

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# Provincial Geologists Journal

# Journal des géologues provinciaux

VOLUME TEN

VOLUME DIX

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Compilé par le Ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick

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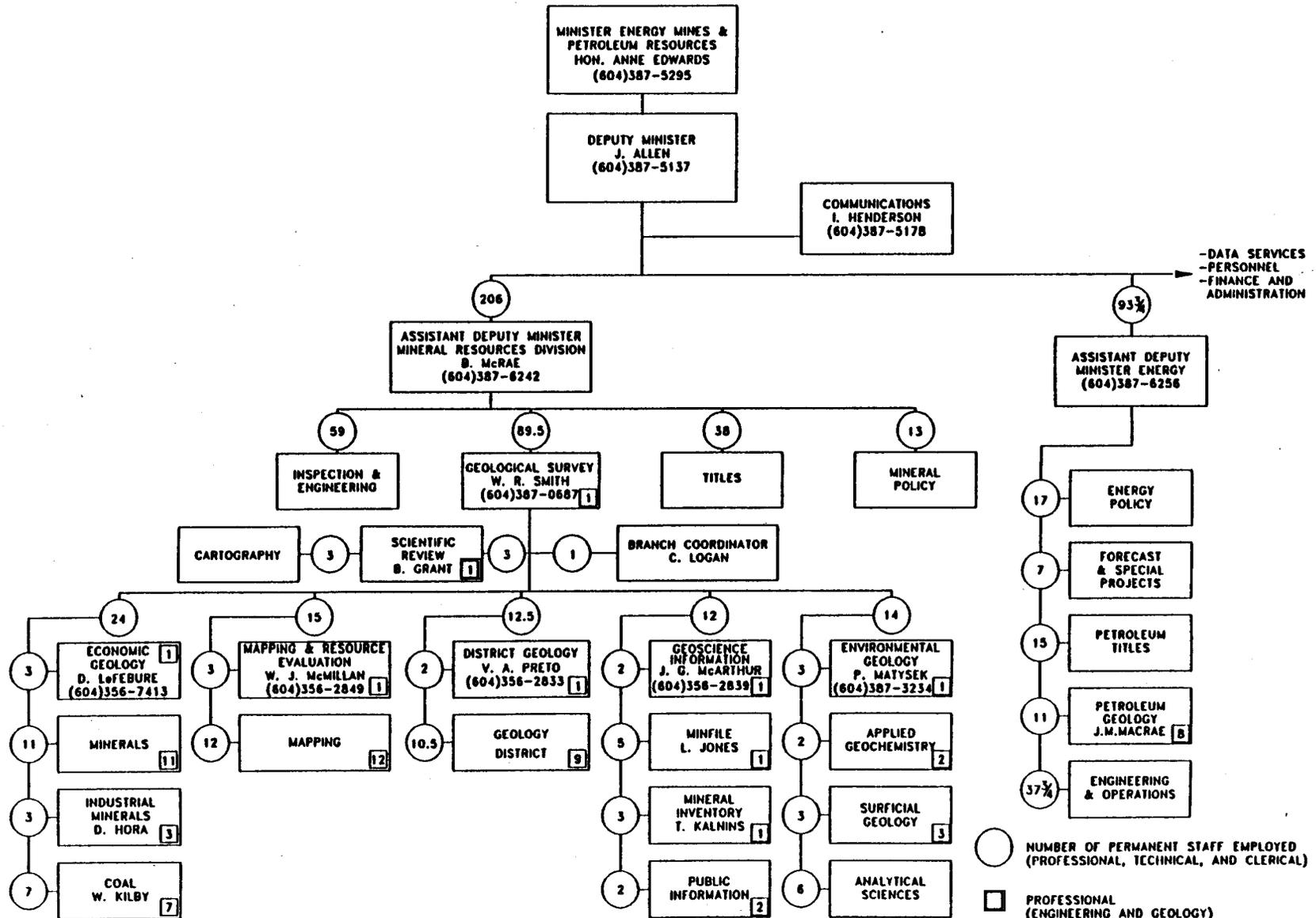
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## NOTES

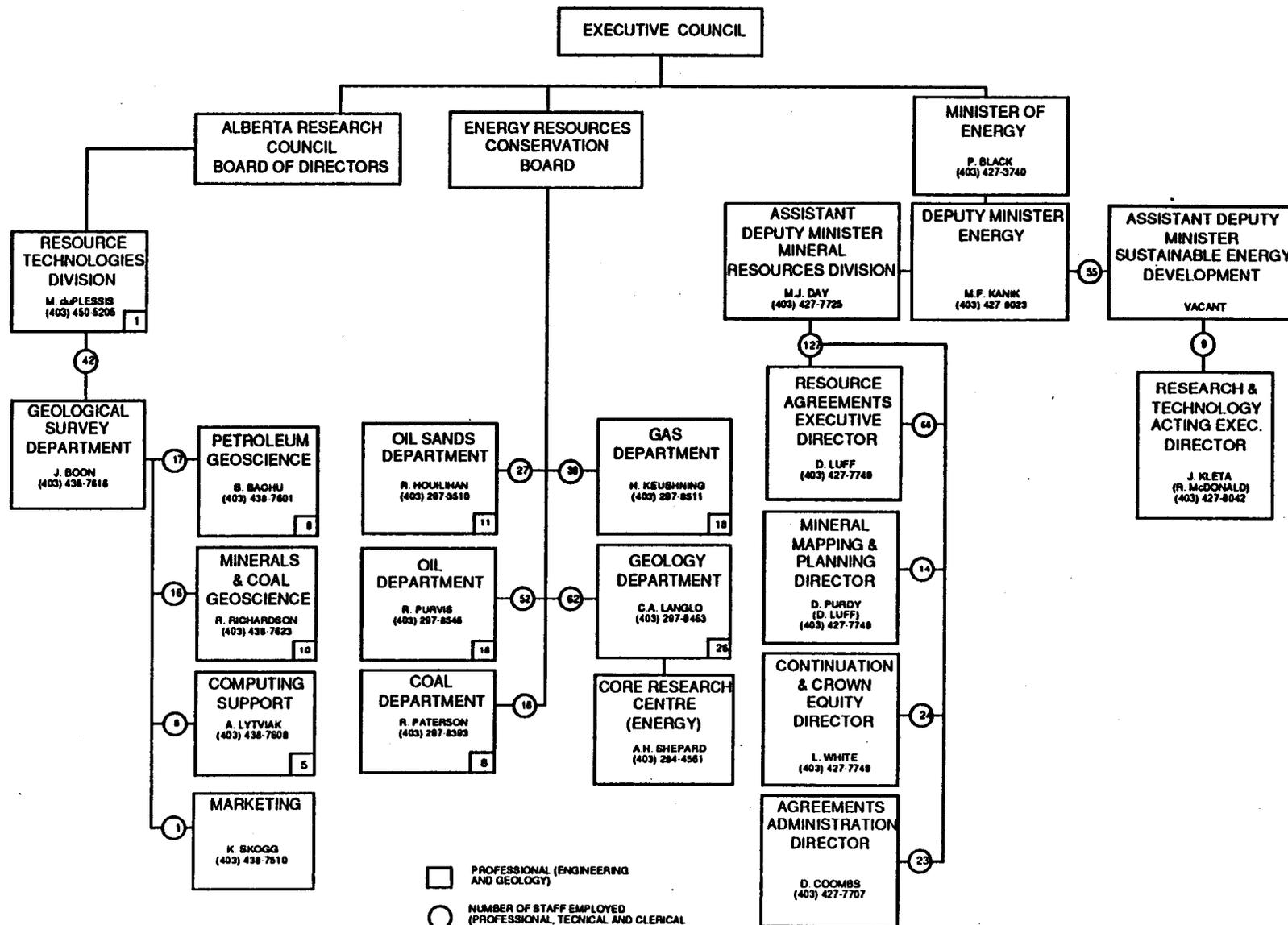
## GEOSCIENCE ORGANIZATION CHARTS

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 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.

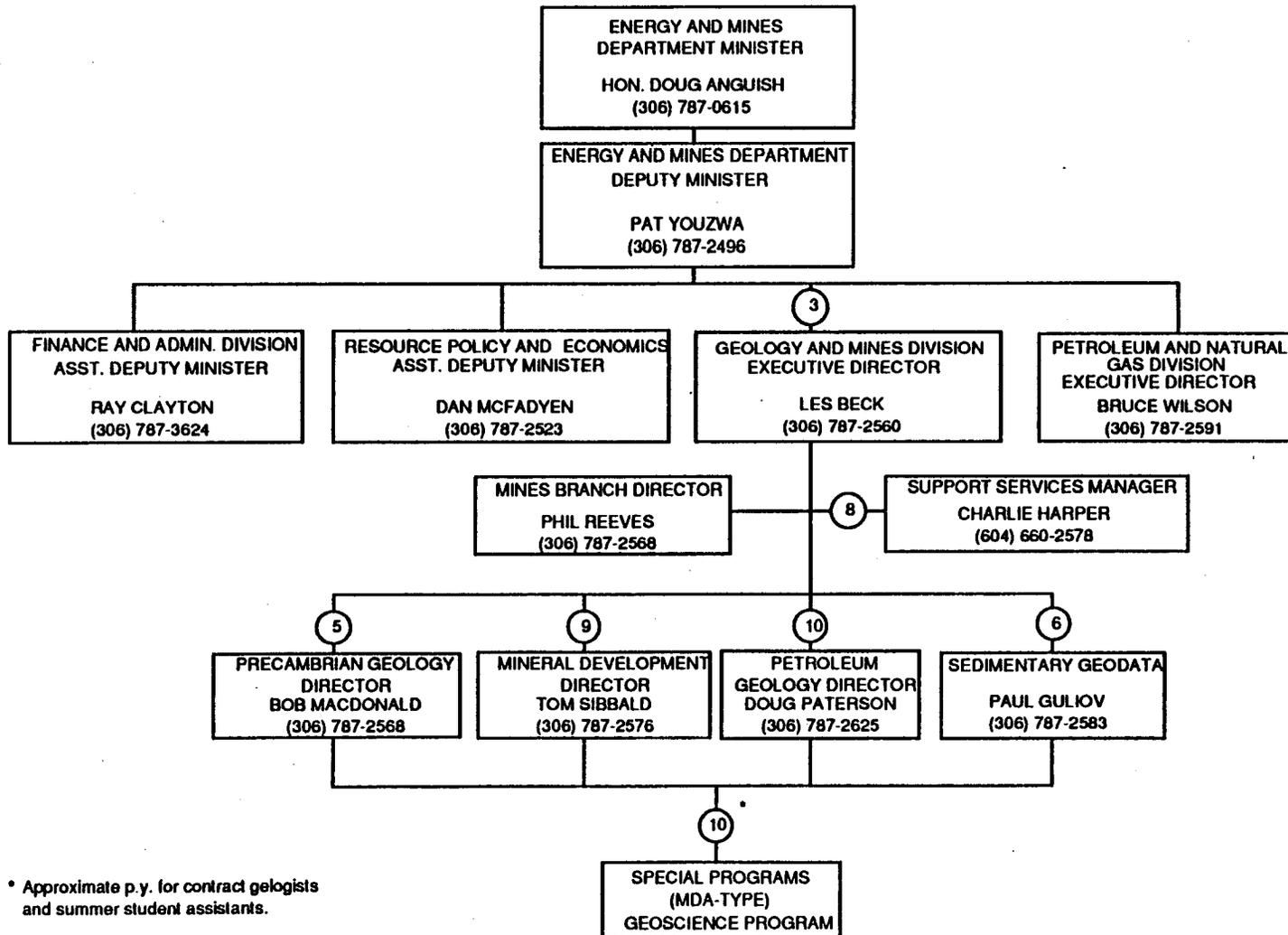
# BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART



# ALBERTA GEOSCIENCE ORGANIZATION CHART



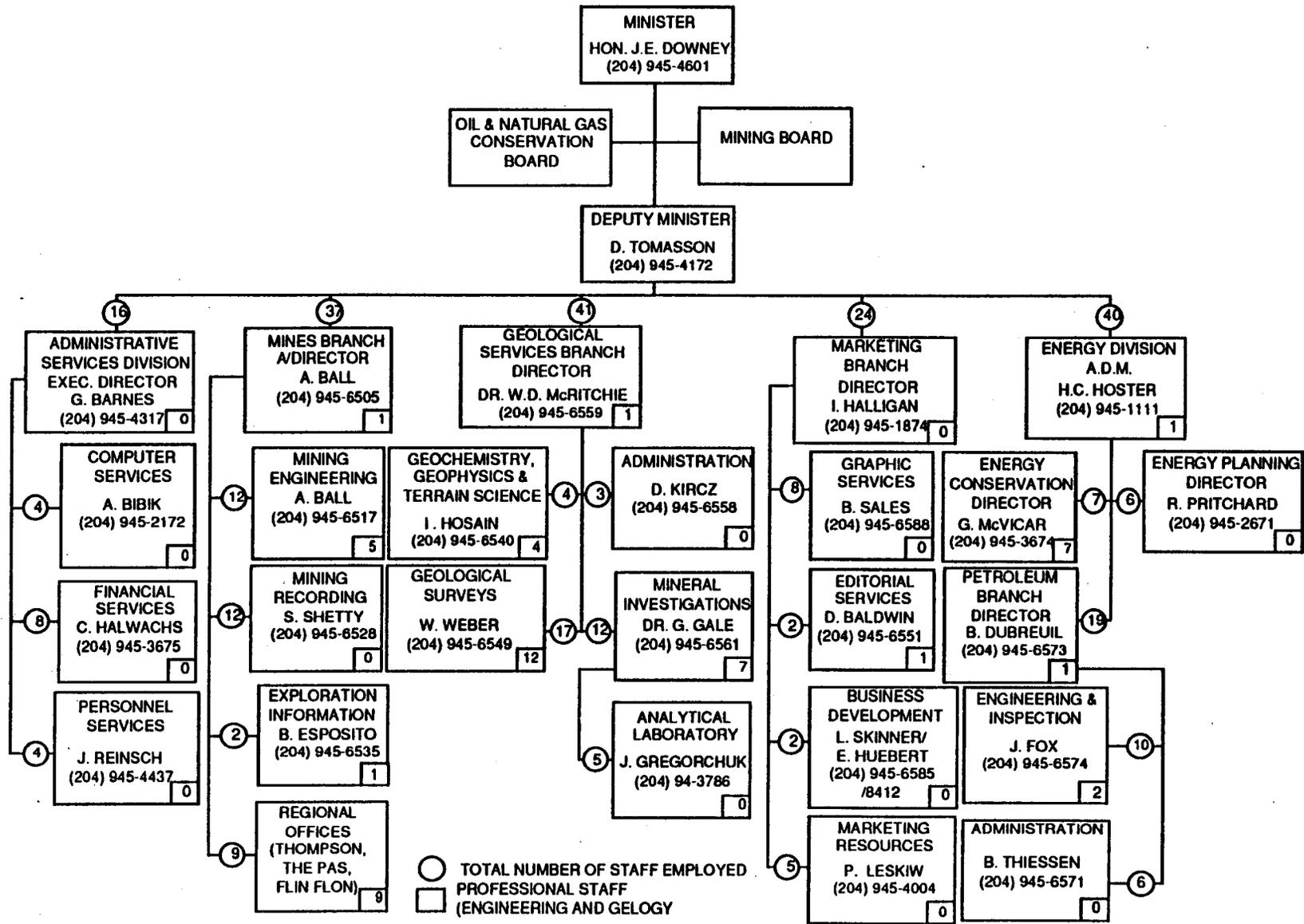
## SASKATCHEWAN GEOSCIENCE ORGANIZATION CHART



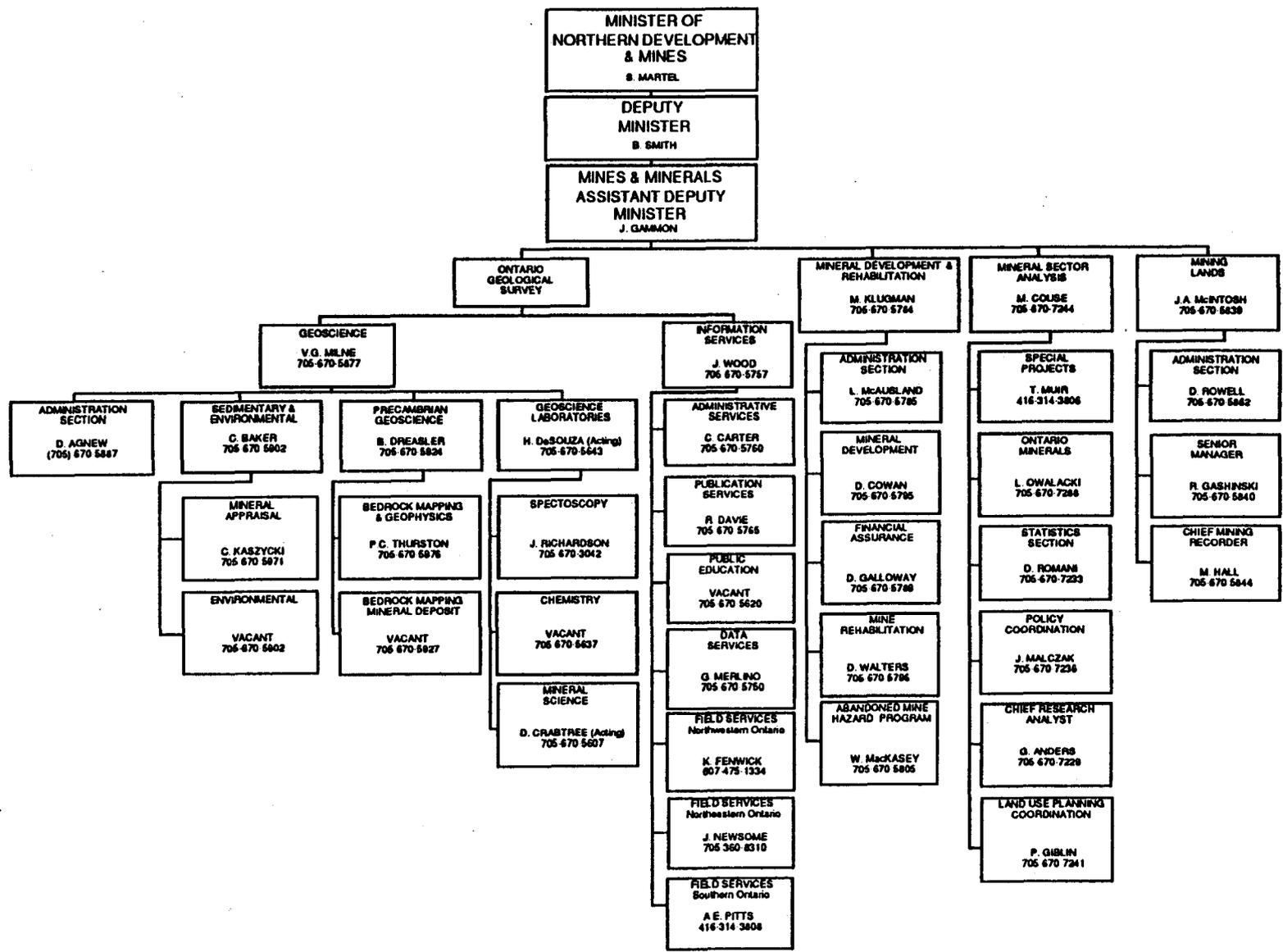
\* Approximate p.y. for contract geologists and summer student assistants.

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

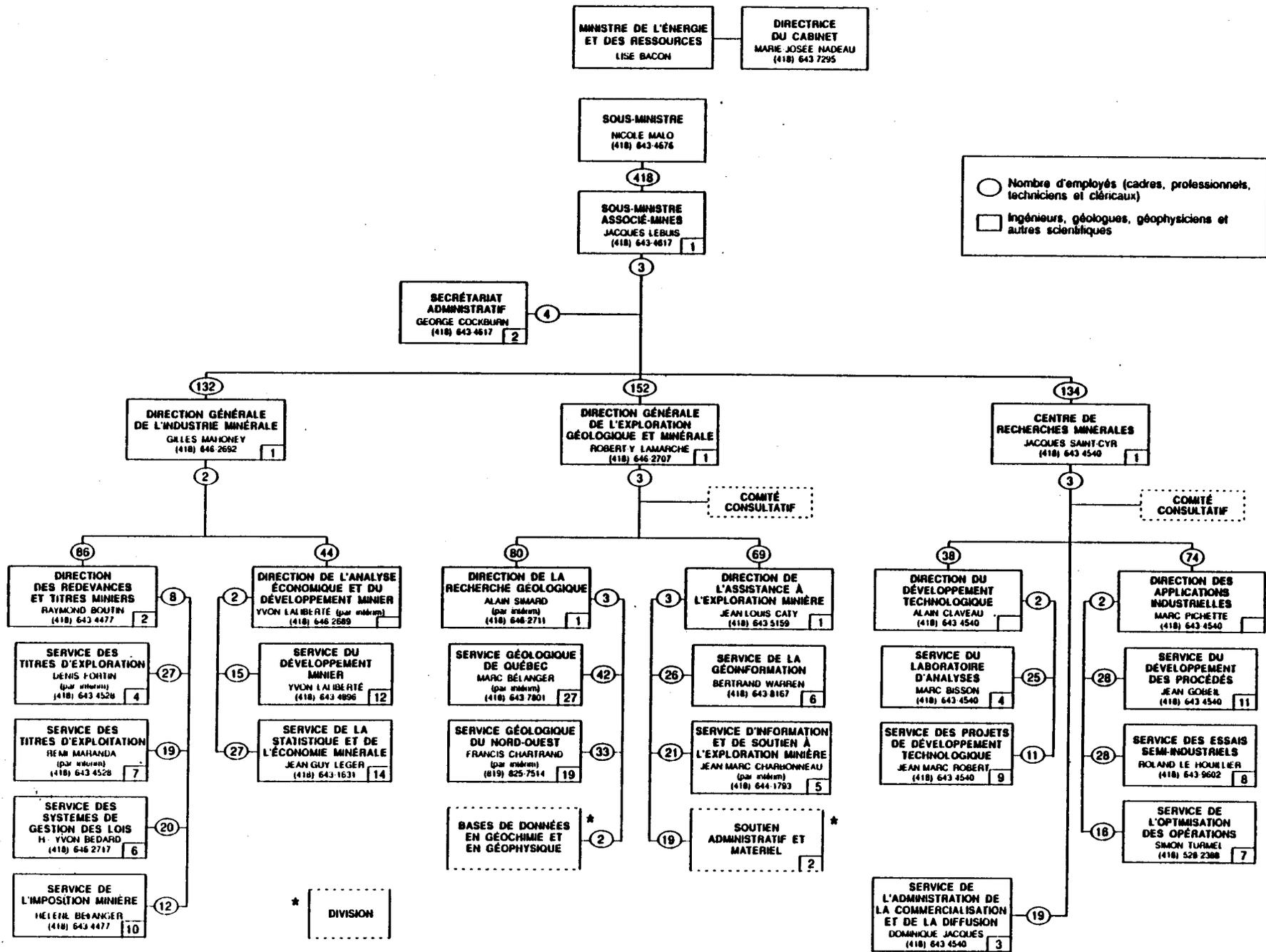
# MANITOBA GEOSCIENCE ORGANIZATION CHART



# ONTARIO GEOSCIENCE ORGANIZATION CHART

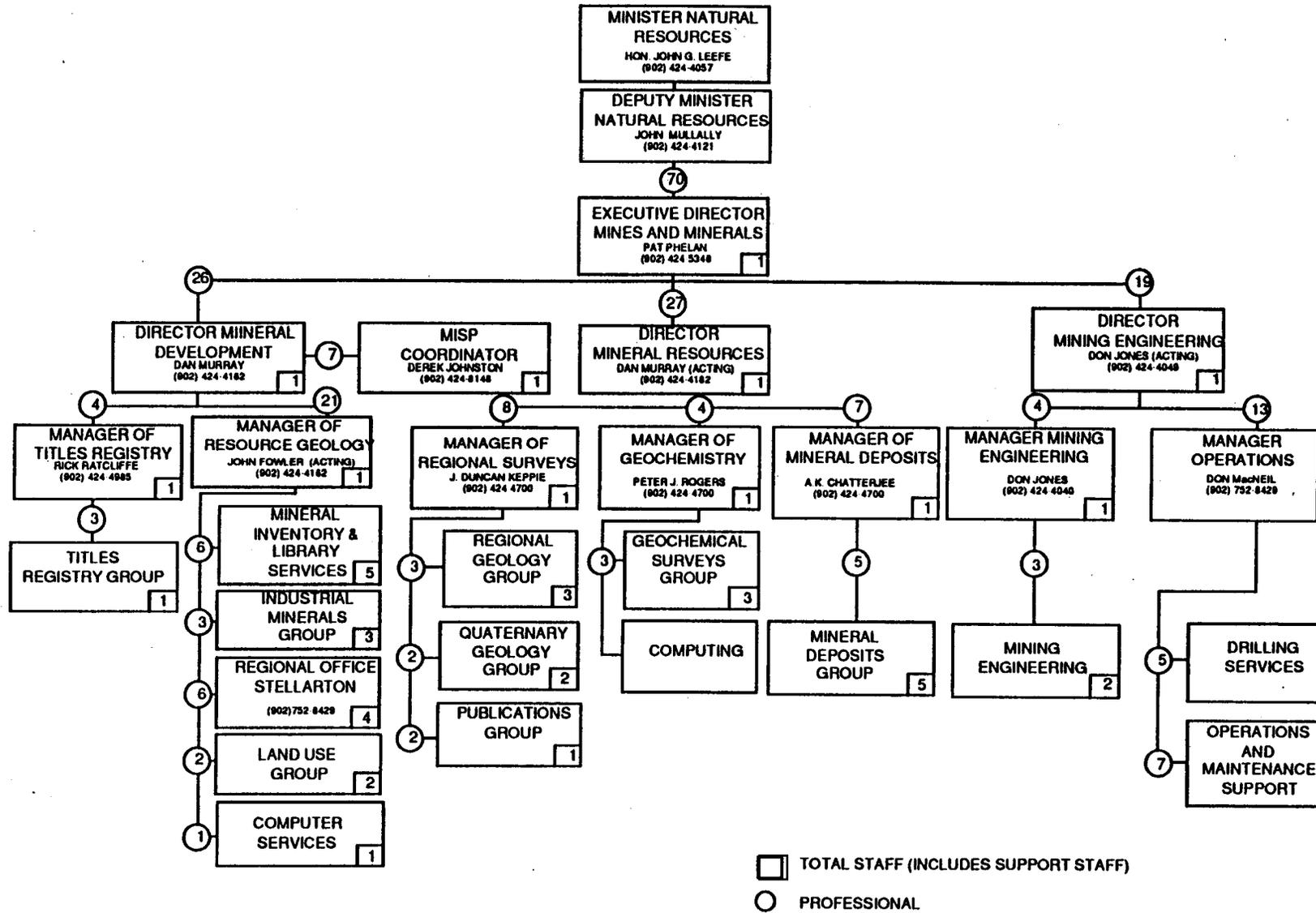


# ORGANIGRAMME DU MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES (MINES) DU QUÉBEC



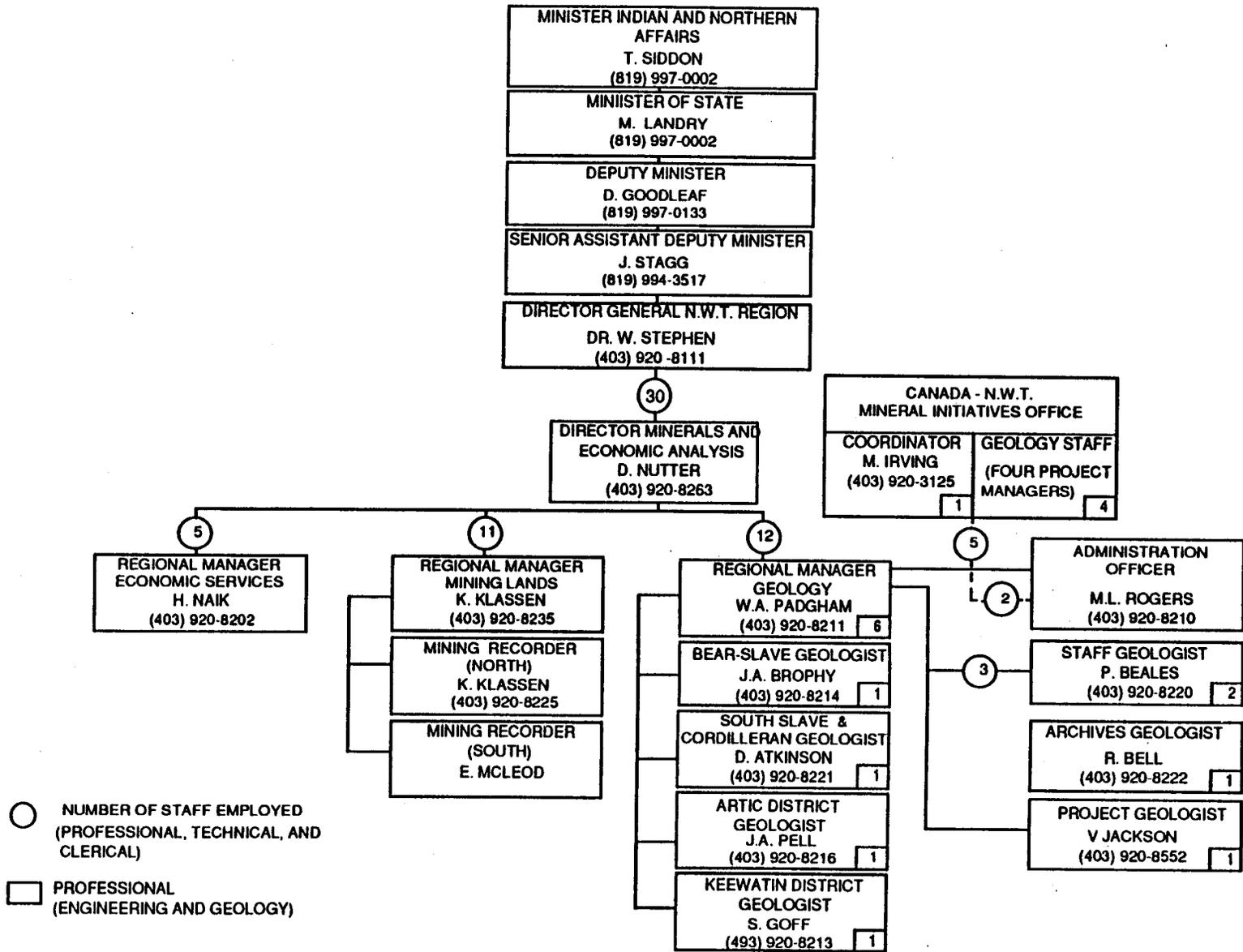


# NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART

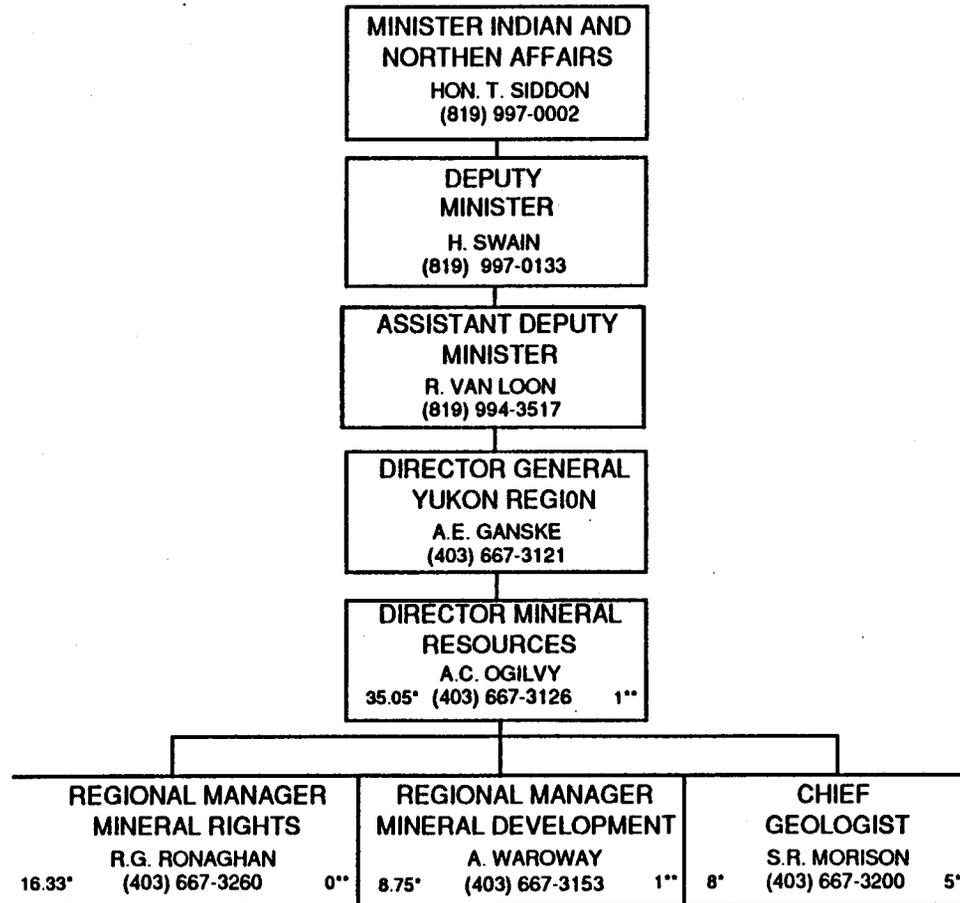




# NORTHWEST TERRITORIES GEOSCIENCE ORGANIZATION CHART



## YUKON GEOSCIENCE ORGANIZATION CHART



\* NUMBER OF STAFF EMPLOYED (PROFESSIONAL, TECHNICAL, AND CLERICAL)  
 \*\* PROFESSIONAL (ENGINEERING AND GEOLOGY)

**PROVINCIAL GEOLOGICAL SURVEY**  
**EXPENDITURES**  
**1991-1992**

**PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES  
1991 - 1992**

SURVEY PROVINCE/ TERRITORY	SURVEY EXPENDITURES \$ X 10 <sup>6</sup>	% OF TOTAL	TOTAL 1991 VALUE OF PROVINCIAL	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF	AREA OF	SURVEY \$ SPENT/KM <sup>2</sup>	POPULATION	\$
			MINERAL PRODUCTION <sup>1</sup> \$ X 10 <sup>9</sup>	PROVINCIAL MINERAL PRODUCTION	PROVINCE/ TERRITORY KM <sup>2</sup> X 10 <sup>3</sup>		(1991) X 10 <sup>5</sup>	SPENT/ CAPITA
NEWFOUNDLAND	5.9	8.6	793 306	.74	405	14.6	568	10.4
NOVA SCOTIA	3.5	5.1	206 627	1.69	55	63.6	900	3.9
PRINCE EDWARD ISLAND	-	-	2 453	-	6	-	130	-
NEW BRUNSWICK	2.4	3.5	582 808	.41	73	32.9	724	3.3
QUÉBEC	16.3	23.6	2 934 229	.56	1 541	10.6	6 896	2.4
ONTARIO	18.9	27.3	4 980 207	.38	1 069	17.7	10 085	1.9
MANITOBA	3.9	5.7	1 014 860	.38	650	6.0	1 092	3.6
SASKATCHEWAN	4.1	5.9	1 178 233	.35	652	6.3	989	4.1
ALBERTA	4.5	6.5	472 290	.95	661	6.8	2 546	1.8
BRITISH COLUMBIA	7.5	10.9	1 906 533	.39	948	7.9	3 282	2.3
YUKON	.7	1.0	346 215	.20	483	1.5	28	25
NORTHWEST TERRITORIES	1.3	1.9	544 681	.24	3 380	.4	58	22.4
<b>TOTALS</b>	<b>69.0</b>	<b>100.0</b>	<b>14 962 442</b>	<b>-</b>	<b>9 923</b>	<b>-</b>	<b>27 298</b>	<b>-</b>

<sup>1</sup>Source: Energy, Mines and Resources Canada; Statistics Canada

PROVINCE: BRITISH COLUMBIA  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	PERMANENT \$	OPERATING EXPENDITURES \$	TOTALS
Chief's Office	GSB (MRD)	EMPR	-	6	-	218 000	290 000	508 000
Vancouver Office	GSB (MRD)	EMPR	3	3	-	120 000	64 000	184 000
Geoscience Grants	GSB (MRD)	EMPR	20	-	-	-	95 000	95 000
Geochemistry	GSB (MRD)	EMPR	4	2	1	183 000	143 000	326 000
Surficial Geology	GSB (MRD)	EMPR	7	3	1	208 000	158 000	364 000
Regional Mapping	GSB (MRD)	EMPR	9	10	5	641 000	597 000	1 238 000
	GSB (MRD)	MDA	2	-	3	180 000	250 000	430 000
Mineral Deposits	GSB (MRD)	EMPR	9	8	5	620 000	425 000	1 045 000
Coal Resources	GSB (MRD)	EMPR	9	6	2.5	339 000	278 000	617 000
Industrial Minerals	GSB (MRD)	EMPR	13	2	1	139 999	142 000	281 000
Graphic Information Systems Project (MRD)	GSB (MRD)	MDA	1	-	1	50 000	25 000	75 000
Mineral Deposits Inventory and Analysis	GSB (MRD)	EMPR	5	7	4	523 000	498 000	1 019 000
District Geology	GSB (MRD)	EMPR	13	7.5	2	537 000	316 000	853 000
Scientific Review/Publications	GSB (MRD)	EMPR	-	5	-	198 000	312 000	510 000
Laboratory Analysis	GSB (MRD)	EMPR	-	6	-	252 000	159 999	411 000
Oil and Gas Inventory and Analysis	PGB (ERD)	EMPR	-	5	-	414 000	63 000	486 000
Petroleum Subsurface Investigations	PGB (ERD)	EMPR	-	3	-	248 000	38 000	286 000
<b>TOTALS</b>								
GSB (MRD)	-	-	-	65.5	23.5	3 978 000	3 473 000	7 451 000
MDA	-	-	-	-	-	230 000	275 000	505 000
PGB (ERD)	-	-	-	8	-	662 000	101 000	763 000

GSB (MRD) - Geological Survey Branch (Mineral Resources Division)  
PGB (ERD) - Petroleum Geological Branch (Energy Resources Division)  
EMPR - Ministry of Energy, Mines and Petroleum Resources  
EMR - Energy, Mines and Resources Canada  
MDA - Canada - B.C. Mineral Development Agreement

PROVINCE: ALBERTA  
1991-1992

SUPPLIES AND SERVICES PROGRAMS	SURVEY		NO. OF PROJECTS (OR FACILITIES)	SALARIES				
	RESEARCH	FUNDING		PERMANENT	CASUAL	PERMANENT	CASUAL	
	AGENCY	AGENCY		SMY	SMY	\$	\$	\$
Chief's Office	ARC/ERCB	ARC/ERCB	4	1.15	-	161 433	-	37 387
Core Repositories	ARC/ERCB	AE	1	1.02	.35	87 720	10 646	16 198
Geological Survey, Bedrock:								
Reconnaissance (1:100 000)	-	-	1	.84	-	78 414	-	14 314
Geophysical	-	-	1	.01	-	621	-	619
Geological Survey, Surficial:								
Reconnaissance (1:100 000)	ARC	ARC/AE	2	.31	-	35 732	-	24 318
Reclamation/Environmental Impact	ARC	CANAG/ALTAAG	-	-	-	-	-	-
		ARC/TRANSALTA						
Hydrogeological	ARC	ARC/AE	5	.48	-	43 213	-	106 322
Information and Education	ARC	ARC/AE	5	1.61	.03	140 734	1 147	35 990
Laboratory Analysis	ARC	ARC/AE	1	1.09	-	92 323	-	5 123
Mineral Deposit Inventory Analysis	ARC	ARC/AE	5	2.27	-	208 024	-	33 541
Energy Resources Inventory and Research:								
Petroleum and Natural Gas	ARC/ERCB	ARC/ERCB/AE	2	3.27	.16	335 639	8 666	43 927
Oil Sands	ARC/ERCB	ARC/AOISTRA AE/ERCB	6	5.87	.30	544 896	10 315	160 801
Coal Geology	ARC	ARC/AE	10	7.71	.32	709 039	19 523	269 934
Stratigraphic Research	ARC/ERCB	ARC/ERCB/AE	1	2.79	-	317 139	-	433 502
Other	ARC/ERCB	ARC/ERCB	5	3.36	-	327 818	-	217 835
<b>TOTALS</b>			<b>49</b>	<b>31.78</b>	<b>1.16</b>	<b>3 082 745</b>	<b>50 297</b>	<b>1 399 811</b>

ARC - Alberta Research Council  
 CANAG - Agriculture Canada  
 AOISTRA - Alberta Oil Sands Technical Research Authority  
 AE - Alberta Department of Energy  
 ALTAAG - Alberta Agriculture  
 ERCB - Energy Resources Conservation Board  
 TRANSALTA - TransAlta Utilities Ltd.

PROVINCE: SASKATCHEWAN  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCIES	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT PY	CASUAL PY	SALARIES			TOTALS
						PERMANENT \$	CASUAL/TEMPORARY \$	OPERATING EXPENDITURES \$	
Administration				15.79	0.25	490 350	13 000	115 200	618 550
SGS:	SGS	SGS	n/a	4.79	0.25	266 350	13 000	41 200	320 550
Divisional	SGS	SGA	n/a	1.33	-	66 000	6 000	15 500	89 850
Precambrian	SGS	SGS	n/a	1.16	0.25	66 000	5 000	9 000	80 000
Mineral Development	SGS	n/a	0.50	-	35 250	-	10 700	45 950	-
Sedimentary Geodata	SGS	SGS	n/a	0.40	-	27 000	-	1 000	28 000
Petroleum Geology	SGS	SGS	n/a	1.00	-	47 000	-	2 500	49 500
Support Services	SGS	SGS	n/a	0.40	-	25 100	-	2 500	27 800
SRC:	SRC	SRC	n/a	11.00	-	224 000	-	74 000	295 000
Core Repositories				5.30	0.30	135 400	14 200	60 800	210 400
Phanerozoic	SGS	SGS	1	5.00	-	135 400	7 000	49 000	191 400
Precambrian	SGS	SGS	1	0.30	0.30	-	7 200	11 800	19 000
Surficial/drift prospecting	SRC	SRC	2	0.30	-	28 000	-	40 000	68 000
Geological Surveys, Bedrock	SGS	SGS	6	2.10	7.75	117 300	206 000	153 640	476 940
Detailed (typically 1:20 000)	SGS	SGS	5	2.00	7.25	110 000	192 000	153 640	455 640
Reconnaissance (1:100 000)	SGS	SGS	-	-	-	-	-	-	0
Compilation (1:250 000 or less)	SGS	SGS	-	0.10	0.50	7 300	14 000	-	21 300
Geological Surveys, Surficial	SRC	SRC	2	1.00	-	86 000	-	43 000	129 000
Geophysical Surveys				3	0.60	40 128	13 482	41 000	94 610
	SRC	SRC	2	0.30	-	17 128	13 482	25 000	55 610
	SRC	SRC	1	0.30	-	23 000	-	16 000	39 000
Hydrogeological Surveys	SRC	SRC	4	2.50	-	208 000	-	55 000	263 000
Information and Education	SGS	SGS	1	1.00	0.30	65 280	-	25 280	90 560
Laboratory Analyses and Studies:				5	1.30	23 000	0	74 000	97 000
Isotope/Geochronology	Various	SGS	2	-	-	-	-	47 000	47 000
Enhanced geomagnetics	SGS	SGS	-	-	-	-	-	-	0
Other	SGS	SGS	-	1.00	-	-	-	10 000	10 000
Mineral Deposit Inventory/Compilation	SRC	SRC	3	0.30	-	23 000	-	17 000	40 000
Metallic	SRC	SRC	5	2.43	1.70	114 925	49 468	7 200	171 593
Industrial	SGS	SGS	1	2.40	1.20	112 900	21 000	7 200	141 100
	SGS	SGS	1	0.03	0.50	2 025	28 468	-	30 493
	SRC	SRC	3	-	-	-	-	-	0
Oil and Gas Inventory and Analysis			n/a	See Pet Nat Gas	-	-	-	-	-
Publications/Cartography			7	7.00	1.50	325 827	54 060	143 239	526 126
General	SGS	SGS	n/a	6.60	1.00	289 327	36 060	102 750	428 137
Computerization	SGS	SGS	5	0.20	0.50	14 500	18 000	22 989	55 489
	SRC	SRC	2	0.20	-	25 000	-	17 500	42 500
Resident Geologist Offices	SGS	SGS	1	2.00	-	109 400	-	18 000	127 400
Subsurface (Stratigraphic) Studies				7	1.00	295 701	25 204	47 000	367 905
	SGS	SGS	5	4.00	1.00	229 701	25 204	19 000	273 905
	SRC	SRC	2	0.70	-	66 000	-	28 000	94 000
Water Resource Inventory and Analysis	SRC	SRC	7	2.20	-	258 000	-	105 000	363 000
Mineral Deposit Studies				18	3.35	190 792	108 934	259 801	559 827
Metallic	Various	SGS	8	0.50	0.60	30 200	17 100	127 900	175 000
Industrial Minerals/Kimberlite	Various	SGS	5	1.27	2.25	60 592	91 834	71 901	224 327
Metallic		SRC	5	1.00	0.50	100 000	-	60 000	160 000
Industrial Minerals/Kimberlite		SRC	2	0.50	-	25 000	-	56 000	81 000
<b>Totals</b>			<b>69</b>	<b>44.59</b>	<b>18.85</b>	<b>2 535 432</b>	<b>505 034</b>	<b>1 121 871</b>	<b>4 095 811</b>

SGS - Saskatchewan Geological Survey  
SRC - Saskatchewan Research Council

PROVINCE: MANITOBA  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL/TERM SMY	SALARIES		OPERATING EXPENDITURES \$	TOTAL
						PERMANENT \$	CASUAL \$		
Core Repositories	MGB	MAN	3	.26	-	27 600.00	0.00	34 800.00	62 400.00
Geochemical Surveys									
Bedrock	-	-	-	-	-	-	-	-	-
Soil	MGS	MAN	1	1.0	.47	58 200.00	21 800.00	25 000.00	105 000.00
Vegetation	MGS	MAN	1	1.0	-	58 200.00	-	28 000.00	86 200.00
Geological Surveys, Bedrock									
Precambrian									
Reconnaissance (1:100 000)	-	-	-	-	-	-	-	-	-
Detailed (1:50 000 and larger)	MGS	MAN	9	7.26	1.0	356 000.00	21 100.00	73 500.00	450 600.00
Phanerozoic	MGS	MAN	3	1.0	.13	44 800.00	4 000.00	13 800.00	62 600.00
Geological Surveys, Surficial									
Reconnaissance (1:50 000)	-	-	-	-	-	-	-	-	-
Detailed (1:50 000)	-	-	-	-	-	-	-	-	-
Geophysical Surveys									
Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
Airborne Magnetic, Gradiometer	MGS	MAN	1	1.0	-	54 500.00	-	24 000.00	78 500.00
Ground Magnetic	-	-	-	-	-	-	-	-	-
Gravity	-	-	-	-	-	-	-	-	-
Seismic	-	-	-	-	-	-	-	-	-
Hydrogeology	MWR	MAN	2	4.0	-	188 000.00	-	65 000.00	253 000.00
Information, Education, Assessment Services and Compilation	MGS	MAN	5	6.0	-	227 500.00	-	21 100.00	248 600.00
Laboratory Analysis	MGS	MAN	3	8.0	.26	289 700.00	-	58 200.00	347 900.00
Mineral Deposit Inventory and Analysis	MGS	MAN	7	5.0	1.26	248 200.00	35 300.00	67 700.00	351 200.00
Industrial Minerals	MGS	MAN	3	3.0	.13	120 200.00	4 900.00	14 300.00	139 400.00
Oil, Gas Inventory and Analysis	MP	MAN	2	1.08	-	75 300.00	-	20 000.00	95 300.00
Publications	MGS	MAN	2	2.0	-	85 600.00	-	41 600.00	127 200.00
Resident Geologist's Office	MGS	MAN	2	1.26	.26	71 000.00	-	12 500.00	83 500.00
Subsurface Invest, Indust Min Drilling and Management	MGS	MAN	4	1.26	1.26	76 000.00	36 300.00	43 000.00	155 300.00
Water Resource Inventory and Analysis	MWR	MAN	1	7.0	-	262 000.00	-	80 000.00	342 000.00
Other:									
Administration	MGS	MAN	-	5.0	2.0	201 100.00	53 000.00	149 000.00	403 100.00
Drafting	MGS	MAN	-	9.0	-	343 000.00	-	19 300.00	362 300.00
Computerized Data Capture	MGS	MAN	4	4.0	0.08	137 100.00	1 500.00	35 700.00	174 300.00
<b>TOTALS</b>				<b>69.08</b>	<b>8.29</b>	<b>2 924 000.00</b>	<b>177 900.00</b>	<b>826 500.00</b>	<b>3 928 400.00</b>

MGS - Manitoba Geological Services Branch  
MP - Manitoba Petroleum Branch  
MWR - Manitoba Water Resources

PROVINCE: ONTARIO  
1991-1992

PROGRAMS	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERSON-YEARS		SALARIES		OPERATING EXPENDITURES \$	TOTALS \$
			PERMANENT	CASUAL	PERMANENT \$	CASUAL \$		
Administration (Director's Office OGS)	MNDM	-	8	2.5	474.0	76.8	603.3	1 154.1
Drill Core Libraries	MNDM	7	11	-	484.5	-	127.7	612.2
Geophysical Surveys/Research	MNDM	5	7	2.0	552.6	44.7	310.0	907.3
Geochemical Surveys/Research	MNDM	3						
Geological Surveys:								
Precambrian	MNDM	33	26	20.0	1 986.5	378.1	1 011.2	3 375.8
Phanerozoic	MNDM	2						
Quaternary	MNDM	10	19	4.0	957.0	171.8	310.0	1 438.8
Aggregate	MNDM	10						
Geoservices (OGS)	MNDM							
Administration, Vehicles, Equipment	MNDM	-	4	1.0	208.0	30.0	450.0	688.0
Publications	MNDM	-	10	8	553.3	217.1	1 174.8	1 945.2
Information, Education								
Library, Assessment Files	MNDM	-	12	4.0	770.2	65.0	639.2	1 474.4
Laboratory Analysis	MNDM	-	30	-	1 390.1	-	530.9	1 921.0
Resident Geologist's Office	MNDM	15	59	4.0	2 812.0	94.5	696.8	3 603.3
Geoscience Research Grants Programs	MNDM	22	-	-	-	-	581.8	581.8
Other Geological Research Grants	MNDM	13	-	-	-	-	650.0	650.0
NODA	CAN/ONT	8	-	9.5	-	384.0	180.7	564.7
<b>TOTALS</b>			<b>186</b>	<b>55.0</b>	<b>10 188.2</b>	<b>1 462.0</b>	<b>7 266.4</b>	<b>18 916.6</b>

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

PROVINCE: QUÉBEC  
1991-1992

PROGRAMMES	MAÎTRE D'OEUVRE	FINANCEMENT	NOMBRE DE PROJETS OU D'INSTALLATIONS	EMPLOYÉS PERMANENTS PERS.-ANNÉE (C-P-A-)**	EMPLOYÉS OCCASIONNELS PERS.-ANNÉE	BUDGET ALLOUÉ \$
Levés géologiques	-	-	-	-	-	-
1) Côte-Nord et Nouveau-Québec	DGEGM	MER	14	6P-1A	1	1 403 100
2) Montréal-Laurentides	DGEGM	MER	9	3P-3A	-	388 700
3) Gaspésie-Les Îles	DGEGM	MER	7	4P-2A	-	549 100
4) Estrie-Laurentides	DGEGM	MER	13	5P-2A	2	1 013 000
5) Minéraux Industriels du Québec	DGEGM	MER	2	3P-1A	-	212 300
6) Rouyn-Noranda	DGEGM	MER	18	3P-3A	-	867 800
7) Val-d'Or	DGEGM	MER	13	3P-3A	1	896 100
8) Chibougamau	DGEGM	MER	11	3P-3A	1	1 130 100
Bases de données	DGEGM	MER	-	2A	-	552 700
Supervision et contrôle	DGEGM	MER	-	2C-16P-9A	1	900 700
Gestion et planification	DGEGM	MER	-	2C-2P-2A	1	440 900
Opérations (équipement de terrain informatique, etc)	DGEGM	MER	-	2P-17A	3	1 015 000
Assistance financière	DGEGM	MER/EMR*	120	1P	-	1 142 000
Géoinformation	DGEGM	MER	-	2C-5P-18A	3	3 854 200
Information géoscientifique	DGEGM	MER	-	1C-5P-14A	4	1 295 400
Gestion interne	DGEGM	MER	-	2C-1A	-	491 800
Communication	DGEGM	MER	-	1A	-	150 000
<b>TOTAUX</b>	-	-	-	<b>9C-61P-82A</b>	<b>17</b>	<b>16 302 900</b>

DGEGM - Direction générale de l'exploration géologique et minérale

MER - Ministère de l'Énergie et des Ressources du Québec

EMR - Energy, Mines and Resources, Ottawa

\* - Entente auxiliaire Canada-Québec sur le développement minéral

\*\* - C = cadre

P = professionnel

A = autre

PROVINCE: NEW BRUNSWICK  
1991-1992

PROGRAMS	AGENCY	NO. OF PROJECTS	PERMANENT	STAFF CASUAL	CONTR.	SALARIES	OPERATING	TOTALS
Geophysics	GSB	1	-	-	-	-	21 600	21 600
Geological Surveys	GSB	-	-	-	-	-	-	-
Bedrock	GSB	5	8.0	1.25	-	338 000	267 000	545 000
Surficial	GSB	1	1.0	1.25	-	60 800	28 200	87 000
Geochemical Surveys	GSB	-	-	-	-	-	-	-
Till	GSB	1	0.5	-	-	25 000	-	25 000
Drainage	GSB	1	2.5	0.25	-	123 000	123 000	185 000
Mineral Deposits	GSB	2	1.5	0.25	-	-	-	132 000
Regional Offices	GSB	2	2.0	0.25	-	60 000	50 000	-
Geoscience Information System	GSB	1	0.5	-	-	24 000	40 000	64 000
Diamond Drill Core Mangement	GSB	3	0.5	-	-	44 000	17 000	61 000
Publications (Editorial)	GSB	1	1.0	-	-	45 755	4 945	50 700
Grants to Prospectors	GSB	1	0.5	-	-	-	-	63 000
Prospecting Courses	GSB	2	-	-	-	-	9 000	9 000
Directors Office	GSB	1	2.0	-	-	89 723	19 662	109 400
Information, Education	PAB	3	3.0	-	-	106 000	16 000	122 000
Industrial Minerals	MDB	3	2.0	-	-	120 000	22 000	142 000
Peat Resources	MDB	1	1.0	-	-	49 000	10 500	59 500
Coastal Zone	MDB	1	1.0	-	-	36 000	10 500	46 500
Coal, Oil, Gas, Oil Shale	ERB	2	1.0	-	-	86 000	50 000	144 000
Canada-New Brunswick Agreement	GSB	8	-	1.75	8	257 000	195 000	452 000
<b>TOTALS</b>			<b>28.0</b>	<b>5.50</b>	<b>8</b>	<b>1 477 800</b>	<b>882 407</b>	<b>2 359 400</b>

GSB - Geological Surveys Branch  
MDB - Mineral Development Branch  
PAB - Planning and Administration Branch  
ERB - Energy Resources Branch

PROVINCE: NOVA SCOTIA  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT STAFF MAN-YEARS	CASUAL STAFF MAN-YEARS	BUDGET ALLOCATIONS \$
Core Repositories	NSDME	NSDME/NSDITT	3	5	1	216 800
Geochemical Surveys:	NSDME	NSDME/NSDITT	1	4	-	313 300
Bedrock	-	-	-	-	-	-
Drainage	-	-	-	-	-	-
Soil	-	-	-	-	-	-
Geological Surveys, Bedrock:						
Reconnaissance (1:100 000)	-	-	-	-	-	-
Detailed (1:50 000)	NSDME	NSDME/NSDITT	3	4	-	267 600
Geological Surveys, Surficial:						
Reconnaissance (1:100 000)	-	-	-	-	-	-
Detailed (1:50 000)	NSME	NSME/NSDITT	1	2	-	114 700
Geophysical Surveys:						
Airborne Radiometrics	-	-	-	-	-	-
Airborne Magnetic (includes VLF-EM)	-	-	-	-	-	-
Ground Magnetic	-	-	-	-	-	-
Gravity	-	-	-	-	-	-
Seismic	-	-	-	-	-	-
Hydrogeological Surveys						
Information and Education	NSDME	NSDME/NSDITT	4	1	2	116 200
Laboratory Analysis	-	-	-	-	-	-
Mineral Deposit Analysis	NSDME	NSDME/NSDITT	8	10	2	812 900
Coal and Peat	NSDME	NSDME/NSDITT	3	3	-	397 000
Oil and Gas Inventory and Analysis	NSDME	NSDME/NSDITT	2	3	-	577 400
Publications	NSDME	NSDME/NSDITT	N/A	6	-	225 500
Resident Geologist's Office	NSDME	NSDME	N/A	2	-	123 200
Subsurface Investigations	NSDME	NSDME	N/A	4	-	363 900
<b>TOTALS</b>	-	-	<b>25</b>	<b>45</b>	<b>5</b>	<b>3 528 500</b>

NSDME = Nova Scotia Department of Mines and Energy  
NSDITT = Nova Scotia Department of Industry, Trade and Technology

PROVINCE: NEWFOUNDLAND  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT <sup>1</sup> SMY	CASUAL SMY	PERMANENT \$	SALARIES CONTRACT <sup>1</sup> \$	CASUAL \$	OPERATING EXPENDITURES \$
Director's Office	NDME	NDME/DEMR	4	9	1	233 777	65 069	3 563	176 785
Core Repositories	NDME	NDME	1	3	1	93 026	15 315	4 695	42 859
Geochemical Surveys:									
Bedrock	-	-	-	-	-	-	-	-	-
Drainage	NDME	NDME/DEMR	7	4	4	160 018	38 784	15 493	167 719
Soil	-	-	-	-	-	-	-	-	-
Geological Surveys, Bedrock:									
Reconnaissance (1:100 000)	NDME	NDME/DEMR	9	9	10	264 446	104 665	60 338	470 871
Detailed (1:50 000)	NDME	NDME/DEMR	17	12	8	325 812	246 116	51 632	230 593
Geological Surveys, Surficial:									
Reconnaissance (1:100 000)	-	-	-	-	-	-	-	-	-
Detailed (1:50 000)	NDME	NDME/DEMR	5	6	3	145 802	100 867	23 865	96 869
Geophysical Surveys:									
Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
Airborne Magnetic	-	-	-	-	-	-	-	-	-
Ground Magnetic	NDME	NDME/DEMR	2	2	-	-	81 251	-	6 271
Gravity	-	-	-	-	-	-	-	-	-
Seismic	-	-	-	-	-	-	-	-	-
Radiometric	-	-	-	-	-	-	-	-	-
Hydrogeological Surveys	-	-	-	-	-	-	-	-	-
Information and Education	NDME	NDME	6	12	-	290 836	163 667	-	224 315
Laboratory Analysis	NDME	NDME	4	8	-	288 866	-	-	269 651
Mineral Deposit Inventory and Analysis	NDME	NDME/DEMR	11	14	5	341 038	298 092	32 315	203 864
Publications	NDME	NDME	4	10	1	282 541	50 026	10 825	249 470
Resident Geologist's Office	-	-	-	-	-	-	-	-	-
Subsurface Investigations	-	-	-	-	-	-	-	-	-
Water Resource Inventory and Analysis	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
<b>TOTALS</b>	-	-	<b>70</b>	<b>89</b>	<b>33</b>	<b>2 426 182</b>	<b>1 163 852</b>	<b>2 02 726</b>	<b>2 139 267</b>
<b>Grand Total</b>							<b>5 392 027</b>		

<sup>1</sup>Includes long-term temporary staff

NDME - Newfoundland Department of Mines and Energy

DEMR - Department of Energy, Mines and Resources, Canada

PROVINCE: NORTHWEST TERRITORIES  
1991-1992

PROGRAMS <sup>2</sup>	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES <sup>1</sup>		OPERATING EXPENDITURES \$
						PERMANENT \$	CASUAL/ TEMPORARY \$	
Head Office (Administration, General Support)	NWT GD	DIAND	1	5.4	-	260	-	120
Head Office (Administration, General Support)	MIO	MIO*	1	-	1.5	-	-	217
Head Office (Administration, General Support)	NWT GD	DIAND	1	0.1	.3	10	-	5
Core Repositories	-	-	-	-	-	-	-	-
Geological Surveys:								
Bedrock (1:50 000)	NWT GD	DIAND	6	1.0	2.5	60	100	152
Bedrock (1:50 000)	MIO	MIO*	3	-	6.	-	-	535
Surficial (1:50 000)	NWT GD	DIAND	4	0.1	-	5	-	5
Education	NWT GD	DIAND	-	0.1	-	25	-	5
Education	MIO	MIO*	-	-	-	-	-	0
Laboratory Analysis	NWT GD	DIAND	-	-	-	-	-	15
Mineral Deposit Inventory and Analysis	NWT GD	DIAND	-	1.3	-	50	-	109 800
Mineral Deposit Inventory and Analysis	MIO	MIO*	2	-	2.3	-	-	0
Publications	NWT GD	DIAND	9	2.5	1.1	125	57	20
Publications	MIO	MIO*	3.3 <sup>3</sup>	-	0.9	-	-	0
Other:								
Prospectors' Assistance	NWT GD	DIAND	-	0.5	.1	10	-	0
Geological Contracts	NWT GD	DIAND	9	-	-	-	-	76
MIO Contracts	MIO	MIO*	2	-	-	-	-	0
<b>NWT GD Totals</b>	-	-	-	<b>11.</b>	<b>4.</b>	<b>520</b>	-	<b>502 800</b>
<b>MIO Totals</b>	-	-	-	-	<b>10.7</b>	-	<b>157</b>	<b>752</b>
<b>GRAND TOTALS (Geoscience)</b>	-	-	-	<b>11.</b>	-	-	-	-
<b>GSC managed Canada-NWT MIO Projects</b>	-	-	<b>11</b>	-	<b>14.4</b>	<b>520</b>	-	<b>1 254 800</b>
	-	-	-	-	-	-	<b>157</b>	<b>1 080</b>

NWT GD - Northwest Territories Geology Division (DIAND)  
MIO - Mineral Initiatives Office (Canada-NWT Government)  
MIO\* - Funding 70% DIAND - 30% GNWT

1. MIO personnel expenditures are included in O&M.
2. Geoscience only.
3. 13 MIO Reports and 19 Geological information folios available through NWT GS Archives Section.

PROVINCE: YUKON  
1991-1992

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT PY	CASUAL PY	SALARIES		OPERATING EXPENDITURES \$
						PERMANENT \$	CASUAL \$	
Head Office (Administration, General Support)	INA	INA	1.0	2.75	-	120 000	-	134 000
Core Repositories	INA	INA	1.0	0.25	0.25	8 750	6 000	17 000
Geological Surveys Bedrock: (1:50 000) and Laboratory Analysis	INA	INA	2.0	1.25	0.17	62 500	4 000	59 000
Geological Surveys, Surficial	INA	INA	1.5	0.50	0.50	25 000	12 000	19 500
Education Public	INA	INA	3.0	0.25	-	12 500	-	8 500
Thesis	INA	INA	2.0	0.00	0.50	-	12 000	9 500
Yukon MINFILE	INA	INA	1.0	1.00	0.25	42 500	4 000	16 500
Mineral Deposit Inventory	INA	INA	4.0	1.00	-	50 000	-	22 500
Publications	INA	INA	12.0	1.00	-	50 000	-	12 250
<b>TOTAL</b>	-	-	<b>27.5</b>	<b>8.00</b>	<b>1.67</b>	<b>371 250</b>	<b>38 000</b>	<b>299 500</b>

INA - Indian and Northern Affairs Canada

**NOTES**

**GEOLOGICAL PROGRAM HIGHLIGHTS**

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

### **INTRODUCTION**

The B.C. Geological Survey had a dual program focus in 1992-93; economic development and resource management/land-use planning. In the past, the Branch's geoscience programs were directed largely to resource development needs. While this continues to be the main thrust of the program, in 1992/93 the Branch responded to the broader needs of the new NDP Government for information on the Province's mineral resources and mineral potential for integrated resource planning.

### **BUDGET**

The 1992/93 base budget for the Branch was reduced by \$490 000 to \$6.96 million. It was supplemented by \$732 000 from the 1991-1995 Canada-BC Mineral Development Agreement to deliver a number of economic development projects, and by \$900 000 from a new inter-ministry program, named the Corporate Resource Inventory Initiative (CRII), designed to prepare strategic level 1:250 000-scale inventory maps to support land-use planning initiatives.

The base budget reduction resulted in suspension of the British Columbia Geoscience Research Program which offered grants to university researchers, and elimination of the Branch's new created "Outreach" Program.

### **PROGRAM HIGHLIGHTS**

The Branch maintained a vigorous and diverse program of field work and related research in 1992. Highlights include:

Eight 1:50 000-scale geological mapping programs were undertaken: 2 in the Stikine district of NW British Columbia, 2 in the northern Quesnel Trough, 2 in the Central Interior Plateau, 1 on northern Vancouver Island and 1 in the sensitive Tatshenshini area in the northwest corner of the Province. The latter was undertaken to determine the mineral potential of the region, which includes the controversial Windy Craggy Cu-Co deposit. This information is required by the Government's Commission on Resources and the Environment which is charged with developing a land-use plan for the area by 1993.

A multi-disciplinary geoscience program in the Interior Plateau, funded largely by the MDA, and designed to assess the mineral potential of this heavily drift covered region. The program involved geological and surficial mapping and research in lake-sediment geochemistry and involved GSB and GSC geologists.

A placer program to locate buried deposits in the Cariboo. Models of placer deposition in the area developed by GSB staff were successfully tested using ground penetrating radar, by GSC scientists, and verified by follow-up drilling.

Completion of a study of magnesite deposits in Cambrian carbonates in the Rocky

## Mountains.

Assessment of the potential for graphite deposits in the Coast Plutonic Complex, and talc in the Rockies.

Continuation of a regional study to examine intrusion related hydrothermal systems transitional between porphyry copper and epithermal settings. These favourable targets for copper-gold-silver deposits are characterized by advanced argillic alteration, sulphate mineralization and enargite. Field work in 1992 was conducted in the Vancouver Island copper belt, Taseko River and Contileves Ranges areas.

Evaluation of the gold potential of a poorly known and under explored belt of oceanic Cache Creek rocks in the Stuart Lake area. This work utilized a model for listwanite gold deposits developed by staff geologists working in the Atlin area.

Completion of the Peace River coal field mapping project. This project covered fourteen 1:50 000 map sheets over the past 7 years.

An international meeting on coal and coalbed methane was hosted by the Branch in Parksville in February, 1992.

## NEW INITIATIVES

The major new initiative for the Branch in 1992/93 was a 3 year program to prepare 1:250 000-scale mineral potential maps for the entire province. A workshop on the subject was held in Victoria in April which attracted experts from USGS, GSC, and BC explorationists. From this workshop a methodology was established. It is based on the USGS Tongass method and utilizes a GIS system. The first areas for evaluation include Vancouver Island, the Kootenays, and the Cariboo Mountains.

## PROSPECTOR TRAINING AND DISTRICT SERVICES

District Geology staff were involved more on land-use planning and less on providing traditional services to explorationists. Early in the year, the District Geologists were involved almost on a full-time basis on "Parks and Wilderness for the 90s", a public planning process to double the number of parks and protected areas in British Columbia. Later, with the introduction of the Government's Protected Area Strategy planning process, District Geologists are again playing a key role.

The annual Advanced Prospecting Course planned for April, 1992 was cancelled due to a lack of registrants, reflecting the current downturn in exploration activity in the province.

## TECHNICAL LIAISON COMMITTEE

The Minister's Technical Liaison Committee on the Geological Survey Branch was active in 1992/93. The committee met with the new Minister, the Honourable Anne Edwards, twice in the year to offer advice on survey programs and budgets.

## ALBERTA GEOLOGICAL SURVEY

The Alberta Geological Survey is a department of the Alberta Research Council and is co-managed by the Alberta Department of Energy. The mission of the Survey is to be the impartial source of geoscience information and expertise.

During 1992, the Alberta Geological Survey's work was focussed in 2 main areas: Minerals and Coal Geoscience and Petroleum Geoscience. Most work was jointly funded with other government departments and agencies, with a modest part contracted to industry. Realization of the Canada-Alberta Partnership Agreement on Mineral Development (MDA) during 1992 has made a major impact on our program.

Implementation of a strategic marketing plan will see increased effort in 4 main segments: hydrogeology, Alberta Energy, industrial minerals and international oil and gas.

### Minerals and Coal Geoscience

For the first time in perhaps 50 years, a mineral other than coal, oil or gas has been the major focus of exploration in the province. Diamond exploration fever, rampant in the Northwest Territories and Saskatchewan has now spilled into Alberta in a major way. Staking for mineral exploration has escalated more than at any other time in the province's history to include 25 million ha of land. New staking regulations implemented by Alberta Energy have been a powerful stimulant.

Major effort to assist industry in diamond exploration is coming from both the Alberta and federal geological surveys, mainly through the MDA program. Almost one-third of the combined geoscience budget is applied to projects oriented directly or indirectly to this end. The Alberta Geological Survey has established a Diamond Exploration Information Hotline as a source of information to industry and the public.

A magnetite deposit near Pincher Creek in the Crowsnest Pass region is Alberta's first metallic mineral deposit to be developed commercially. The deposit, a magnetite sandstone in the Upper Cretaceous Belly River Formation, will be brought into production this winter by a Calgary company. The main use for the product will be as a heavy medium for coal beneficiation.

Exploration for uranium and gold received divided attention during 1992. Selected diamond-drill cores from earlier exploration totalling about 20 000 m were entered in the Mineral Core Research Facility in Edmonton, adding to the 10 000 m previously archived. Release of this core from confidential status is pending. Uranium is the principal focus of one MDA project involving metallogenic studies for U-polymetallic mineralization in the Athabasca basin and adjacent area of Alberta. Interest in gold was active on several fronts. The Athabasca River region in northeast Alberta is still a target. Gold is one of the primary economic targets in several MDA projects related to the northeast Alberta Shield, and another MDA project is evaluating potential for placer gold in Tertiary sediments. Placer gold and platinum are recovered currently as by-products in 5 sand and gravel operations near Edmonton. This sand and gravel production represents only 5% of the total for Alberta, and it is believed that the

potential for greater by-product recovery of precious metals is possible.

The Canada-Alberta Mineral Development Agreement is a \$10-million, 50:50 partnership agreement. Alberta's contribution to the geoscience portion totals \$3.75 million with Canada's portion totalling \$2.5 million with parallel delivery. As Alberta's first MDA, its objectives are to enhance the province's mineral resource information base in support of industry activities toward development of non-hydrocarbon minerals. The main thrust of this agreement is geoscience. The Alberta MDA is unique in that, on the provincial delivery side, it has direct industry participation as well as subcontracting to industry. Fully one-third of the provincial MDA funding for geoscience has direct Alberta industry involvement. The geoscience program for budget year 1992/93 includes 10 projects on the federal side and 12 on the provincial side, with total MDA funding of just over \$1.8 million. The projects embrace subject areas that include: geological mapping and tectonic studies in Shield terrain, metallogenic studies, geochemical surveys, industrial mineral mapping and resource evaluations, Quaternary geology/geochemistry, kimberlite mineralogy/petrology and indicator mineral surveys, and formation brine studies.

Activity in coal has been greatly reduced this past year with efforts being put toward publication of the compilation maps and maintaining and enhancing the Coal Data Base. Substantial data donations from Esso and Shell were received during the year.

### **Petroleum Geoscience**

The objective of the Petroleum Geoscience Section is to establish a systematic and integrated framework of the Alberta subsurface on a regional scale, which will serve as a basis for: 1) evaluation of the potential of the Alberta basin for energy and mineral resources; 2) exploration and development of energy and mineral resources; and 3) development of economic and environmental policy. This objective is attained on a continuous basis by means of data acquisition; implementation of specialized data bases; data interpretation, analysis, and synthesis; and compilation and publication of various maps, reports, and scientific papers.

The main activity during the period covered by this report involved the large-scale regional description and analysis of the Western Canada Sedimentary Basin. Work advanced on the Geological Atlas of the Western Canada Sedimentary Basin. Electronic data processing of large data bases and the management and compilation of the geological atlas are being carried out by this section, with the help of more than 100 contributors from industry, academia, and government organizations. During this period, many chapters were written and print lay-out was completed. The atlas is scheduled for publication during the summer of 1993.

Regional and local studies of the boundary between Jurassic and Cretaceous strata in west-central Alberta provided information and support to the private sector and the Alberta Department of Energy in establishing lease boundaries.

A hydrogeological study was carried out in the Cold Lake area in support of the Alberta Department of Environment. Also, intermediate and local scale studies of the hydrogeology of formation waters at the AOSTRA Underground Test Facility were

carried out, in preparation for evaluation of the effects of deep injection of residual water at the site.

A study of the economic potential of Alberta brines was initiated in the first year of the Minerals Development Agreement between the Alberta and federal governments. Studies of Ca and Mg concentrations in the Alberta subsurface were completed.

In addition to these Alberta-based activities, staff were involved directly or in support of activities by other Alberta Research Council departments in India, China and Colombia.

Activities relating to the Athabasca oil sands had the objectives of: 1) continuing the long term, regional resource characterization and assessment studies of the major Athabasca oil sands deposits; 2) identifying and characterizing various McMurray-type reservoirs in the Athabasca area; 3) implementing a geological data base for the Athabasca area; and 4) providing fundamental geological support to the Alberta Oil Sands Technology and Research Authority's (AOSTRA) Underground Test Facility (UTF).

The joint oil sands geology program is funded on an equal basis by the Alberta Research Council and AOSTRA. Within this program there are 2 major technical projects: resource characterization and reservoir characterization in the Athabasca area. The resource characterization project team is studying the McMurray/Wabiskaw stratigraphic interval in the Athabasca area. Work is in progress toward synthesizing all the previous studies in the entire Athabasca area.

The strategic oil sands geology program, funded entirely by AOSTRA, provides geological support for AOSTRA's Underground Test Facility. Geological support, which included core work and the correlation and mapping of reservoir units, was provided for the development of Phase B. The development of a model, based on Phase A data, to characterize the distribution of facies and petrophysical properties in the reservoir was initiated. Also, a report was completed on the applicability of the UTF technology to other parts of the McMurray Deposit in the Athabasca area.

## **SASKATCHEWAN DEPARTMENT OF ENERGY AND MINES GEOLOGY AND MINES DIVISION**

### **Geoscience Activities of the Saskatchewan Geological Survey**

The geoscience activities of the Geology and Mines Division, known externally as the Saskatchewan Geological Survey (the Survey), are undertaken by 4 branches: Precambrian Geology, Mineral Development, Petroleum Geology and Sedimentary Geodata. Advice on the Geological Survey's program is provided by the Saskatchewan Geological Liaison Committee comprising representatives from industry, the universities in Saskatchewan, the Geological Survey of Canada and the Saskatchewan Research Council. Liaison with the Geological Survey of Canada continues with the pilot Shield Edge geology Project of the National Geoscience Mapping (NATMAP) program.

## **1. Mineral Exploration in Province**

Exploration in all metallic mineral sectors, including uranium, gold and base metal exploration continues at a low level. Exploration for oil is at about the same level as last year (509 as against 507 wells). Gas drilling was halved (207, down from 437 holes in 1991). There has been a significant increase in the number of horizontal wells (up to 207 from 146), which now account for about 35% of development drilling in southeast Saskatchewan and about 60% in the Lloydminster area. Industrial mineral activity continues at a low level with the exception of diamond exploration, for which about 900 000 ha are now under disposition in the southern sedimentary basin. Some interest in high grade silica resources has also developed. Pilot testing of kaolin from the Wood Mountain—Willow Bunch area was in progress.

## **2. Geoscience Activities by the Survey**

Geoscientific activities continue to be largely focussed toward the promotion of mineral exploration activity in the province. A-base funds provide for permanent staff in all branches and core activities mainly in the southern sedimentary basin. The Survey maintains a comprehensive repository of industry oil and gas drill core and a Well Information System. Sedimentary studies included continuing work on the new Geological Atlas of the Western Canada Sedimentary Basin and regional studies of Silurian and Cretaceous strata. A standard regional east-west Phanerozoic cross-section close to the US border is being prepared as the first of a network of cross-sections covering the entire sedimentary basin of southern Saskatchewan. Well files are being upgraded and formation picks standardized in readiness for producing up-to-date computer-generated regional stratigraphic and structural maps at short notice.

## **3. Mineral Development Agreement**

Operational funds of the Saskatchewan Geological Survey have been provided in recent years almost entirely through federal-provincial mineral development agreements. The present five-year Canada—Saskatchewan Partnership Agreement on Mineral Development (PAMD) is part of a Western Diversification package for the 4 western provinces. The Saskatchewan package has a total funding over five-years of \$10 million, equally cost-shared with Canada on a parallel delivery basis. Saskatchewan funding comes from the Saskatchewan Mineral Industry Diversification Program (MIDP) and the Student Summer Employment Program (SSEP). The federal part of the program is being implemented in the 4 years 1991-1995, with provision for wind up and final reporting in fiscal year 1995-1996. The PAMD is primarily oriented to geoscience with a total of \$7.35 million allocated to geological mapping, geophysical and geochemical surveys, mineral deposit investigations and related studies. Other components of the agreement include research and development in mineral processing, market and other economic studies, and public information.

In the current 1962-1963 (third) year, about 65% of provincial efforts are being directed to northern geoscience projects in the Precambrian Shield area, 20% to the southern sedimentary basin, and the remainder to compilation and database projects as well as prospector training and public information. The program involves

permanent and contract staff, contracts and joint studies mainly with the universities of Saskatchewan and Regina, and the Saskatchewan Research Council, and joint projects with other universities.

### **3.1 Northern Geoscience Program**

Project work is almost entirely dedicated to the southeastern part of the Precambrian Shield around Flin Flon, Hanson Lake and parts of the Glennie and Kisseynew domains. In this region, revision geological mapping and geochemical studies are being carried out in an attempt to gain a better understanding of the geological setting and control of gold and particularly base metal deposits, so as to identify areas worthy of detailed exploration. In order to concentrate on the southeast, the reconnaissance bedrock mapping of the region north of Lake Athabasca, which was revived in 1989-1990, was postponed.

An important feature of the present PAMD is the higher degree of integration of federal and provincial projects than had been attempted in previous federal-provincial parallel delivery programs. The main example of this integrated and holistic approach is the joint program mounted in the Flin Flon—Hanson Lake area involving the province's Project Seagull and the broader GSC Shield Margin Project of the National Geoscience Mapping Program (NATMAP). The program is also fully integrated with a parallel program on the Manitoba side of the border. The fundamental objective here is to provide an integrated and diverse dataset to encourage mineral exploration particularly for base metals both along the Shield edge and farther south in Precambrian basement lying beneath Palaeozoic formations. This involves data acquisition in digital format and GIS-generated bedrock geological maps, and will serve as a useful test case for further development of computerized mapping in the provincial survey. The multidisciplinary nature of the Shield Margin Project is being enhanced by the Lithoprobe Transect of the Trans-Hudson Orogen which crosses the Project Seagull area.

The main provincial activity in the southeastern part of the Shield continues to be revision bedrock mapping at 1:20 000 or 1:12 500 scale. This mapping is being complemented by P-T petrological studies, litho-geochemistry, geochronology and isotope geology. The Survey has also funded a number of projects dealing primarily with individual gold deposits and gold deposit environments, although other studies are directed toward examples of VMS and rare metal mineralization. Much of this work is being undertaken through university contracts.

The Mineralized Core Collection in La Ronge acquired core mainly from gold and base metal exploration sites, and is being serviced by the Resident Geologist Office.

### **3.2 Southern Geoscience Program**

In the south, a number of industrial mineral projects are being conducted. Several geochemical anomalies in the extreme south were revealed during ongoing investigations of kimberlite indicator minerals. Open file reports were produced on kimberlite/diamonds and mineralized formation brines. Compilation and digitization of a large gravity database are about 25% complete with nearly 70 000 stations

digitized. This database is expected to be of value mainly in kimberlite exploration. Sampling and characterization of significant industrial mineral deposits continued with work on kaolinized sands and kaolinitic clays from the Cretaceous Whitemud Formation kaolin. A final report on silica sand deposits sampled in the previous 2 years is almost complete. Computerized indexing of a large geophysical database is now complete to date. Besides containing geophysical data, this file includes seismic shotpoint locations and flowing shothole information.

The Federal-Provincial-Industry joint aeromagnetic survey in the south was continued in 1992-1993 with the Survey in consultative role. This survey has been designed to aid exploration for a range of mineral commodities, *i.e.*, diamonds, potash and hydrocarbons, as well as basement mapping.

### **3.3 Data Files and Computerization**

The program of database and computer enhancement was continued. Full digital methods of mapping have now been used for 2 seasons, using FieldLog software provided originally by the Ontario Geological Survey, and now taken up by the GSC. Notably, in Project Seagull the data is being compiled in a GIS form in collaboration with the GSC. The computerized Well Information File (oil and gas wells) is available on a monthly updated CD-ROM disks. Current active databases include the Assessment Work Catalogs, Mineralized Core Collection Inventory, Mineral Deposits Inventory, Saskatchewan Precambrian Bibliography, and the Geochronology File.

## **MANITOBA DEPARTMENT OF MINES AND ENERGY GEOLOGICAL SERVICES BRANCH**

### **General**

During 1992, budget constraints continued to limit the extent and duration of operations mounted by the provincial Geological Services Branch (GSB). However, this shortfall was in large part compensated by a build-up in the level of Geological Survey of Canada (GSC) contributions, through the new National Mapping Programs (NATMAP) in the Flin Flon region and southern Manitoba, as well as EXTECH and activities funded under the LITHOPROBE initiative. At current projections, the total geological survey program delivery in support of exploration in the region feeding the Flin Flon smelter, over the next 4 year period, will be almost 3 times that of a stand-alone effort by the provincial GSB. Provincial and federal contributions are both funded in part through the 5 year Canada/Manitoba Partnership Agreement on Mineral development (MDA), now in its third year. The GSB developed an in-depth, 10 year plan for continued program delivery in the Province.

### **Flin Flon-Snow Lake**

With a budget of \$2.55 million dollars (MDA and provincial "A" base), the principal emphasis of GSB programming continued to be the Flin Flon/Snow Lake region, where multidisciplinary geological, geophysical and geochemical surveys, mineral deposit documentation and scout drilling, are being conducted in support of industry's exploration for new copper and zinc deposits. The NATMAP Shield Margin project

(NASMAP) is now fully operational with contributions being made by the GSB, GSC and several universities. A 3-day workshop in Winnipeg and field tours in the Creighton, Flin Flon and Snow Lake regions, were convened at the beginning of the field season to coordinate operations in Manitoba with those in Saskatchewan. All information collected in this major cooperative effort conforms to mutually agreed to standards and classifications, the intent being to generate a minerals Geographic Information System for the region. Standardization of input parameters is also facilitating the rapid development of derivative maps and electronic databases. This year 4 full colour maps will be released at the Winnipeg Mining and Minerals Convention with 1:50 000-scale cross-boundary maps planned for early in 1993.

New geochronological data and structural investigations generated through MDA and NATMAP initiatives are also playing a critical role in the interpretation of seismic results that stem from last year's LITHOPROBE transect from Norway House to Flin Flon. LITHOPROBE work-shops were convened in Saskatoon (March), Regina (September), and Winnipeg (May, September), the fall meetings are aimed at developing manuscripts to present the initial interpretations of the processed seismic data, which is of outstanding quality.

Detailed mapping on the Baker Patton felsic complex revealed a stratigraphic link between newly-discovered mineralization at Leo Lake and lithologies at the old North Star Lake Mine.

1:5 000 mapping in the recently burned area northeast of Sherridon delineated local occurrences of hydrothermally altered rocks in the vicinity of the Jungle Lake massive sulphide deposit.

In the nearby Walton Lake area, 1:20 000 geological mapping focussed on high grade metamorphic rocks in the structural and stratigraphic transition zone between the Kisseynew gneiss belt and the Flin Flon volcanic belt. Rocks in the area were subdivided into 4 lithologically and stratigraphically distinct sequences that occur on top of each other as a stack of recumbent folds, and probable thrust slices. Each sequence contains an unique set of mineral occurrences and style of hydrothermal alteration. The recognition of Amisk Group equivalents in the Walton Lake nappe elevates the massive sulphide exploration potential of this region, as well as supporting the interpretation that the Sherridon Suite is also equivalent to the Amisk Group.

One hundred and eighty-five till samples collected from hand-dug pits in the Elbow Lake area, were submitted for geochemical analysis. Ice-flow directions interpreted from dispersal trains indicate ice flow slightly west of south.

Gold and sulphide prospects in the North Star Lake and Elbow Lake areas were mapped as part of the ongoing documentation of mineral occurrences in the Flin Flon belt. A possible volcanogenic massive sulphide type alteration zone has been recognized in rhyolitic rocks in the Tee Lake area. A complex structural history has been recognized in the North Star Lake area where 3 phases of ductile deformation are followed by several brittle events.

The GSC initiated detailed mapping of the Reed Lake gabbro as follow-up to the regional study of mafic/ultramafic intrusions in the Flin Flon Lake mining district.

1:20 000 mapping in the Webb and Fay Lake area encountered mainly Amisk mafic volcanic and volcanoclastic rocks, intruded by fine-grained gabbro sills, together with quartz-plagioclase porphyry dykes and sills. The Amisk rocks are overlain by Missi Group basal conglomerates and quartzofeldspathic paragneisses. Two large composite intrusions, the Echo Lake and Gauthier Lake plutons, underlie more than half the area. Both are cut by east-trending and north-trending faults and shear zones.

Mapping at Claw Lake defined a large, layered mafic/ultramafic complex with crosscutting phases of several ages. Mafic volcanic rocks at Elbow Lake can now be subdivided into both back-arc ocean floor and transitional types; this subdivision has important implications for base metal exploration in the area. Granitoid rocks display a wide range in composition and age. The Gant Lake batholith provides a transect that stitches the boundary between the Flin Flon and Kisseynew belts. Geochemical and isotopic work indicates all mapped granitoid units are calc-alkaline volcanic-arc granites derived from juvenile infracrustal sources.

1:20 000 mapping of greywacke, siltstone and mudstone on Wekusko Lake demonstrated the equivalency of these rocks with those that contain the Bur, Kobar/Ruby zinc-copper massive sulphide deposits to the northeast. This reinforces suggestions, arising from earlier work, that exploration should also anticipate the existence of sediment-hosted massive sulphides in this region.

Thirty-one core samples were collected to delineate the extent of geochemical haloes associated with the Bur Zone zinc-copper deposit. Initial results suggest the deposit is enriched in mercury and may therefore respond to a combination of mercury vapour and ground geophysical exploration techniques.

1:5 000 mapping of the Osborne deposit traced the host felsic pyroclastic rocks northeastward toward the northwest shore of Long Lake. This highly prospective horizon will continue to be the focus of future detailed mapping and geochemical sampling. Brief reconnaissance mapping and geochemical sampling programs were also conducted in the Watch Lake area, and over the Copper-Man zinc-copper deposit.

1:5 000 geological mapping by the GSC and GSB in the Kormans Lake area defined the presence of a major early fold closure that could result in repetition of the felsic rocks that host the Anderson and Stall Lake mines between Tramping and Morgan lakes.

### **Cormorant Area and Nickel Belt Extension**

Elsewhere in the province, drill core from previous nickel exploration along the southwest extension of the Thompson belt, was relogged in an effort to identify occurrences of the lithologies diagnostic of the Ospwagan Group (thought to be the host for much of the nickel mineralization). Sub-Palaeozoic basement geology has been reinterpreted, down the axis of the nickel belt, using the most recent interpretations, augmented by new drill-hole information provided through the

Branch's scout drilling program and nonclassified company information. Ten additional scout holes were drilled in the adjacent Cormorant area (NTS 63K), to ground-truth new interpretations of the airborne magnetic data conducted by Allan Spector and Associates under contract to the GSC. Further control was provided through high resolution gravity surveys sponsored by the GSC in the Spring of 1992. The usefulness of the gravity surveys has prompted proposals for additional coverage south of Snow Lake, and along the extension of the nickel belt.

### **North-Central Manitoba**

Field operations in the north-central sector of the Province were limited to mapping the stratigraphy associated with gold mineralization on Elk and Jowsey islands, Gods Lake, and to a brief vegetation geochemical reconnaissance of the Little Stull Lake area, in cooperation with the GSC and Phelps Dodge.

### **Southeast Manitoba**

Hitherto unrecognized komatiitic rocks, intercalated with magnesian tholeiites and calc-alkaline metabasalts, have been identified by the GSC north and east of a major shear zone that runs through Moore and Beresford lakes. It has been suggested that the komatiites may be correlative with pre 2.8 Ga supracrustal rocks in the Red Lake belt to the east, and that the early shear zone may have played an important role in influencing the distribution of gold mineralization in the Rice Lake belt.

Quartz veins in the Bissett and Wallace Lake area were sampled and mapped to evaluate their potential as a source of lump silica. More than 5 tons of chromite ore was retrieved from the Chrome claims, Bird River Sill, and shipped to ORETECH for crushing and concentrating into a feedstock for metallurgical research being conducted at Laurentian University.

Detailed mapping of chromitite seams on the Page property showed that the stratigraphy, though discontinuous, is similar to that on the Chrome claims. Numerous faults disrupt the continuity of the chrome-bearing seams. A new sequence of chromitite layers, termed the Page Chromitite suite, was defined between the disrupted suite and the Lower Main.

In the nearby Bernic Lake region, additional pine bark and spruce needles were collected as part of a regional assessment of geochemical haloes associated with this district's rare-element pegmatites.

### **Southwestern Manitoba**

Work on the province's Palaeozoic rocks focussed primarily on redefining formational boundaries in the Ordovician, and to a lesser extent the Silurian. This work is intended to promote the search for deep petroleum, in traps below those in the Mississippian and Amaranth formations. A large number of petroleum and mineral exploration drill cores were relogged, wireline logs re-examined, and new picks selected.

Additional information on Devonian reefs at The Bluff, Dawson Bay, and the stratigraphy of Silurian dolomites near The Pas was obtained from new holes drilled in these areas. The Bluff information, combined with earlier drill-hole results, has been used to define the geometry and development of the reefs, the initiation of which appears to have been controlled by the northeast-trending basement structures in the Churchill/Superior Boundary zone. This work has also helped to develop guidelines for petroleum exploration elsewhere in the Williston Basin. A series of stratigraphic reference holes have been drilled over the last few years to aid subdivision and correlation of Silurian dolomite in the northern Interlake. This year the GSC logged one of the reference holes west of Buffalo Lake (Grand Rapids Uplands) and provide an array of geophysical parameters that include density, temperature, conductivity, resistivity and gamma responses.

The GSB continued its input and editorial comment toward, the development of the Atlas of the Western Canada Sedimentary Basin, now scheduled for release in early 1993. Field studies were confined to the ongoing examination of karst features in the Interlake. This work is also helping to refine the stratigraphic maps for the region as new marker beds are found in hitherto unexplored country.

Further stratigraphic information was generated through drilling and outcrop examinations in NTS area 62 I, as part of an inventory of this region's industrial minerals; this included definition of potential new sources of granite dimension stone near Brightstone, Lac Du Bonnet.

Chemical analyses and laboratory tests of drill core from Fisher Branch dolomites near Sandridge, confirmed the high magnesium contents, low residues, and reserves required to qualify these rocks as a potential raw material source for magnesium metal production.

Several different geophysical instruments were used to improve the definition of buried kaolin-filled channels in the Sylvan area, near Riverton. The ground surveys were augmented with airborne VLF data collected by the GSC Skyvan.

Twenty-three drill holes were completed, and 100 surficial till samples collected in southeast Manitoba as part of the NATMAP Southern Prairies project. Initial results suggest the extent of greenstones in the basement is not as widespread as was originally inferred from interpretation of airborne magnetic data.

Work in the Virden area included drilling 4 holes, and 1:100 000 mapping of surficial deposits. Contributions to this project were also made by the University of Manitoba and the provincial Water Resources Branch.

Till and soil samples were collected from 225 sites in southern Manitoba to provide input to the GSC low density Prairie till/soil program. The samples will be processed to glean new data on glacial dispersion trends, to look for lamproite/kimberlite indicator minerals, and to provide geochemical information of value to environmental studies.

## Manitoba General

The Branch continued collaborative work with the Manitoba Mining Association, aimed at identifying candidate areas for designation as Endangered Spaces (ES). Several regions with apparently limited mineral development potential have now been identified, and a preliminary proposal tabled for the undertaking of resource assessments in those areas where the existing database is deemed to be inadequate for conducting appraisals of residual exploration potential. In parallel with these activities the Branch has also worked closely with other government agencies in providing mineral data for ES candidate areas in agro-Manitoba, provincial parks and provincial forests.

Numerous enquiries on mineral related matters were responded to throughout the year, both in Winnipeg and through the Flin Flon and Pas Regional Offices. These included property examinations and field tours held for the benefit of explorationists in the Flin Flon/Snow Lake and Thompson regions.

In addition to providing minerals information to several advisory and land-use committees, the Branch also provided input into the Master Minerals Strategy being developed for the Leaf Rapids region by Watts Griffis and McOuat.

The GSB maintains a number of electronic information files for internal use and for distribution to the public. Although on-line public access to the files is not currently available, selected datafiles, including raw field data, are periodically released on diskettes as interim reports.

The format of the annual open-house was expanded yet again this year, to include concurrent business and technical sessions, as well as displays from the service sector and the traditional core shack. Three hundred and ninety-six delegates attended the meeting including 61 departmental employees.

In addition to publishing several open files, and Mineral Deposit Series reports, the Branch completed the 1:250 000 synoptic bedrock compilation for the Knee Lake area. Similar products covering NTS sheets 63K and 63J are also scheduled for production in fiscal 1992/1993.

As part of ongoing federal/provincial and interprovincial liaison activities, and on behalf of the Provincial Geologists Committee, a paper entitled "The role of the Provincial Geological Surveys, circa 2000" was presented to the International Conference of Geological Surveys in Ottawa (April 1992). The Branch also took part in a Strategic Planning Session with the GSC in Whitehorse, Yukon Territory, immediately following the Mines Ministers Conference in September.

Progress continues in consolidating the new core storage and expediting base at the old Centennial Mine site near Flin Flon. The Flin Flon Regional office is now fully functional with both a Regional and a Staff Geologist. Plans for establishing the Thompson Office are progressing, with an opening anticipated in 1993.

GSC geophysical programs included a regional airborne gamma ray

spectrometer/VLF/magnetometer survey of southeast Manitoba, phase II of the regional airborne magnetic surveys in the Dauphin area, and an extension of gradiometer surveys into NTS areas 63J/3 and 63J/4 south of Wekusko Lake. The Dauphin area surveys were funded in part with contributions from Cameco and Uranerz. Exclusivity rights will permit release of the data in June 1993.

## **ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES ONTARIO GEOLOGICAL SURVEY**

### **Introduction**

The Ontario Geological Survey (OGS) was reorganized into 2 branches namely: the Information Services Branch and the Geoscience Branch. The Information Services Branch consists of 3 sections: Data Services, Publication Services, and Field Services. The Geoscience Branch consists of 4 sections: Precambrian Geoscience, Sedimentary and Environmental Geoscience, Geoscience Laboratories, and Administration Unit.

In the late summer of 1992, the OGS relocated from Toronto into the new Willet Green Miller Centre in Sudbury. This monumental move caused a few weeks of confusion as offices had to be packed and unpacked, reorganized and rearranged.

The second volume of *Geology of Ontario* and the Tectonic Assemblages map theme were released in December 1992. The combined effort of the OGS staff over a 3-year period to bring the Geology of Ontario project to completion shows a remarkable demonstration of application, dedication and ability.

During 1991-92, the Geoscience Branch carried out detailed, regional and province-wide geoscience studies. Some Geoscience Branch projects were undertaken in co-operation with Mines and Minerals Division geologists, universities and private companies. The Ministry supported applied research projects at Ontario universities through the Ontario Geoscience Research Grant program and the Mineral Resources Grant program.

### **Geoscience Research Grant Program**

In 1992, the Ontario Geoscience Research Grant (OGRG) program awarded 21 grants, totalling \$572 664 to 11 universities. The program is designed to help finance research at Ontario universities that will improve and stimulate mineral resource development and management in the province. Summaries of research for the 1991-92 grants were published as OGS Miscellaneous Paper 159, in December 1992. In addition, oral and poster presentations by OGRG recipients were presented during the annual Ontario Mines and Minerals Symposium, held December 7-9, 1992 at the Metro Toronto Convention Centre.

In 1992, other geoscience research grants were awarded to Ontario universities and colleges, companies, and professional organizations to fund projects which benefit the programs and priorities of the Ministry's mineral resources program. Results achieved from these grant projects are released in a variety of formats, including open file reports, poster and oral presentations, and articles in external publications.

## **GEOSCIENCE BRANCH**

### **Precambrian Geoscience Section**

In 1992/1993, the Precambrian Geoscience Section emphasized detailed and regional mapping. A small number of thematic and externally funded projects were also carried out.

In 1992, field investigations were carried out by 14 crews emphasizing detailed and regional mapping. A small number of thematic and externally funded projects were also carried out.

Of the 10 base program funded mapping projects, 5 were in northwestern, 4 in northeastern and 1 in southern Ontario. Four additional projects, 3 in the Thunder Bay area and 1 south of Timmins, were funded under the Northern Ontario Development Agreement (NODA).

Included in the mapping program were: 1) reconnaissance studies in the Berens River Subprovince and detailed mapping projects in the Abitibi, Winnipeg River, English River and Wawa subprovinces of the Superior Province; 2) a detailed mapping project in the western Penokean Foldbelt of the Southern Province; and 3) a detailed to reconnaissance study of parts of the Mazinaw and Bancroft terranes of the Grenville Province. Several field crews compiled geological data digitally and maps will be produced electronically. A 1:15 840 to 1:50 000 bedrock mapping program of the Separation Lake area north of Kenora was carried out in conjunction with a gravity survey by this section and a detailed overburden mapping project by the Sedimentary and Environmental Geoscience Section.

A total of 6 thematic investigations were carried out by staff of the section or by researchers presently or previously associated with the section. Two of these studies, by staff of the Geology Department of Laurentian University, are part of the Elliot Lake Initiative of the Ministry of Northern Development and Mines and dealt with the bedrock geochemistry of the Whiskey Lake greenstone belt and the mineral potential of the East Bull Lake Intrusion.

E.C. Walker, R.H. Sutcliffe and co-workers of the Department of Geology, the University of Western Ontario (London, Ontario) conducted a detailed investigation of the Coldwell Alkalic Complex, including its petrography and mineralization environments.

G.R. Edwards (Athabasca University, Athabasca, Alberta) and M.R. Stauffer (University of Saskatchewan, Saskatoon, Saskatchewan) investigated the structure and stratigraphy of Archaean rocks in the Pipestone Lake area in northwestern Ontario. This study constitutes the continuation of a co-operative project of the 2 researchers and the Precambrian Geoscience Section, which was carried out in 1990.

F.D. Ford of Carleton University, Ottawa, carried out detailed stratigraphic/structural investigations of the Sunday Lake area in southeastern Ontario in conjunction with R.M. Easton's mapping of the Palmerston Lake area.

R. Mussakowski of the Ontario Centre for Remote Sensing (Ministry of Natural Resources, Toronto) and N. Trowell of this section conducted a remote sensing study of an area near Thunder Bay. Lineaments were interpreted from 3 data sources: Landsat Thematic Mapper, Airborne SAR Radar, and Digital Topographic Elevations Model.

### **Geoscience Laboratories**

Over the past year, the decommissioning of the Toronto laboratory and the relocation to the new facilities at the Willet Green Miller Centre, Sudbury, unfortunately left little time for program development. Staff successfully cleared all the samples submitted before we closed the Toronto operation. In addition to consulting extensively on the new building design, staff spent many hours investigating, testing, and selecting the new equipment for the Sudbury facility. As a result, the new labs contain probably the most modern equipment in North America.

For the last few months, staff have been busily commissioning the new labs. With a building and services this complex, inevitably commissioning can prove finicky. While some programs can be transferred with little change and come on-line very quickly, for some programs, many new procedures must be developed for the new equipment. Staff are also working to complete extensive method validations for these new procedures.

### **Mineral Sciences Program**

Little time has been available for program development over the past year owing to the decommissioning of the Toronto laboratory and the relocation and establishment of new facilities in the Willet Green Miller Centre in Sudbury. There has been an expansion of the program with the development of a number of new initiatives. These include a Geostandards laboratory for the development of geological reference materials which will be made available to all geoanalysts. Facilities in micromineralogy have been expanded with the acquisition of an electron microprobe and a scanning electron microscope interfaced with an image analysis and energy dispersive x-ray system for automated mineral identification. A new isotope geochemistry facility is in the process of being completed.

Much of the new equipment acquired is automated to improve productivity. New technologies have also been incorporated into existing programs to improve quality and performance. Examples include use of laser diffraction particle sizing in grain size determinations; a Magstream separator in the mineral separation laboratory and a novel multi-mill for pulverization of rock chips to analytical fineness of up to 80 samples simultaneously.

Of critical importance in the design of the new facility was protection of the analyst from hazards encountered in the geological laboratory. Special venting was designed for all dust producing equipment such as jaw crushers and soil mills and most noise producing equipment is sound proofed to less than 80 db. Special gravity vented hoods are used for handling lead and nickel compounds in the fire assay laboratory and for using toxic heavy liquids in the mineral separation laboratory.

Critically important in the new facility design were systems to protect the analyst from the hazards typically encountered in geological laboratories. Special venting was designed to contain dust from any dust producing equipment, such as crushers, saws, and mills. Most noisy equipment has been sound proofed to less than 80 dB. Handling compounds in the fire assay laboratory and using toxic heavy liquids in the mineral separation laboratory now occurs in special gravity vented hoods.

### **Spectroscopy**

Since moving, the spectroscopy subsection is now recommissioning to bring the base program on-line by mid 1993. Extensive planning led to an efficient recommissioning method. All analytical packages will be validated using a special approach.

The outline of the program planning for the major-elements packages, M1, M2, M3, to integrate the new equipment, such as the thermal gravimetric analyser to determine loss on ignition, the C/S analyser, and the energy dispersive X-ray fluorescence (XRF) analyser has been made. The new wavelength dispersive XRF will enhance the ability to determine light elements such as Na, Mg, O, and F.

All the trace-element packages (T2, T4, T5) normally offered using inductively coupled plasma (ICP) spectrometers will be revised for new instruments. The extensive tests performed for these packages in Toronto will provide the benchmarks to be met in the new laboratory.

### **Temiskaming Testing Lab (TTL)**

In addition to its normal business performing numerous fire assay and AA analyses for northern mining camps and prospectors, TTL has been performing analyses for the other Geoscience Labs. In recent months, TTL has also been doing several special metal recovery or recycling jobs using its unique crushing and sampling mill operation, including from bricks and computer chips.

### **Sedimentary and Environmental Geoscience Section**

#### ***Introduction***

The Sedimentary and Environmental Geoscience Section of the Geoscience Branch, Ontario Geological Survey has the mandate to investigate Phanerozoic age materials and sediments within the province. Activities undertaken include the mapping of Palaeozoic age rocks and Quaternary sediments, assessment of the mineral resource potential contained therein (such as sand and gravel, limestone, peat, salt, gypsum, and so on), investigation of past and current geological processes which affect the occupation and use of the land, and defining the physical properties or geochemical signature of the landscape.

#### ***Environmental Program***

The environmental program of the section was concentrated in southern Ontario, specifically, the Greater Toronto Area and surrounding regions.

Work commenced on the Oak Ridges moraine, a glacial feature that is at the centre of much public debate. The objectives of this project are to: 1) define the moraine through mapping; and 2) gain an understanding of how it was constructed. Results of this study will provide information that will be of value in formulating land-use decisions. The surficial data base being created will allow for informed planning decisions to be made on a variety of matters currently affecting the moraine including urban development, aggregate extraction, surface and groundwater, and the establishment of recreational areas.

An aggregate inventory of Haldimand and Alnwick townships, located at the eastern end of the Oak Ridges moraine south of Rice Lake, was also completed this year. The results of the study have been released as Aggregate Resources Inventory Report 143. The information produced on location, quality and quantity of mineral aggregates in the townships was of significant importance in the drafting of Official Plan documents.

### ***Exploration Program***

Exploration-related projects were operative in 4 areas in northern Ontario and 1 in southern Ontario. These projects were designed to provide data bases which will assist in mineral appraisal and evaluation.

A mapping and drift sampling program began in the north and east rims of the Sudbury Basin. The project, a co-operative effort with the Geological Survey of Canada, will provide a framework for mineral exploration using Quaternary sediments. In addition, the project will yield data on the geochemical behaviour of Ni-Cu-PGEs in the surficial environment. The fact that the project area is situated in an area affected by decades of mining and smelting activity also allows the anthropogenic effects of this activity on the environment to be evaluated.

Quaternary mapping and drift sampling were completed in the Separation Lake area north of Kenora. This project is part of an integrated geoscience approach to assessing the geology of the local greenstone belt. The reconnaissance sampling completed this year will provide a baseline geochemical data set. Lines on which detailed sampling was conducted will serve as pilot projects for follow-up surficial sampling. The location of future detailed sampling is to be determined on the basis of the Precambrian mapping in the area.

Palaeozoic mapping in the area east of Lake Simcoe, southern Ontario resumed. This mapping program will provide an up-to-date geoscientific data base on the rocks in the area. Particular attention is being paid to defining the stratigraphic position and lateral extent of alkali-reactive beds. This information will allow alkali-reactive beds to be avoided in operating quarries; and future quarries to be sited with a knowledge of the position and thickness of the deleterious beds. The mapping will also provide data which will contribute to reasoned and informed development and land-use decisions. Planning and environmental pressures are on the rise in the area due to, among other things, the number of proposed bedrock quarries.

The Sedimentary and Environmental Geoscience Section managed 2 exploration-

related projects funded under the federal-provincial Northern Ontario Development Agreement (NODA). A geochemical sampling and surficial materials inventory began in the Swayze Greenstone Belt southwest of Timmins. The project will: 1) define geochemical trends in the area, at a regional and local scale; and 2) assess the use of various fractions of the glaciogenic sediments in drift exploration. Sampling down-ice from known mineralization will provide data on the character of geochemical signatures associated with glacial dispersal in the area.

The second NODA project is an aggregate-industrial minerals inventory in the area between Blind River and Bruce Mines, east of Sault Ste. Marie. The first phase of the project will determine the distribution as well as the quality and quantity of mineral aggregates in the area. As sources of aggregate in southern Ontario come under more pressure due to environmental and conflicting land-use demands, northern deposits may, potentially, play an important role in supplying southern markets.

### ***Applied Research***

Applied research projects undertaken by the Sedimentary and Environmental Geoscience Section are designed to: 1) develop methods of use in or to assist mineral resources exploration; or 2) determine geological processes which may affect occupation or use of the land base. The latter includes collecting geoscientific information on a range of environmental issues.

The radon soil gas survey conducted in southern Ontario was a pilot project designed to investigate geologic controls on the distribution and level of radon gas in the soil profile. The most interesting finding was the apparent relationship, in southwestern Ontario, between oil and gas fields and the radon soil gas. Initial results are currently being followed up by detailed surveys.

Results from the pilot project for the Geochemical Map of Ontario indicate that low density sampling can define geochemical environments across the province. The field work conducted as part of this project also demonstrated the effectiveness of a Global Positioning System to a helicopter-supported field program.

The planning and design of a mobile laboratory unit (MLU) was continued in 1992. The MLU will add a new dimension to the geochemical capabilities of the section, especially in the realm of water analyses. The rapid sample turn around time provided by the MLU will be of benefit to both environmental and exploration type projects. Current plans call for the unit to be constructed by early 1993 with operational trials continuing for the remainder of the year.

### **INFORMATION SERVICES BRANCH**

Creation of this Branch dates back to September 1991 when the Mines and Minerals Division of the Ministry of Northern Development and Mines was fundamentally reorganized. Out of that reorganization came 2 Ontario Geological Survey branches, the Mineral Development and Rehabilitation Branch, the Mining Lands Branch and the Mineral Sector Analysis Branch.

The Geoscience Branch embraced part of what was formerly known as the Ontario Geological Survey (OGS); the data, library, public education and publication functions of the former OGS were put together with the resident geologist function to create the new Information Services Branch. Both of these branches have been subdivided as stated in the introduction.

### **Data Services Section**

The continued march into an electronic environment caused the organization to take a look at its future with respect to how the Division did business. This has led to the definition of a future vision for the organization entitled Earth Resource and Land Information System (ERLIS), and the undertaking of an Information Resource Management (IRM) exercise.

The provision of resources in the 1992/93 budget for creation of databases within the definition of ERLIS is leading to a restructuring of the functions formerly included in the Geoscience Data Centre. The coming years promise exciting developments as we implement the creation of electronic databases within the Mines and Minerals Division of the Ministry.

The library, which has moved into its new quarters in Sudbury, is adapting to the new physical and technological environment, and will offer Sudbury area patrons and any others who drop by, an excellent forum for their research.

### **Publication Services Section**

This was a busy year for the Publication Services Section. In addition to the trauma of disassembling and recreating itself in Sudbury, including changes in staff, the second volume of the "Geology of Ontario" was completed. This volume contained 814 pages for a total of 1525 pages in volumes one and two. Nine sheets of tectonic assemblage maps with time-space charts were released for a total of 87 sheets to accompany the 2 volumes.

The relocation to Sudbury also brings Publication Services Section another step closer to being a totally digital organization with the delivery of an Intergraph digital map production system, complete with a high resolution scanner-plotter.

### **Public Education Section**

This section grew out of the need for general information by the public-at-large, and the perceived need to have the public-at-large better informed on the importance of minerals in their everyday lives.

Principle initiatives for this very recently created section are to: prepare kits for the use of teachers in the elementary school system, attend mineral fairs and similar attractions. An Intergovernmental Working Group (IGWG) meeting on public education is being organized for 1993. This section is also the primary contact for the organization of displays at various national meetings.

## **Field Services Section**

The Field Services Section includes 15 Resident Geologist's Offices, one Regional Specialist's Office, 7 Drill-Core Libraries, and the Mines and Minerals Information Centre (MMIC) in Toronto.

The primary goal of the Field Services Section is to provide professional consultative services and advice on the geology, mineral deposits, and exploration and mining activities within the province to prospectors, mineral exploration companies, internal government agencies, private interest groups, and the public.

Other goals are to attract, stimulate and guide mineral exploration development.

The Mines and Minerals Information Centre was opened to the public in Toronto on October 5, 1992. It was created to provide a comprehensive service to the public in the Toronto area following the departure of the Head Office of the Division to Sudbury. A notable characteristic in this office is the extensive use of building stone for tables, counters, floors, etc.; interestingly, the costs were competitive or better than those for traditional materials.

The Field Services Section is divided into 3 areas; these are the Northeastern Ontario, Northwestern Ontario and Southern Ontario areas. Each area has its own manager.

The year 1993 promises to be exiting and interesting for the Branch as it settles into the new organizational structure in its new surroundings (for Sudbury staff) with its new technological directions and its influx of new staff.

## **MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES GOUVERNEMENT DU QUÉBEC**

### **SECTEUR "MINES"**

Pour l'année financière 1992-93, l'objectif de base du ministère, en ce qui concerne le Secteur mines, est de promouvoir le développement de l'industrie minérale du Québec par un ensemble de mesures visant à appuyer l'initiative et le leadership du secteur privé, tout en s'assurant que l'exploitation des ressources minérales se fait selon les meilleurs intérêts des québécois. Plus particulièrement, il s'agit de :

1. stimuler les investissements privés pour le développement de nouveaux gisements, l'expansion des capacités de production existantes et la modernisation des usines de première transformation;
2. focaliser la recherche et le développement sur des projets spécifiques répondant aux besoins de l'industrie et pouvant aider à consolider notre position concurrentielle et susciter le développement industriel à court et moyen termes;
3. contribuer au renouvellement des réserves domestiques pour les minerais de cuivre et de zinc et favoriser la diversification de la production minérale dans les régions du Québec par la stimulation de l'exploration minière;

4. assurer la promotion et la défense de l'amiante et, au niveau mondial, promouvoir l'adoption de législations visant un usage sécuritaire de ce produit.

Chacune des trois directions générales du Secteur "mines" répond plus spécifiquement à l'un ou l'autre des grands objectifs cités.

#### **LA DIRECTION GÉNÉRALE DE L'INDUSTRIE MINÉRALE (DGIM)**

La Direction générale de l'industrie minérale est chargée d'administrer les lois minières, de tenir à jour les connaissances relatives au contexte fiscal, économique et réglementaire dans lequel évolue le secteur minéral et de favoriser la mise en valeur, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec, et ce, dans une perspective de développement durable pour la collectivité québécoise.

#### **Le Service de la statistique et de l'économie minérale (SSEM)**

Au sein de la Direction de l'analyse économique et du développement minier, le Service de la statistique et de l'économie minérale est chargé d'acquérir, de traiter et de diffuser les connaissances statistiques propres aux activités de l'industrie minière québécoise et les connaissances économiques reliées au contexte dans lequel elle évolue.

De plus, le SSEM participe à la recension et à l'élaboration des politiques qui guident l'action gouvernementale en vue de favoriser l'exploration, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec 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;
- 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 les perspectives d'avenir, collabore au recensement et à l'élaboration des politiques gouvernementales, participe à l'orientation de la planification stratégique du Secteur mines et propose des interventions appropriées;
- publie des périodiques, informe les agents économiques des performances et des perspectives de l'industrie minière et fournit, sur demande, des informations statistiques non confidentielles;
- 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 de l'Énergie et des Ressources et d'autres organismes gouvernementaux.

En 1992-1993, 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) diverses études portant, notamment, sur la libéralisation des échanges et son impact sur l'industrie minérale du Québec, l'économique de l'exploration, l'impact des mesures environnementales sur l'industrie minière, l'impact de la fiscalité sur l'industrie minière, la problématique de la main-d'oeuvre, la problématique des activités de R/D des entreprises minières, et la politique minière du Québec.

### **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 l'évolution des activités des intervenants dans chacun des secteurs de l'industrie minérale du Québec dans le but de fournir à la direction du MER et à ses gestionnaires des informations et des avis pertinents sur leur état de situation et leurs perspectives d'avenir, de contribuer à la planification stratégique des activités du Secteur mines du Ministère et de 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 1992-1993, le SDM prévoit plus particulièrement être actif dans les principaux dossiers suivants : renouvellement de l'Entente auxiliaire Canada-Québec sur le développement minéral, reconduction du programme sur les études technico-économiques et travaux d'expérimentation et sa mise en oeuvre le cas échéant, renouvellement de l'assistance à l'industrie de l'amiante via l'Institut de l'Amiante, mise à jour périodique de l'inventaire des projets miniers, grappe industrielle de transformation des métaux et des minéraux, états de situation d'exploitations minières menacées de fermeture, problématique minière de la région de Joutel-Matagami, etc. Il poursuivra également la mise en oeuvre du programme de soutien du secteur minier de la région Chapais-Chibougamau, ainsi que ses études et travaux de restauration et de sécurisation de sites miniers, particulièrement au niveau des parcs à résidus appartenant à la Couronne. Enfin, il entend continuer ses analyses des incidences économiques des politiques et des règlements touchant l'environnement dans le secteur minier et l'accessibilité au territoire.

## **Actions accréditives**

Cette partie décrit brièvement le 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").

Le régime québécois a les particularités suivantes par rapport au régime fédéral actuel :

- \* Les frais 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.).
- \* 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 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 vente des actions accréditives peut être aussi bas que 38,9% de leur coût d'acquisition, en tenant compte de l'impôt fédéral, avant que l'investisseur subisse une perte.

## **Loi sur les mines**

Cette loi prévoit les diverses modalités relatives à l'attribution des droits miniers, et elle édicte les conditions d'exercice de l'activité minière au Québec. Le 17 juin 1991, l'Assemblée nationale du Québec décidait de modifier à nouveau la Loi sur les mines en adoptant le projet de Loi 130 (1991, chapitre 23), principalement afin d'assurer le réaménagement et la restauration d'un terrain affecté par des activités minières.

Ainsi, une personne qui effectue certains travaux miniers d'exploration ou d'exploitation, qui dirige une usine de concentration de certaines substances minérales ou qui effectue certains travaux d'exploitation à l'égard de résidus miniers sera dorénavant tenue de faire approuver par le ministre un plan de réaménagement et de restauration du terrain affecté par ses activités, de se conformer au plan et de déposer une garantie à cet effet. En cas de défaut, le ministre pourra notamment faire exécuter les travaux requis aux frais de la personne qui omet de se soumettre à ces exigences et, s'il ne peut en recouvrer les frais au moyen de la garantie, toute somme due à la Couronne constituera une dette privilégiée sur tous les biens du débiteur. La Loi 130 comporte également une disposition par laquelle le ministre pourra enjoindre une personne qui a déjà cessé ses activités minières sur un site donné, de procéder

à des travaux de réaménagement et de restauration nécessités par la présence de résidus miniers.

Par ailleurs, la Loi 130 indique que certains territoires pourront être délimités à des fins non exclusives de récréation, de tourisme et de conservation de la flore ou de la faune et que certaines conditions spécifiques pourront être imposées à l'égard des travaux miniers effectués dans ces territoires. En procédant ainsi, le gouvernement québécois espère conserver accessible à l'industrie minière la plus grande partie de son territoire, tout en tenant compte de ses autres utilisations.

### **LE CENTRE DE RECHERCHES MINÉRALES (CRM)**

Le Centre de recherches minérales (CRM) constitue l'une des trois directions générales du secteur Mines, de l'actuel ministère de l'Énergie et des Ressources. Il compte 136 employés permanents (chercheurs, techniciens, fonctionnaires et ouvriers) et une vingtaine d'employés occasionnels. Il dispose en 1992-1993 d'un budget annuel de 9,4 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.

Le CRM poursuit ses efforts en vue d'élargir sa clientèle. En 1991-92, la valeur des 94 projets réalisés pour le compte de clients industriels s'élève à 4,1 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 recherches 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 et d'un savoir-faire certain 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 1991-1992, les laboratoires d'analyses du CRM ont effectué l'analyse de quelque 42 000 échantillons, dont 54% proviennent de la Direction générale de l'exploration géologique et minérale du ministère. De plus, le CRM a géré quatre projets d'une valeur de 342,3 k\$ prévus au volet technologique de l'Entente auxiliaire de développement minéral.

Le CRM gère aussi la participation gouvernementale du Québec dans le programme de neutralisation des eaux de drainage dans l'environnement minier pour un montant de 449,4 k\$ dans huit projets.

La raison d'être du CRM traduit sa fonction gouvernementale qui 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 substances 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 fera des efforts supplémentaires pour devenir pour l'industrie minérale un centre d'excellence dans l'application aux opérations de l'automatique et de la simulation et pour augmenter son niveau d'intervention en industrie. Le CRM s'impliquera davantage dans le transfert de connaissances en étant encore plus actif dans l'organisation de colloques, de cours et de séminaires spécialisés.

Le CRM est déjà très 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 de d'autres équipes de recherches pour leur réalisation. Dans le secteur du fer entre autres, cinq projets de cette nature sont en voie de réalisation pour un montant global de 1,68 M\$.

Cette approche semble d'ailleurs favoriser le maillage université-entreprise et accélérer le transfert technologique vers les entreprises participantes. D'autre part, les avantages fiscaux que peuvent en retirer les entreprises sont très favorables au Québec et servent à alléger les coûts de la recherche pour les entreprises. Le CRM ne ménage pas ses efforts pour sensibiliser sa clientèle à cet état de fait.

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, coordonner de tels projets en participation, et les mener à terme au bénéfice de toute l'industrie minérale.

#### **DIRECTION GÉNÉRALE DE L'EXPLORATION GÉOLOGIQUE ET MINÉRALE (DGEGM)**

L'année financière 1992-93 est marquée par un niveau d'activités comparable à celui de 1991-1992 qui se résume à l'acquisition de connaissances géoscientifiques et à la poursuite du programme d'assistance financière à l'exploration minière. En 1992-93, 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.

La DGEGM consacre 7,4 millions de dollars au volet "acquisition de connaissances"

et un montant de 7,4 millions de dollars est consacré à des programmes d'assistance financière à l'exploration ainsi qu'à la préparation et à la diffusion de la géoinformation.

### **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.

### **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 reposant au nord du 55° 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 du personnel de la Division des minéraux industriels.

Au cours de l'année 1992-1993, le Service géologique de Québec disposait d'un budget de 3,4 millions de dollars pour la réalisation de 30 projets de terrain et l'achèvement de trois autres projets entrepris l'année précédente. Le budget global est réparti entre quatre divisions régionales, correspondant aux districts régionaux et deux divisions thématiques.

**La Division Côte-Nord — Nouveau-Québec** dispose d'un budget de 943,3 K\$, dont la plus grande partie a été consacrée à cinq projets de levés et études dans le Grenville, deux autres projets de moindre envergure ont été exécutés dans le nord québécois. Les travaux sur la Côte-Nord, incluant la région de Fermont, se sont poursuivis; ils portent sur la continuation d'un levé au 1:50 000 sur le Haut Plateau de Manicouagan aux environs de la rivière Sainte-Marguerite. Nous avons amorcé un levé géologique et métallogénique du Complexe lité mafique de Sept-Îles et réalisé une reconnaissance métallogénique dans le Groupe de Wakeham. Un échantillonnage des sables a été fait pour l'évaluation du potentiel en minéraux lourds des plages de la Moyenne et Basse Côte-Nord et une étude de caractérisation des ressources pour les tourbières de la Haute Côte-Nord a été amorcée. Nous avons publié les résultats d'un levé géophysique aéroporté dans la région de Fermont.

Aucun travail de terrain n'a été poursuivi dans la région de la Fosse de l'Ungava, mais les efforts ont porté sur la préparation d'un mémoire pour les travaux effectués de 1983 à 1988. Pour la Fosse du Labrador et les territoires adjacents, les travaux ont consisté en reconnaissance gîtologique dans le secteur de la Baie d'Ungava.

**La Division Montréal — Laurentides** compte sur un budget de 537,6 K\$. Les principaux éléments de la programmation touchent la compilation géologique et

structurale de la région de Fort Coulonge, l'étude des corridors de déformation de la région de Grand Remous — Maniwaki, Danford Lake. Des études métallogéniques ont porté sur des indices de tourmalinite, amas sulfurés zincifères et formations de fer dans la région de Maniwaki-Gracefield, des indices de cuivre et nickel dans le secteur du Réservoir Taureau, les pegmatites et gneiss à néphéline du Réservoir Cabonga. Des travaux d'inventaires de tourbières de la Mauricie-Lanaudière et des carrières des Basses-Terres du Saint-Laurent ont été exécutés.

Les travaux sur le territoire de la **Division Estrie — Laurentides** ont été menés avec un budget de 986,4 K\$. En Estrie-Beauce, ils ont porté sur le projet de levé géologique régional dans la région du Lac Mégantic, les compilations géologiques et métallogéniques au 1:50 000 de l'Estrie-Beauce et de la région de Québec, de même que sur le volcanisme appalachien et les minéralisations associées des régions de la colline Tibbits et de Bolton. Trois projets d'inventaires ont été exécutés, soit celui des ressources en granulat, de la Beauce, les carrières de l'Estrie et les tourbières de la région de Trois-Rivières. Deux projets de cartographie dans le Grenville visaient le levé régional de la partie nord du Complexe de la Bostonnais et la vérification de certaines données géologiques au nord du lac Saint-Jean dans un contexte propice à la découverte d'horizons riches en wollastonite.

La **Division Gaspésie — Îles-de-la-Madeleine** a présenté cette année les premiers feuillets publiés suite aux travaux de compilation des dernières années. Le budget de 430,8 K\$ alloué à cette région a permis de réaliser une première étape d'un projet de géochimie alluvionnaire dans le Bas-Saint-Laurent, de franchir la dernière étape du projet de métallogénie du segment ouest de la Faille du Grand Pabos et de compléter un projet de vérification et compilation dans la région de Ristigouche.

La **Division des minéraux industriels, de la tourbe et des matériaux de construction** gère la plus grande partie de ses activités sur les territoires des quatre divisions régionales du Service géologique de Québec. Outre ces activités qu'elle gère en collaboration avec les autres membres des divisions régionales, elle est responsable de levés, compilations et études qui touchent l'ensemble du Québec pour répondre à des besoins exprimés par la clientèle du ministère intéressée par ces substances minérales. Un budget de 73,2 K\$ est consacré au soutien technique aux entreprises et à la production de documents de synthèse et d'information, tel un atlas sur les gravières et sablières du Québec.

La **Division de la géochimie et de la géophysique** s'occupe de gérer les levés, les études et les compilations menés sur le territoire du SGQ. Le Service géologique de Québec a, par l'entremise de cette division dépensé 497,2 K\$. De ce montant, 238,1 K\$ ont été consacrés à des levés et analyses en géochimie principalement dans le Bas-Saint-Laurent et 259,1 K\$ pour des levés et études en géophysique surtout dans le secteur du Haut Plateau de Manicouagan.

#### **Service géologique du Nord-Ouest (SGNO)**

Le Service géologique du Nord-Ouest (SGNO) 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 une Division de géochimie et de géophysique.

Le SGNO dispose, pour l'année 1992-1993, d'un budget de 2,7 millions, ce qui représente sensiblement le même montant que l'année dernière. Cependant, compte tenu de la réduction de son budget par rapport aux années antérieures à 1991-1992, le SGNO a réduit le nombre et l'envergure des levés géologiques et géophysiques et les contrats aux firmes et instituts.

À cause de la coûteuse logistique requise, un seul levé (1:20 000) fut effectué en région isolée soit celui du lac Troilus. Il s'agit toutefois d'un levé important puisqu'un gîte prometteur, le gîte du lac Troilus (Minnova/Kerr-Addison) se trouve en plein coeur de la région levée. D'autres levés détaillés ont été poursuivis dans des secteurs clés pour l'exploration minérale soit ceux de Lebel-sur-Quévillon près des gîtes de Grevet et ceux de Porcupine-Destor qui englobent le secteur de la mine Duquesne. Un nouveau levé détaillé a été amorcé dans le secteur de Belleterre, un autre secteur d'intérêt pour l'exploration minérale. Dans le cadre du programme fédéral-provincial de soutien au secteur minier de Chapais-Chibougamau, un levé géophysique (magnétique, électromagnétique et VLF) hélicoptère détaillé a été complété dans le secteur de Caopatina-Est au sud de Chibougamau. Ajoutons qu'un important levé géologique régional a été complété dans le Grenville, à l'est de Val-d'Or, dans un secteur qui suscite beaucoup d'intérêt.

Au niveau des études, il faut souligner les efforts déployés dans la région de Val-d'Or afin de redéfinir le cadre stratigraphique et le contexte des gîtes. Une étude des grandes discontinuités structurales en Abitibi a été préparée par le SGNO et réalisée par le Centre d'études sur les ressources minérales (Université du Québec à Chicoutimi).

Dans le domaine de la métallogénie, la Division des gîtes minéraux a poursuivi ses travaux sur les minéralisations de métaux usuels et de métaux précieux. On a également amorcé des travaux sur les minéralisations de sulfures disséminés associées aux roches granitoïdes et on a terminé les travaux sur la synthèse des gisements de métaux usuels dans le secteur de Rouyn-Noranda.

Dans le cadre du projet du Système d'information géominière du Québec (SIGÉOM), le SGNO a continué de piloter divers volets : la compilation des forages contenue sur 25 feuillets à l'échelle 1:50 000 a été complétée en Abitibi.

Enfin signalons que le réaménagement des trois carothèques du Nord-Ouest est complété et qu'on a produit un premier répertoire du contenu de ces carothèques.

Au cours de la dernière année, les géologues du service ont réalisé 109 cartes et rapports ainsi que 14 articles scientifiques. Ils ont également présenté dans divers congrès régionaux, nationaux ou internationaux, 31 conférences et 22 photoprésentations.

## **Direction de l'assistance à l'exploration minière**

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.

### **Service de la géoinformation**

Le Service de la géoinformation a édité et mis en forme, au cours de l'exercice financier 1991-1992, 93 nouveaux documents géoscientifiques faisant état des résultats des 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, pour le compte du ministère de l'Énergie et des Ressources, a débuté l'implantation du SIGÉOM, un système intégré d'information géominière à référence spatiale, qui facilitera grandement, pour l'industrie minière, l'accès et le traitement de l'information géoscientifique disponible sur le territoire québécois.

Cette volonté d'implantation fait suite à une démarche réfléchie, cohérente et structurée de planification en marche depuis 1987. Cette démarche a comporté la réalisation d'un plan directeur des systèmes d'information, d'une étude d'opportunité technologique et d'un projet pilote d'utilisation de la géomatique dans une région minière particulièrement active (région de Rouyn-Noranda). L'étude d'opportunité et le projet pilote ont été réalisés dans le cadre de l'entente Canada-Québec sur le développement minéral. Les résultats très encourageants de ce projet ont conduit à des mises à l'essai du prototype développé, pour expérimenter en situations opérationnelles concrètes le fonctionnement du futur système. Finalement, une conception administrative, élaborée à la lumière des informations recueillies précédemment, a complété la planification détaillée du système à implanter.

Les objectifs retenus pour le SIGÉOM sont les suivants :

-assurer une production et une mise à jour rapide de l'information géoscientifique du territoire québécois;

-assurer à la clientèle minière un accès rapide et intégré, en format numérique, à cette information;

-utiliser une technologie accessible à cette clientèle, pour lui permettre de s'en servir pour produire et traiter ses propres données.

Le SIGÉOM sera donc un système intégré d'accès, de traitement et de diffusion de l'ensemble de l'information géominière à référence spatiale du Québec. Cette information comprend la géologie, la géochimie, la géophysique, les gîtes minéraux, la localisation des travaux et les données issus des dossiers d'exploration minière.

Afin de permettre aux compagnies minières, aux prospecteurs et aux consultants du

domaine minier d'utiliser le système pour y incorporer leurs propres données et leurs propres traitements, le SIGÉOM utilisera des logiciels commerciaux reconnus, opérant sur des micro-ordinateurs de type IBM PC courants.

L'implantation et le fonctionnement du SIGÉOM nécessiteront un investissement de quelque 16 millions de dollars au cours des dix prochaines années, à même nos budgets réguliers. L'implantation elle-même se fera en cinq phases, chacune identifiant des biens livrables précis, en commençant par ceux qui seront les plus utiles à la clientèle minière. Cette implantation, au coût de 10 millions, sera financée dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement minérale.

### **Service d'information et de soutien à l'exploration minière**

Le Service d'information et de soutien à l'exploration minière (SISEM) a été formé au cours de la dernière année suite au regroupement de la Division des données géoscientifiques et de la Division des programmes d'aide.

### **Division des données géoscientifiques**

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

Le Centre de diffusion a traité plus de 3 180 commandes, ce qui représente un accroissement de 29 % par rapport à l'exercice précédent.

Au 31 mars 1992, la banque EXAMINE contenait 51 148 références de rapports d'exploration minière publiés, 383 de rapports confidentiels, 3 386 références de publications de la direction générale et 1 554 références de thèses universitaires.

La banque COGITE à laquelle s'ajoute les nouveaux indices minéralisés répertoriés mensuellement comprend à ce jour au delà de 7 250 gîtes et indices minéralisés. L'équipe COGITE a repéré 454 indices minéralisés dans les nouvelles publications de la DGEGM, dans les nouveaux rapports d'exploration minière ainsi que dans les anciens rapports publiés entre 1977 et 1986. De plus, l'équipe a revu et corrigé 2 866 fiches de gîtes.

L'équipe des cartes de localisation a numérisé, sur le logiciel à références spatiales (MICROSTATION) les quelque 3 300 périmètres de travaux relatifs aux publications de la DGEGM. De plus, diverses tâches prérequis à la numérisation des périmètres des quelque 50 000 rapports d'exploration minière ont été réalisées. Ces données numérisées seront intégrées au système d'information géominière (SIGÉOM).

Dans le cadre du volet promotion-éducation, 22 sorties promotionnelles et éducatives ont été organisées à travers la province, rejoignant près de 50 000 personnes. Le Guide pratique d'identification des minéraux et la carte géotouristique du Sud du Québec ont été publiés en collaboration avec Les Publications du Québec.

## 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. Ces programmes s'inscrivent dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement économique des régions du Québec.

La Division a géré un budget de quelque 2 M \$ pour l'assistance financière à la prospection et à l'exploration minière en 1992-93. La plus grande partie de ce budget a été consacrée à deux programmes :

- . le programme fédéral-provincial d'assistance financière à la prospection minière dans l'Est du Québec (Bas-Saint-Laurent et Gaspésie - Iles-de-la-Madeleine);
- . le volet II du programme fédéral-provincial de soutien du secteur minier de Chapais-Chibougamau.

Dans le cadre du programme de l'Est du Québec, une soixantaine de prospecteurs ont bénéficié d'une assistance financière pour la réalisation de 30 projets sélectionnés par un comité de suivi technique; onze nouveaux indices minéralisés ont été découverts. De plus, six compagnies ont reçu des subventions pour valoriser leurs propriétés minières et une subvention de 200 K \$ a été versée au Fonds d'exploration minière du Bas-Saint-Laurent; ce montant s'ajoute à la contribution de 85 K \$ des municipalités et des organismes locaux pour ce fonds.

Le nouveau programme de soutien à la région de Chapais-Chibougamau a été annoncé le 12 juin 1992. Au niveau de l'assistance à l'exploration, les subventions ont totalisé 600 K \$ pour la réalisation de cinq projets de compagnies et d'une quinzaine de projets soumis par des prospecteurs ou groupes de prospecteurs.

Par ailleurs, une subvention de 130 K \$ a été octroyée au Conseil régional de l'Estrie dans le cadre d'activités liées à l'encadrement de prospecteurs et à la mise sur pied d'un fonds minier pour l'Estrie-Beauce.

Province : Québec  
1991-1992

ACTIVITÉS	MAÎTRE D'OEUVRE	FINANCEMENT	NOMBRE DE PROJETS OU D'INSTALLATIONS	EMPLOYÉS PERMANENTS PERS.-ANNÉE (C-P-A)**	EMPLOYÉS OCCASIONNELS PERS.-ANNÉE	BUDGET ALLOUÉ (\$)
1) Levés géologiques :			-	-	-	-
a) Côte-Nord et Nouveau-Québec	DGEGM	MER	14	6P-1A	1	1 403 100
b) Montréal-Laurentides	DGEGM	MER	9	3P-3A	-	388 700
c) Gaspésie-Les Îles	DGEGM	MER	7	4P-2A	-	549 100
d) Estrie-Laurentides	DGEGM	MER	13	5P-2A	2	1 013 000
e) Minéraux industriels du Québec	DGEGM	MER	2	3P-1A	-	212 300
f) Rouyn-Noranda	DGEGM	MER	18	3P-3A	-	867 800
g) Val-d'Or	DGEGM	MER	13	3P-3A	1	896 100
h) Chibougamau	DGEGM	MER	11	3P-3A	1	1 130 100
2) Bases de données	DGEGM	MER	-	2A	-	552 700
3) Supervision et contrôle	DGEGM	MER	-	2C-16P-9A	1	900 700
4) Gestion et planification	DGEGM	MER	-	2C-2P-2A	1	440 900
5) Opérations (équipement de terrain, informatique, etc.)	DGEGM	MER	-	2P-17A	3	1 015 000
6) Assistance financière	DGEGM	MER/EMR*	120	1P	-	1 142 000
7) Géoinformation	DGEGM	MER	-	2C-5P-18A	3	3 854 200
8) Information géoscientifique	DGEGM	MER	-	1C-5P-14A	4	1 295 400
9) Gestion interne	DGEGM	MER	-	2C-1A	-	491 800
10) Communication	DGEGM	MER	-	1A	-	150 000
TOTAUX	-	-	-	9C-61P-82A	17	16 302 900

DGEGM - Direction générale de l'exploration géologique et minérale

MER - Ministère de l'Énergie et des Ressources du Québec

EMR - Energy, Mines and Resources, Ottawa

\* - Entente auxiliaire Canada-Québec sur le développement minéral

\*\* - C = cadre

P = professionnel

A = autre

## NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES AND ENERGY

### Geoscience Activities and Exploration

Late in 1991, the Minister of Natural Resources and Energy - Morris Green, Minister of State for Mines and Energy - Edmond Blanchard, and Deputy Minister - B.J. Walker, were replaced by the Honourable Alan Graham, the Honourable Doug Tyler, and Mavis Hurley, respectively.

The total value of mineral production in 1991 was \$618 million, down from \$900 million in 1990. This drop reflected the long strike at the Brunswick No. 12 mine in the Bathurst base-metal mining camp in 1990/91. The value of production of zinc, lead, copper, silver, and other metals was reduced from over \$600 million to about \$325 million.

The 1992/93 fiscal year brought a reduction to the Mineral Resources Division budgets. The Geological Surveys Branch budget was cut by approximately 6%. The NBDNRE geoscience program of 1992 continues that work described in 1991. Approximately \$2.3 million was spent on geoscience in New Brunswick in 1991/92.

The emphasis of the Province's geoscience program is on the terranes that have the highest mineral resource potential, particularly the Bathurst mining camp, located at the northeast end of a complex Lower Palaeozoic terrane called the Miramichi Zone or Highlands. The zinc-lead-silver-copper sulphide deposits of this region are hosted by a Middle Ordovician back-arc, dominantly felsic volcanic, complex. S.R. McCutcheon, J.P. Langton, L.R. Fyffe, and R.A. Wilson are involved in 1:10 000-scale and 1:20 000-scale mapping of the complex. Meanwhile, geological mapping in the region flanking the Bathurst Camp is being completed by J. Walker and S. Gower. This region of Upper Ordovician-Silurian-Devonian rocks is host to a variety of mineral deposits that have been divided into 18 categories by W.W. Gardiner. He is updating the files on the 280 mineral occurrences known within the area mapped under the Antinouri-Nicholas Project. The mineral resource assessment work produced by mineral exploration companies is also being compiled for the Antinouri-Nicholas area. All data are digitized and entered into a CARIS-based geoscience system. R.R. Irrinki, L. McNeill, and M.P. Rennick will complete this work in late 1992.

Surficial geological mapping in northern New Brunswick was continued by M. Parkhill who mapped parts of 21 P/5. Till geochemistry maps will be made available to exploration companies and prospectors, while the surficial data will assist forestry and help identify materials for mine reclamation.

Emphasis in southern New Brunswick is focussed on completion of two 1:250 000 geology maps - 21 G and 21 H. A.A. Ruitenbergh, M.J. McLeod, and S. Johnson are the principal mappers. Several problem areas are being remapped, but the 1:250 000 compilations are to be published in early 1993. A. Caron is wrapping up his Pokiok project involving the structural evolution and alteration history of W-Mo-Au skarns and

Sb-Au veins in the contact aureole of the Pokiok granite. A.A. Seaman is mapping the surficial geology of 21 G/13 and G/11W in support of the Pokiok project. A.G. Pronk, assisted by R. Boldon, is carrying out a stream silt geochemical survey in southwestern New Brunswick.

The Mineral Exploration Stimulation Program (MESP) has been put on hold for 1992/93 following a substantial budget cut. G. Crouse, R.R. Irrinki, and J.L. Davies are evaluating the results of the three-year old program and it is hoped that prospecting grants will be offered in 1993/94. Meanwhile, courses for prospectors were held in Sussex and Bathurst. B.M.W. Carroll and S.A. Abbott provided the editorial support for the Mineral Resources Division.

Geoscience projects carried out by geologists T.C. Webb and D.V. Venugopal of the Mineral Development Branch included projects related to dimension stone and bedrock aggregate studies.

### **Mineral Exploration 1991**

Total value of investment in New Brunswick in 1991 was estimated in November 1991 by Energy, Mines and Resources to be \$14 million. The final figure was probably closer to \$17 million or roughly the same as that spent in 1990.

Most of the expenditures were made in search of base-metal targets in the Bathurst Mining Camp, but there was significant investment in exploration for base metals and gold in the Annidale belt.

The number of new mineral claims staked rose 5%, and the number of renewed claims was up by 11%. By the end of 1991, 21 350 claims were in good standing.

Noranda Exploration Company Limited and Brunswick Mining and Smelting Corporation Limited spent approximately \$6.1 million on exploration in the Province. Fifty-three other companies reported expenditures in 1991, including NovaGold Resources, Teck Corporation, BHP Utah Mines Ltd., Falconbridge Limited, Rio Algom Limited, Stratabound Minerals, Phelps Dodge Corporation of Canada Ltd., Freewest Resources, Cominco, Granges Inc., and Acadia Mineral Ventures.

## **NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES GEOSCIENCE ACTIVITIES**

### **INTRODUCTION TO THE DEPARTMENT**

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, Mineral Resources and Mineral Development from the Mines and Minerals Branch and Energy Resources from the Energy Branch, administer geoscience projects.

## **Developing and Encouraging Geoscience Activities**

Nova Scotia signed a new Canada-Nova Scotia Cooperation Agreement on Mineral Development in August 1992. This agreement provides \$10 million over 3 years (1992-1995) to encourage the economic development of the mineral industry in Nova Scotia. Of this total, \$3.9 million is budgeted for the Exploration Stimulation Program. The Department will spend \$0.9 million over 3 years supporting the provincial geoscience projects.

## **GEOSCIENCE ACTIVITIES**

A wide variety of geoscience activities are being undertaken by the staff of the Department. These projects can be categorized as follows: 1) energy resources studies; 2) metallic and non-metallic mineral resources and deposit studies; 3) regional mapping; 4) geochemistry; 5) Quaternary research; and 6) services to industry and the public. Most of these activities are supported by the Cooperation Agreement.

### **Energy Resources Studies**

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 works in conjunction with the Canada-Nova Scotia Offshore Petroleum Board in administering offshore petroleum resources.

A reprocessing project was completed involving 1982 industry seismic data in the St. Georges Bay of Nova Scotia. Final reprocessed sections, a report, raw field and processed data on magnetic tape were provided to the Department at the completion of this project. This improved data will be incorporated into a joint study by the Atlantic Geoscience Centre and this Department to completely remap this area of Nova Scotia which may lead to petroleum plays that may be of interest to exploration companies. Coalbed methane gas has long been known in the Province's coal basins. The Department has begun an extensive inventory of coalbed methane potential in the province and will produce a database which will include gas contents of individual coals. This information will be valuable in the future development of the untapped resources.

In the offshore realm, staff have been busily monitoring the progress of Canada's first offshore oil and gas project, the Cohasset-Panuke oil field development. This project saw the production of high-quality oil in June of 1992. Work was completed on royalty agreements which set royalties for the project which have already accrued to the Province during the first production season. Ongoing work is occurring with respect to reserve evaluation of various offshore fields including the Cohasset and Panuke fields.

Low-sulphur coal resources in the western Cumberland Basin, Stellarton Basin, and Debert-Kempton coalfield were the subject of a continuing program of regional

mapping and research on the controls of coal formation. In the Sydney coalfield, the Harbour Seam is the focus of detailed sedimentological studies to define geological controls on seam thickness and on deposition of roof and floor strata. Detailed studies of the Hub Seam and roof strata in the Prince Mine were resumed as part of a co-operative program with the mine geologists of Cape Breton Development Corporation. The focus of research is prediction of sandstone bodies and areas of thin coal occurrences which are hindrances to safe and economic mining.

A study of the elemental composition of Nova Scotia coals were completed, and an extensive computer database of coal geology of the Sydney, Stellarton and Cumberland Basins is near completion, both funded under the Cooperation Agreement.

### **Mineral Resources and Deposits Studies**

Studies on metallic mineral deposit continued during the year and reports on Carbonate-hosted Gays River Pb-Zn deposit and Tangier gold deposits were released. Petrological and geochemical studies on the East Kemptville tin deposit were also undertaken and a report on the age of the mineralization was published. Polymetallic tin deposits hosted by Cambro-Ordovician metasediment in Southwestern Nova Scotia were investigated and publication of results is anticipated during the year 1993.

Diamond drilling was undertaken in the New Canaan and Boot Jack Bog areas to evaluate the base-metal and precious-metal potential. A number of talks were presented at the GAC/MAC meeting at Wolfville on the mineral deposits of the Meguma Zone. Work on describing the occurrences and mineral potential of limestone, dolomite, silica, barite, andalusite, mica and garnet continues.

Bedrock aggregate potential was investigated during the 1992 field season in two areas of the Province. In the Halifax-Dartmouth area regional mapping and sampling of the bedrock continued. In the Cobequid Highlands near Amherst, a drilling program is being conducted to identify rock types suitable for crushed stone aggregate. One area in New Canaan, Cumberland County, has subsequently been put into production.

### **Regional Mapping**

In the context of remapping the Province to provide up-to-date (<20-25 years old) 1:50 000 geological maps, mapping projects were started in the Avalon Composite Terrane in the Creignish Hills (central Cape Breton Island) and in the central Meguma Terrane (Musquodoboit batholith and Rawdon area). The Creignish Hills provides the largest outcrop area of the Proterozoic George River Group with potential for metallurgical lime, base- and precious-metal mineralization that is deformed and cut by Late Proterozoic plutons associated with hydrothermal mineralization. The objectives of remapping the Meguma Terrane assisted by vertical gradient magnetic maps is to provide further stratigraphic subdivision of the Meguma Group, structural and metamorphic data, subdivision of the batholith, and metallogenic information on the gold and base-metal mineralization. Reports on the several Carboniferous basins were prepared including Cumberland Basin, Antigonish Basin, and Lake Enon Basin. A Structural Analysis of the Canadian Appalachians was published.

## Quaternary Studies

The Quaternary geology subsection of the regional geological mapping was involved in the following activities during 1992.

1. Surficial mapping of the inner continental shelf of Nova Scotia in coordination with the Geological Survey of Canada. The economic goals of this mapping are to define the offshore aggregate and placer gold potential of the inner shelf. Scientific pursuits include correlation of onshore and offshore glacial deposits and events and determination of climatic changes at the end of the last glaciation.
2. Completion of surficial mapping in Southern Nova Scotia with the production of open file 1:50 000 maps. These maps depict the nature, thickness and distribution of surficial deposits and can be used for environmental assessment, industrial construction, forestry and mineral exploration.
3. Final reports on the surficial geology and till geochemistry of the South Mountain Batholith (southern Nova Scotia) and the investigations of Debris Avalanches in the Cape Breton Highlands are due in 1993.
4. Work was started on a comprehensive memoir about the glacial and Quaternary geology of mainland Nova Scotia and the inner shelf. This memoir will accompany the recently released Surficial Map of Nova Scotia (1992).

## GEOCHEMISTRY

The Geochemistry Section continued investigations into the application of applied exploration techniques to define mineral potential in the Province. Field investigations were begun into anomalous areas within the St. Mary's Graben Carboniferous rocks. Biogeochemical sampling of bark has indicated potential for Au, PGE and other related elements. Follow-up work has also confirmed the presence of gold grains in selected Meguma till and bedrock samples at North Brookfield, Long Lake and Boot Jack Bog. Biogeochemical traverses were also carried out over the Whycocomagh, Jubilee and Lime Hill deposits on Cape Breton Island. Overbank stream sediment samples were collected from the Sackville River as part of a long term monitoring study of geochemical baselines in the Province.

The Section was also represented on the Nova Scotia Remote Sensing Committee and as a member of the European Radar Satellite - 1 Working Group. During the year two full scene SAR images were collected over Central Nova Scotia with processing to begin in late 1992. The Province's geochemist remained as a Counsellor for the Association of Exploration Geochemists and a Director of the Geomatics Association of Nova Scotia. During 1992 conference presentations were made to the International Geochemical Mapping Project IGCP 259, at the Goldschmidt meeting in Reston, Virginia and the geochemical exploration workshop at the CIM District 1 meeting in Halifax. The section was also actively involved in the registration and financial aspects of the CIM meeting.

## **Service to Industry and the Public**

The Department maintains a regional office at Stellarton with a library, core storage facilities and core library. Over 500 000 m of core from industry and department drilling programs are stored here. Facilities are available at the Core Library for core study and sampling. Private sector exploration activities are monitored from this office.

Large databases, including GEOSCAN are available for use. The information is covered by a national geological bibliographic database. Additional databases on mineral occurrences, drill-hole information and geological/geophysical maps are also available.

The Integrated Land Use Project provides information needed to formulate policy ensuring the protection, conservation and proper management of energy and mineral resources. Mineral Resource Land Use (MRLU) maps are being compiled at 1:50 000 scale to provide input to all strategic land and resource planning throughout Nova Scotia.

Public awareness activities are an important part of the Mines and Minerals Branch work. The purpose of this work is to describe the mineral industry, promote its economic value and assist many audiences in understanding its importance to Nova Scotians. Through prospecting courses, displays, seminars, interpretive walks, publications and education materials for schools, members of the Branch are reaching a variety of audiences to promote public education and awareness, mineral development, and greater appreciation of the mineral industry.

## **CONCLUSION**

The geoscience projects described here support and encourage mineral exploration. Canada and Nova Scotia are working together to encourage mineral development and to strengthen the mineral industry through the programs of the Canada-Nova Scotia Cooperation Agreement on Mineral Development. The steady production of industrial minerals, coal and aggregates provides a stable and diversified mineral industry. The strong mineral industry coupled with a variety of geological environments makes Nova Scotia an attractive location for mineral exploration and development.

# **NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MINES AND ENERGY**

## **GEOLOGICAL SURVEY BRANCH**

### **Introduction**

The Geological Survey Branch of the Newfoundland Department of Mines and Energy carries out programs in regional geology, mineral deposits research, environmental geology, and public information in 1992. The programs were funded, in part, under the 1990-1994 Canada-Newfoundland Cooperation Agreement on Mineral Development.

## Regional Geology Program—Bedrock Mapping

The Branch's bedrock mapping program has the long-term objective of complete coverage of the island of Newfoundland at the 1:50 000 scale, and of Labrador at the 1:100 000 scale. That program, which has been underway since 1972, is slightly more than 60% complete.

Four mapping projects were active on the island of Newfoundland in 1992. Brian O'Brien continued his analysis of structure and stratigraphy in Notre Dame Bay. His work this year demonstrated that the upper part of the Botwood Group, formerly thought to post-date the main deformation in the area, in fact displays structures similar to those in the older rocks. These structures, where invaded by intrusive rocks, are an important regional control on gold mineralization. O'Brien's work on the structure and stratigraphy of the area was assisted by detailed sedimentological studies carried out by Thomas Dec.

Lawson Dickson completed mapping in the 2D/14 map sheet. The map area is underlain by Middle Ordovician and Silurian strata, intruded by the Mount Peyton Intrusive Suite. Gabbroic phases of the Mount Peyton are being developed for dimension stone. Dickson's and O'Brien's mapping was supported by palaeontological studies by Doug Boyce.

Andy Kerr continued compilation of a database on the geochemistry of intrusive rocks in Newfoundland. The field season was devoted to sampling of intrusives presently under-represented in the database, concentrating on southwestern Newfoundland.

Sean O'Brien continued mapping in the northwestern part of the Avalon Zone, concentrating on the southern Bonavista Bay area (parts of map sheets 2C/5 and 2D/8). His work has shown that the base of the stratigraphic succession in the area is a group of highly strained volcanic rocks (Love Cove Group), conformably overlain by turbidites (Connecting Point Group). Terrestrial volcanic and sedimentary rocks of the Musgravetown Group form 2 basins in tectonic contact with other rock units. Locally deformed members of the Musgravetown Group have formerly been placed in the Love Cove Group, causing considerable confusion in geological interpretation in southeast Newfoundland. O'Brien continued to support Bob Holdsworth of the University of Durham in his study of the contact between the Avalon and Gander zones. The dextral shear zone which defines this boundary in the north is cut by interconnected brittle faults farther south; these brittle faults define the boundary in southern Newfoundland.

Jan Knight was seconded to the Centre for Earth Resources Research at Memorial University for much of the field season, to assist with a study of the petroleum potential of western Newfoundland.

Four mapping projects were carried out in Labrador. Dick Wardle continued his work in northernmost Labrador, in cooperation with a Geological Survey of Canada project under Martin van Kranendonk. The area covers the boundary between the Archaean Nain craton and the Lower Proterozoic mobile belt of eastern Churchill Province; represented in large part by the Burwell Domain. The Burwell Domain includes large areas of reworked Archaean gneiss, possibly equivalent to Nain Province crust,

interleaved as thrust or nappe sheets with Proterozoic metasedimentary and plutonic rocks. U-Pb dating has established the age of Burwell Domain arc-plutonism at 1.91 to 1.86 Ga. Early structural development consisted of thrust/nappe imbrication of basement and arc assemblage rocks prior to sinistral shearing along the Komaktorvik Shear Zone. The level of crustal exposure in the Burwell Domain is too deep to hold much promise for typical arc-related mineral deposits. Many young lamproite dykes were discovered, which may indicate the possibility of kimberlites in the area.

Don James began systematic 1:100,000 mapping in eastern Churchill Province, east of the Labrador Trough. The area is underlain by metamorphosed supracrustal rocks, variably metamorphosed and deformed granitoid rocks, included mafic intrusions of several ages, and part of a major intrusion of granite-charnockite belonging to the De Pas Batholith. The most recent age of high-grade metamorphism is Hudsonian but relict Archaean lithologies and structures are present. The supracrustal rocks include metamorphosed chert-magnetite iron formation and metavolcanic rocks, and may have potential for gold and base-metal mineralization.

Bruce Ryan continued mapping of the Nain Plutonic Suite and the Archaean gneisses it intrudes. Work this summer indicates the presence of 2 distinct Archaean gneiss terrains, separated by elements of the Nain Plutonic Suite. The western gneisses contain migmatized anorthosite-noritic intrusions. Mapping within the Nain Plutonic Suite has revealed the presence of several separate plutons within areas previously thought to comprise a single intrusion. Sulphide-bearing zones within and adjacent to the Nain Plutonic Suite were examined. The Eastern Grenville project, under the direction of Charlie Gower, moved into the St. Lewis River area of southeastern Labrador. Mapping resulted in the recognition of a previously unknown 80-km-long layered mafic intrusion, which may have potential for PGE and base-metal sulphide mineralization. Eight previously unmapped late- to post-Grenvillian plutons were identified. A distinctive potassic granite-syenite terrane, with potential for granophile mineralization, was mapped in the southern part of the area.

### **Regional Geology Program—Surficial Mapping**

Martin Batterson continued surficial mapping in the Humber River area of western Newfoundland, taking advantage of the new sections opened up by major construction along the Trans-Canada Highway. This season's work confirmed the dominant coastward ice-flow direction from the Topsails Hills, and new evidence was found to

suggest a southward flow down the Humber Valley from an unknown source. Marine silts and clays were found below 50 m asl throughout the Deer Lake basin, confirming an extensive postglacial marine incursion.

David Liverman continued a surficial mapping project in the Labrador Trough near Schefferville, in order to develop a model of glacial sediment dispersal relevant to mineral exploration companies using surficial geochemistry and drift prospecting. Preliminary results suggest that ice flow in the area had two major phases, an early southeast flow, which had a major effect on geomorphology, and a later northeast flow that was the main agent of dispersal of surface sediment.

Dave Taylor continued his island-wide striation reconnaissance program, concentrating this year in western Newfoundland. Five 1:50 000-scale map sheets were surveyed. All provincially collected striation data are now available in digital form.

The Branch supported 2 M.Sc. studies, by Catriona MacKenzie and Mandy Munro, on the Quaternary geology of the Botwood and Carmanville areas of northeastern Newfoundland, respectively. In both areas the glacial sediments are broadly divisible into diamicton, glaciofluvial sands and gravel, and raised marine gravels.

### **Mineral Deposits Program**

The mineral deposits program consists of metallogenic studies, industrial mineral assessments, mineral deposit inventory, and regional and follow-up geochemical studies.

Three metallogenic projects were active in the field in 1992. Dave Evans completed field work on the metallogeny of gold deposits in central Newfoundland, concentrating this year on the Bay d'Espoir area. Gold showings in this area are all structurally controlled and epigenetic. The mineralization can be broadly classified as either vein-hosted or vein and wall-rock (disseminated) hosted. Field work was also completed in an M.Sc. study of the Duder Lake occurrence in the northeastern part of the project area.

Randy Miller continued his study of the high-tech-metal potential of peralkalic rocks in the province, concentrating mainly on more detailed work in the Flowers River area of Labrador and on the King's Point Complex in Newfoundland. Detailed mapping and sampling programs were carried out in both areas, where previous work had revealed anomalous rare-metal values and high radioactivity. Results await completion of analytical work.

Scott Swinden, Senior Geologist for the Mineral Deposits Section, carried out an assessment of base-metal occurrences in the eastern Labrador Trough. These occurrences are hosted in black shales, sandwiched between gabbro sills. Swinden's work suggests that Besshi-type exploration models may be most appropriate for exploration in this area.

Cindy Saunders continued work on compilation of a database of volcanic rock geochemistry. Emphasis in 1992 was on data contained in thesis studies.

An industrial mineral assessment project, under the leadership of Ambrose Howse, concentrated on metamorphic mineral occurrences (garnet, muscovite, refractory minerals) in southwestern Newfoundland. Howse also continued his assessment of industrial carbonates on the west coast.

Jamie Meyer continued his efforts to promote development of dimension stone prospects in the Province. A major conference on dimension stone in Newfoundland, held in St. John's in April, attracted international attention. Quarries are now being developed in granite, marble, anorthosite, and slate deposits in the Province. Meyer assessment of potential quarry sites has been a major factor in this development.

Jerry Ricketts continued his regional granular aggregate surveys, moving into the Great Northern Peninsula area. This project determines the location, quantity and quality of sand and gravel deposits, utilizing field studies as well as petrography, abrasion and soundness testing, and alkali reactivity testing. The work on the Great Northern Peninsula outlined a number of potential deposits which may relieve current pressure on coastal areas as aggregate sources.

A new project was initiated, under the direction of Sharon Scott, to evaluate the potential for placer deposits in onshore glaciofluvial and raised marine deposits, and to develop a sampling strategy to assess placer occurrences. Sharon spent most of the field season evaluating gold placer occurrences in northeastern Newfoundland. Deposits in this area show features characteristic of proximal glaciofluvial outwash, with braided stream channels. Palaeoflow indicators suggest that the material was moving in a northwesterly direction. Assessments of grade and tonnage await the results of geochemical analyses.

The mineral inventory project continued documentation of mineral occurrences in Labrador and updating of mineral occurrence maps in Newfoundland. A digital version of the Mineral Occurrence Data System (MODS-PC) was released late in 1991.

Analysis of archived lake sediments for gold and related elements was completed early in 1992, under the general direction of Peter Davenport. Results are being released as a series of open files covering the island of Newfoundland. The project has led to considerable new staking over the past three years.

Field geochemical surveys were carried out in northern Labrador, where John McConnell led an investigation of areas which had shown anomalous gold and base-metal values in regional lake sediment and stream surveys. Work consisted primarily of detailed stream sediment sampling; water, panned concentrates and rock samples were also collected. Three new areas of base-metal mineralization were identified during the course of the work. McConnell also assisted GSC with detailed geochemical studies in the Moran Lake area of central Labrador.

### **Environmental Geology Program**

Lloyd St. Croix continued work on the compilation of geotechnical data on the St. John's area, building a digital database for use in urban planning and construction.

The Branch supported an M.Sc. study by Terry Christopher, investigating the nature and chronology of geochemical changes in the St. John's area. Using lake-sediment cores, records of chemical, physical and biological change are being measured against a chronological framework defined by pollen stratigraphy and radiometric dates.

### **Information Program**

The publications section, under the direction of scientific editor Christopher Pereira, published 11 geoscientific reports since September, 1991, including the Current Research volume (Report 92-1). Other reports include the summary Report of Activities, 20 open-file reports, user manuals and indexes.

The cartographic unit, led by Ken Byrne, produced 4 full-colour maps, including a metallogenic map of central Newfoundland. Eight 2- to 3-colour mineral occurrence and geological maps were published, and 188 open-file "blueline" maps were released in the geochemistry and surficial-geology series.

Industry Services, under the direction of Norm Mercer, is responsible for approximately 10 000 geoscientific documents, a technical library and industry requests for information and advice. Some 500 company orders for maps and reports were filled during the report period.

The fourth in a series of GEOSCAN NTS indexes was published in December, 1991. It covers assessment reports for the period July 1990 to June, 1991. Another download of records was made from the National Geoscan Database to an in-house, user-friendly database which now contains over 14 000 records on the province. On-line searches to meet individual requirements continued. Catherine Patey is project geologist for the GEOSCAN project.

Baxter Kean, as public information geologist, continued to promote the province's mineral potential to industry and to explain geoscience and mining to students and the general public. Displays, guidebooks, posters, media kits and brochures were prepared and distributed.

Gerry Kilfoil, the Branch's geophysicist, continued his assessment and treatment of available digital geophysical data. The work included digitizing data from company geophysical surveys in Labrador, preparation of a digital index to airborne geophysical surveys on the island of Newfoundland, and processing and correction of gamma-ray spectrometric data from government surveys in Newfoundland. Arcview, a Windows-based display package for Arcinfo data, is being evaluated for its ability to query and display information from geophysical and geochemical databases. A new colour electrostatic plotter, installed early in 1992, is being used to produce customized maps from a variety of digital databases.

The database management project, led by Jim Butler, continued collection, verification and documentation of geochemical datasets (stream and lake sediment, soil, till, and rock) from government surveys in the province, to provide this data in readily usable digital form to users inside and outside the department. This project will be extended to encompass geophysical and geological data in digital form.

## **NORTHWEST TERRITORIES**

The Canada-NWT Mineral Initiatives, part of the 1991-1996 Canada-NWT Economic Development Agreement, were fully operational in 1992. The Department of Energy, Mines and Petroleum Resources (EMPR), GNWT is the Implementing Party for the Initiatives. The Canada NWT Mineral Initiatives Office (MIO) was established to coordinate and deliver projects under the Mineral Initiatives. Under the Geoscience Initiative, 19 field projects were supported; 7 delivered by the MIO, the others by the GSC (see Table 1). The field activities of the NWT Geology Division, MIO and GSC were coordinated to maximize efficiency. Results from these projects were presented at the 20th Annual Geoscience Forum in November, 1992. In addition, the NWT Geology Division and the GSC, along with the MIO are developing a Computerized

Mineral Showings Database (CMSD) and Mineral Resources Maps (MRM) for the NWT.

Under the Prospector Initiative, EMPR, the Chamber of Mines and the NWT Geology Division coordinated a Prospector Grubstake program and several Training courses.

## **INDIAN AND NORTHERN AFFAIRS CANADA**

### **NWT Geology Division**

The NWT Geology Division manages and conducts the provincial-type geological survey responsibilities of the Department of Indian and Northern Affairs in the Northwest Territories. In 1992 mineral exploration and mining was monitored by a full-time staff of 6. One full-time staff member and 8 part-time (term) staff assisted with geological mapping. Most of the term staff worked only during the summer field season. Four District Geologists monitored mineral exploration and evaluated assessment work submissions for their respective districts. They also map and study mineral showings and deposits and provide professional and technical advice to those requesting such assistance. A Staff Geologist monitors mining and manages the Geological Archive, where an Archives Geologist and technician provide public access to the geological data preserved therein. A Project Geologist directs 1:30 000-scale mapping of supracrustal belts and manages the C.S. Lord Core Library, where collections of rocks, minerals and drill core are maintained. Contracts are let each year, mainly to university staff, to add to the NWT geological data base through detailed mapping projects and mineral deposit studies. In most cases these include a graduate thesis project.

### **Activity in 1992**

The summer of 1992 was marked by Canada's largest ever staking rush after discovery of a diamond-bearing kimberlite pipe (at 64°34'N, 110°08'W) in the barrens on the east shore of Lac de Gras. During the first 8 months of 1992 nearly 5000 claims covering almost 51 800 km<sup>2</sup> (20 000 square miles) were recorded. Most claims were staked with the help of global positioning systems carried in helicopters which permitted individual claim blocks comprising 50 claims and averaging 5000 ha to be staked in record time. As a result of the discovery, nearly 60 000 km<sup>2</sup>, which covers most of the central and southern Slave Structural Province, has been staked for diamonds.

NWT Geology Division staff continued close involvement with the planning and execution of the Mineral Initiatives Program conducted under the Canada-NWT Economic Development Agreement.

Dorothy Atkinson and Walter Gibbins produced an open file report describing the diamond potential of the Slave Province as well as numerous poster sessions on the discovery. Dorothy also worked extensively on the development of a computerized mineral showing database (CMSD), a project funded mainly by the Mineral Initiative Program.

Table 1. Canada-NWT Mineral Initiatives Projects

PROJECT	DESCRIPTION	GEOLOGIST	AGENCY
Camsell Lake	1:50 000-scale mapping of the Camsell Lake supracrustal belt	R. Johnstone	MIO
	Geochemistry of anorthositic rocks, Lake of the Enemy area	A. Laroque/ A. Lalonde	MIO/ Univ. of O
Fishing Lake	1:50 000-scale mapping of the Fishing-Thistlethwaite Lakes areas	M. Stublely	MIO
	Geochemistry of the Squalus Lake Alkaline Intrusion	S. Cairns/ R. Luth	MIO/ Univ of Alb.
Anialik River	1:50 000- to 1:20 000-scale mapping of the Anialik River supracrustal belt	C. Relf	MIO
Point Lake	1:20 000- to 1:50-000 scale mapping in the northern Point Lake map sheet.	J. Gebert	MIO
	Geochemistry of Archaean Gabbro-Diorite Complexes, Napaktulik Lake area	J. Jensen/ R. Creaser	MIO/ Univ of Alb.
CMSD	A digital database of the mineral showings of the NWT	D. Atkinson/ M. Irving	DIAND/MIO
Winter Lake	1:50 000-scale mapping of Winter Lake supracrustal sheet	J. King/ B. Hrabi	GSC
High Lake	1:20 000-scale mapping of the High Lake greenstone belt	J.R. Henderson	GSC
Minto Inlier	1:50 000-scale mapping of the Minto Inlier	R. Rainbird	GSC
Hurwitz/Kaminak	1:50 000-scale mapping of the Henik/Kaminak and Hurwitz Groups	L. Aspler	GSC
Gibson-Meliadine	1:50 000-scale mapping of the Meliadine greenstone belt.	S. Tella	GSC
Ege Bay	1:50 000-scale mapping of the Koch Island area	G. Jackson	GSC
Kimberlites	Detailed studies and characterization of NWT kimberlites	B. Kjarsgaard	GSC
Great Bear Magmatic zone	Detailed assessment of the southern Great Bear magmatic zone	S. Gandhi	GSC
High Lake/ Courageous Lake	To document and evaluate known mineral concentrations in the High Lake and Courageous Lake areas	J. Kerswill	GSC
Metallogeny of the Churchill	Detailed mapping and classification mineral deposits/prospects/showings of the Archaean greenstone belts of the Churchill Province	A. Miller	GSC
Redbed Cu-Ag-Co in Keewatin	Detailed mapping of the Dubawnt Group for Cu-Ag-Co mineralization	A. Miller	GSC
Fe-Formation	Documentation and classification of iron formation hosted gold deposits	J. Kerswill	GSC
Mineral Resources Map	Produce an up-to-date comprehensive and accurate mineral potential map of the NWT	C. Jefferson	GSC

V. Jackson with a crew of 6 mapped portions of the Napaktulik Lake area (86 I/7, 9, 10, 11, 15 and 16), part of a project to map supracrustal rocks in the northwestern Slave Province, at a scale of 1:30 000. This work is part of INAC's contribution to the Slave Province NATMAP project.

John Brophy studied auriferous turbidite-hosted iron formations in the southwestern Slave Province and discovered an unexplored iron formation from which a grab sample assayed 26 g/t Au (grab sample). This work was part of a Mineral Initiatives project to study gold in Slave iron formations. The project was coordinated by John Kerswill of the Geological Survey of Canada. An open file map and report on the Wheeler Lake iron formation hosted gold showings was released as part of this project. John also began a study of gold in shear zones in the Western Plutonic complex west of the Yellowknife volcanic belt, and began mapping of supracrustal rocks north and east of the Russell Lake (85 O/4) area.

W.A. Padgham studied old rocks and fluvial or shallow marine quartz arenites and feldspathic arenites that appear to mark a northerly trending zone of non-turbidite deposition that divides the Slave Province into a western area with abundant signs of old rocks and eastern area that may be devoid of such rocks. This work was done in cooperation with sedimentologists from Carleton, Chicoutimi and St. Petersburg (Russia) universities and with scientists from Massachusetts Institute of Technology.

Studies of old rocks along the western half of the Slave Structural Province continued in consort with Professor S.A. Bowring of M.I.T.

K. MacLachlan mapped parts of the Chan Formation to determine its relationship to the Dwyer Formation. The latter is a quartz arenite-iron formation-felsic volcanic package that rests on circa 3.1 Ga granitic gneiss and appears to lie structurally and stratigraphically beneath the Yellowknife volcanic belt.

Most Division work in the Slave Province is directly or indirectly coordinated with Slave Province NATMAP, part of the National mapping program.

Steve Goff visited numerous gold showings in the Rankin Ennadai volcanic terrain. Information collected will be used to develop metallogenic models for gold in this area.

Contracts let to university professors or consultants for specific studies or to map problem areas are listed in the table below:

CONTRACTOR	GROUP	STUDY
S.A. Bowring C. Isachsen J.A. Donaldson	Mass. Institute of Technology Carleton University	Dating of Slave Province rocks. Fluvial/shallow marine arenites of the Slave Province
N.A. Duke	University of Western Ontario	Raquette Lake Fm./Sleepy Dragon Complex relations and metallogeny
W.K. Fyson	University of Ottawa	Structural features of the Slave Province
H. Helmstaedt	Queen's University	Chan Formation dyke complex and relation of the Chan to the Crestaurum and Dwyer Formations
W.S. Fyfe D.J. Atkinson	University of Western Ontario	To complete geological maps showing the results of studies in the Western Plutonic Complex west of Yellowknife volcanic belt.
D. Kerr	Northern Alpine Surveys	Compile surficial geological maps of Napaktulik Lake area for incorporation into 1:50 000 geological maps

**INDIAN AND NORTHERN AFFAIRS CANADA****EXPLORATION AND GEOLOGICAL SERVICES DIVISION YUKON**

Exploration and Geological Services Division (EGSD) is part of the Mineral Resources Directorate of the Northern Affairs Program, one of 5 programs of Indian and Northern Affairs Canada. EGSD consists of 5 geologists, one geotechnician, an office manager, and a map sales manager. This group is responsible for geoscience data collection, interpretation and dissemination of information in partial fulfilment of the management of mineral resources in Yukon Territory.

EGSD produces an annual review of mineral exploration and department activities entitled, "Yukon Exploration". In addition, summaries of exploration assessment reports are compiled in "Yukon Minfile", a text and map-based mineral occurrence digital inventory, formerly the Northern Cordillera Mineral Inventory of Archer, Cathro and Associates (1981) Ltd. EGSD purchased the file in 1990 through the Canada/Yukon Economic Development Program and later transformed it into a computer database similar to B.C. Minfile. The entire database is updated annually and will soon be available in WordPerfect format. Please contact Mike Burke (403-667-3202) for further information. The "Yukon Geology" series is a vehicle for publishing the results of geological research on a variety of topics and Volume 3 was published in 1992. EGSD also maintains the Yukon outlet of the Canada Map Office and sells topographic, geological (surficial and bedrock), aeromagnetic, aeronautical and land-use maps. Geological Survey of Canada publications and other government publications related to Yukon Territory and Northern British Columbia are also available. A complete publications list is available from the Canada Map Office, Indian and Northern Affairs Canada, 200 Range Road, Whitehorse, Yukon, Y1A 3V1. In addition, a library containing geological texts and journals and selected aerial photographs covering the Yukon from latitude 60° to 65°N is available to the public.

The projects described below were funded either by EGSD, or through the Canada-Yukon Economic Development Agreement (EDA).

**GEOLOGY DIVISION PROJECTS - 1991****S.R. Morison - Chief Geologist**

Responsible for supervising and coordinating the activities of the Geology Division and representing the Mineral Resources Directorate on several national and local committees. Assisted with the planning of the new Mineral Resources Cooperative Agreement of the Canada/Yukon Economic Development Agreement including the planning of new MDA Yukon Geoscience Office. Chaired the committee which planned and organized the 19th Annual Yukon Geoscience Forum. Advised the Placer Mining Implementation Review Committee (IRC), which is responsible for updating the existing water quality standards and stream channel restoration in placer mines, as a scientific authority by chairing a technical subcommittee. In addition, advised the Yukon Mining Advisory Committee (YMAC) on land-use regulations on mineral claims. Used his placer sedimentology expertise to advise groups and support related geological studies.

**Grant Abbott - Senior Geologist**

Responsible for 1:50 000-scale bedrock mapping projects and this year worked in the Nash Creek and Larsen Creek Map areas near the Hart River and Blende mineral deposits. Reviewed numerous geological publications for division and prepared two open files for release in early 1992. In addition, acted as a land claims advisor by reviewing local band land selections for mineral occurrences.

**Trevor Bremner - Mineral Deposit Geologist**

Assisted in the design and update of Yukon Minfile. Carried out fieldwork in the Brewery Creek and Wellgreen areas. Chief editor and overall responsibility for the publication of Yukon Geology, Volume 3.

**Bill LeBarge - Staff Geologist**

Approved, catalogued and indexed assessment reports from the Mayo and Dawson Mining Districts and all Yukon placer reports. Field work included visiting several actively explored mining properties in the Dawson District and collecting geotechnical information and samples from placer operations in the Dawson area. Departed on educational leave in September and duties assumed by Robert Deklerk.

**Dennis Ouellette - Staff Geologist**

Approved, catalogued and indexed assessment reports from Watson Lake and Whitehorse Mining Districts. Visited active exploration projects in the Whitehorse and Watson Lake Mining Districts. Coordinated the compilation and dispersion of exploration and development data collected by staff geologists. Chief editor and overall responsibility for the publication of Yukon Exploration, 1991.

**AFFILIATED PROJECTS**

Dennis Brown, University of London - PhD detailed structural analysis of the Vangorda deposit, Faro mining area.

Craig Hart, University of British Columbia - MSc study of the metallogeny of the Coast Plutonic Complex southwest of Whitehorse.

John Knight - Study of the trace-element chemistry and morphology of placer gold.

**RECENT PUBLICATIONS**

Yukon Minfile updates - 26 of the 38 sheets available required updates in 1991. Nine maps were also updated.

95D	105F	105K	115A	115J
105A	105G*	105L	115B	115N&O*
105B*	105H	105M	115F&G*	115P
105C	105I	105O*	115H*	116A*
105D*	105J	106D	115I	116B&C
105E*				

\*DENOTES UPDATED MAPS

INAC, (1991). Yukon Exploration 1990; Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada.

Placer mining Section 1991. Yukon Placer Industry 1989 to 1990; Mineral Resources Directorate, Yukon, Indian and Northern Affairs Canada.

#### **EGSD FIELD WORK IN 1991**

Nash Creek 106 D  
Larsen Creek 116 A  
Kluane Lake 115 G

#### **CANADA-YUKON ECONOMIC DEVELOPMENT PROGRAM MINERAL RESOURCES SUBAGREEMENT-**

Regional Stream Sediment and Water Geochemistry Surveys  
Administered by Geological Survey of Canada

Maps Released in 1991 include:

G.S.C. Open File 2363 105 N

G.S.C. Open File 2364 105 O, PARTS OF 105 P

G.S.C. Open File 2365 116 B, PARTS OF 116 C, 116 F, 116 G

#### **H.S. BOSTOCK CORE LIBRARY**

The H.S. Bostock Library houses approximately 112 000 m of diamond-drill core from 172 properties. The facility is located across the road from the Northern Affairs building at 200 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. Diamond saws, a core splitter and microscopes are available for use in heated examination rooms.

**NOTES**

**ARTICLES**

FEDERAL/PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS (1990 and later)

Province/ Territory	Amount of agreement millions \$	Cost sharing formula	Period	Programs	Budget (\$ x 10 <sup>3</sup> )	Sharing formula % Can./Prov.
British Columbia*	10	50/50	1991-95	Geoscience	5000	44/56
				Technology	2850	63/37
				Economic Development	950	37/63
				Public Information	550	45-55
				Evaluation, Administration	650	62/38
Alberta* R. Harrison 402-438-7615	10	50/50	1991-95	Geoscience	6000	42/58
				Others	4000	
Saskatchewan Bob Macdonald 306-787-2568	10	50/50	1990-95	Geoscience	7350	37/63
				Mining and Processing	1350	100/0
				Economic Development	400	75/35
				Public Information	350	64/36
				Evaluation and Administration	550	68/32
Manitoba Charlene van Engel 204-945-1872	10	50/50	1990-95	Geoscience	5500	54/46
				Technology	2000	75/25
				Economic Development	1400	28/72
				Public Information	350	71/29
				Evaluation and Administration	750	46/54
Ontario* L. Owsjacki 705-670-7288	30	50/50	1991-95	Geoscience		
				Mining & Mineral Technology		
				Information Transfer		
				Exploration Technology		
				Industrial Minerals		
Québec	100	50/50	1992-98	Geoscience & Mineral Exploration	44 000	50/50
				Mineral Development	32 750	50/50
				Research & Innovation	21 000	50/50
				Communications & Administration	2250	50/50

\* Under negotiation

**FEDERAL/PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS (1990 and later)**  
(continued)

Province/ Territory	Amount of agreement millions \$	Cost sharing formula	Period	Programs	Budget (\$ x 10 <sup>3</sup> )	Sharing formula % Can./Prov.
New Brunswick J.L. Davies 506-453-2206	10	60% Can. 40% N.B.	1990-95	Geoscience	4000	60/40
				Technology Development	3750	50/50
				Development Opportunities	500	60/40
				Public Information	500	50/50
				Evaluation & Administration	1250	58/52
Nova Scotia D. Murray 902-424-4700	9	65% Can. 45% N.S.	1990-92	Geoscience	3172	57/43
				Minerals Technology	2160	76/24
				Economic Development	1827	22/78
				Mineral Investment Stimulation	500	100/0
				Public Information	573	35/65
Newfoundland D. Murray 902-424-4700	17.5	70% Can. 45% N.S.	1990-94	Geoscience	9000	48/52
				Minerals Technology	3500	29/71
				Economic Development	1000	50/50
				Mineral Industry Assistance	2000	50/50
				Public Information	930	59/41
Northwest Territories Martin Irving 403-920-3125	8.2	70% Can. 30% Terr.	1991-96	Geoscience	7500	70/30
				Technology		
				Information	200	
				Prospectors Assistance	300	
Yukon Steve Morison 403-667-3200	1.01	70% Can. 30% Yukon	1990-91	Geoscience	3650	100
				Geochemistry	5500	100
				Mining Research & Development	750	96/4
				Administration	200	

**SURVEY OF HARD-ROCK DRILL-CORE PROGRAMS IN CANADA  
FISCAL YEAR 1991-92**

PROVINCE	B.C.**	ALTA.	SASK.	MAN.	ONT.	QUÉ.	N.B.	N.S.	NFLD. & LAB.	P.E.I	YUKON	N.W.T
No. of facilities	1	1	1	4	7	5	3	4	6	1	1	1
Staff-Person Days Work 1991-92	10	220	183	120	2970	220	400	867	750	---	210	80
Capital Cost 1990-91 (\$ X 000)	5.4	30.0	nil	6.0	nil	5.0	---	6.6	40.0	---	---	---
Operating Cost 1991-92 (\$ X 000)	5.0	115.0	19.3	5.5	111.0	120.0	60.7	194.6	44.0	---	5.0	25.4
Core Collected and/or Delivered 1991-92	---	12 000 m	2 135 m	6 464 m	68 574 m	4 642 m	40 000 m	19 617 m	108 300 m	---	662 m	---
Core Reductions*	nil	nil	nil	nil	nil	nil	nil	nil	nil	---	nil	nil
Use of facilities person days (pd) 1991-92 visits (v)	15 pd	nil <sup>1</sup>	75 pd	13 v	1 995 pd	65 pd	250- 300 pd	346 pd	157 pd	2	15 pd	16
Total Core in Storage (from all years)	15 000 m	30 722 m	74 626	198 717	1 286 188	242 195	351 700	503 010	800 027	1 298	112 662 m	30 055 m
Total Exploration Drilling 1991-92 (in metres)	2 270	confidential	146 564	179 000	28 000 m	519 000	150 000	10 000	43 000	---	35 743	183

\* Over last year

\*\* Coal Core is not hard rock. There are no facilities for hard rock in B.C. -- figures are for coal

<sup>1</sup> Facility closed for renovations.

**DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1991**

**Province: B.C.**

Mine:	Snip	Al (BV Zone)	Silver Butte	Goldstream	Dome Mtn.
Discovery techniques: (Reassessment)	Prospecting/ Trenching/ Diamond drilling	Prospecting/ Trenching/ Diamond drilling	Prospecting/ Diamond drilling	Prospecting/ Diamond drilling	Prospecting/ Trenching Diamond drilling
Discovery:	Old/Extension	New	Old/Extension	Old/Extension	Old/Extension
Date of original discovery: (Reassessment)	1965 (1986)	1985	1910 (1987)	1974 (1989)	1931 (1985)
NTS:	104B/10W	94E/06W	104B/01E	82M/09	93L/10E
Location:	100 km NW of Stewart	300 km N of Smithers	32 km N of Stewart	80 km N of Revelstoke	30 km NE of Smithers
Years of Operation:	1991 - present	1991	1991	1983-84 1991 - present	1991 - present
Discovered (reassessed) reserves:	914 000 tonnes grading 28.5 g/t Au	50 000 tonnes grading 9.6 g/t Au	96 209 tonnes grading 9.91 g/t Au, 65.9 g/t Ag, 0.32% Cu, 0.67% Pb, 3.85% Zn	1 860 000 tonnes grading 4.81% Cu, 3.06% Zn	293 868 tonnes grading 12.34 g/t Au
1991 Production:	122 600 tonnes yielded 109 162 ounces gold	est. 40 815 tonnes yielded approx. 11 425 ounces gold	102 535 tonnes yielded 27101 ounces gold and 81653 ounces silver	227 695 tonnes yielded 19 931 587 lbs. Cu and 45 304 ounces silver	5125 tonnes yielded 3 895 ounces gold
Mining type:	Underground	Surface cut	Underground	Underground	Underground
Mining rate:	400 tonnes/day	Custom (at Lawyers)	Custom (at Premier)	1043 tonnes/day	Custom (Equity Silver)
Commodities:	Au	Au	Au,Ag	Cu,Zn	Au,Ag
Deposit Classification:	Vein - mesothermal	Vein - epithermal	Vein - mesothermal	Massive sulphide - volcanogenic	Vein - mesothermal
Key reference:	MINFILE 104B023	MINFILE 94E091	MINFILE 104B150	MINFILE 82M141	MINFILE 93L022

**DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1991**

**Province: Newfoundland & Labrador**

Mine:	Leila Wynne
Discovery technique:	Diamond drilling
Discovery:	New
Date of original discovery:	1984
NTS	23G2
Location:	Western Labrador 17 km north of Wabush
Discovered (reassessed) reserves:	4 million tonnes, open to north & south 21% MgO, 3% SiO <sub>2</sub>
Mining type:	Open pit
Commodities:	Dolomitic marble
Deposit Classification:	Metasedimentary
Key reference:	23G/2/DOL 2

**Province: Manitoba**

Mine:	Ruttan West Anomaly
Discovery technique:	Diamond drilling
Discovery:	Old
Date of original discovery:	1960's
NTS	64B5
Location:	21 km east of Leaf Rapids
Discovered (reassessed) reserves:	9 124 000 tons (short) 1.37% Cu, 1.75% Zn
Mining type:	Underground
Commodities:	Copper, Zinc
Deposit Classification:	Massive sulphide - volcanogenic
Key reference:	

**Province: Ontario**

Mine:	Cheminis Mine	Mine:	Hislop East Mine
Discovery technique:	Diamond drilling	Discovery technique:	Diamond drilling
Discovery:	Old	Discovery:	Old
Date of original discovery:	1937	Date of original discovery:	1918
NTS	info not available	NTS	info not available
Location:	info not available	Location:	info not available
Discovered (reassessed) reserves:	256 661 tonnes @ .156 opt Au	Discovered (reassessed) reserves:	835 544 tons @ .17 opt Au
Mining type:	Underground	Mining type:	Underground
Commodities:	Au	Commodities:	Au
Deposit Classification:	Fault related	Deposit Classification:	Vein/fault related
Key reference:		Key reference:	

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