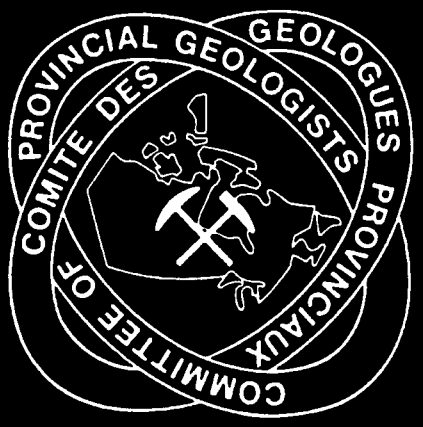

Provincial Geologists Journal

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1996 - VOLUME 14

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B.C. Geological Survey
Victoria, B.C.
April 1997

COMMITTEE OF PROVINCIAL GEOLOGISTS
CHAIRPERSON'S REPORT 1996

With the signing of the Inter-Governmental Geoscience Accord (*see* page 33) at the 1996 Mines Ministers Conference in Yellowknife, the Committee of Provincial Geologists entered a new phase of codified relations with the Geological Survey of Canada (GSC). The next few years will see workshops and discussion groups designed to ensure that the Accord works as it was planned to. Monitoring the effectiveness of the Accord and development of systems and methods to ensure its effectiveness will be undertaken by the national Geological Surveys Committee on which sit representatives of the Geological Survey of Canada and the Provincial and Territorial Geological surveys. As well, bi-lateral accords between the GSC and Provincial Geological Surveys and tri-lateral accords between the GSC, territorial governments and Indian and Northern Affairs geological agencies are being developed to elaborate the Geoscience Accord to take cognizance of the particular needs of each jurisdiction of the country.

Needs workshops, considered to be a fundamental part of rationalizing geoscientific research in Canada are planned for most jurisdictions and in fact have been recently completed for British Columbia, the Yukon, and Nova Scotia. These workshops solicit input from the numerous users of geological survey data including environmentalists, government planners, mineral and hydrocarbon explorationists. The ever increasing complexity of our modern industrial society and the steadily increasing demands for earth material to build its required infrastructure and to provide for the needs of the country's expanding population will require that similar needs workshops be repeated every few years to ensure that the geo-survey organizations do not loose sight of their client's needs.

The needs workshops, and the Intergovernmental Geoscience Accord together with the bi-lateral and tri-lateral accords that are being developed under its umbrella, are designed to improve the effectiveness of government geoscience in Canada by defining a new collaborative relationship between Provincial and Territorial Surveys on the one hand, and the Geological Survey of Canada on the other. The Accord stresses the complementary roles and responsibilities of the geoscience agencies and is expected to lead to a better utilization of scarce resources in the future.

Exciting mineral discoveries of the last few years in Canada have revived the exploration sector which is now attracting very significant amounts of venture capital. Many discoveries can be directly related to government survey work and the new mines that can be expected to be developed on these discoveries will require significantly more background geoscience data to ensure environmentally sound operations.

William Padgham
Chair, Committee of Provincial Geologists
September 1996

Provincial Geologists Journal

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1996 VOLUME 14

Compiled by the
British Columbia Geological Survey Branch

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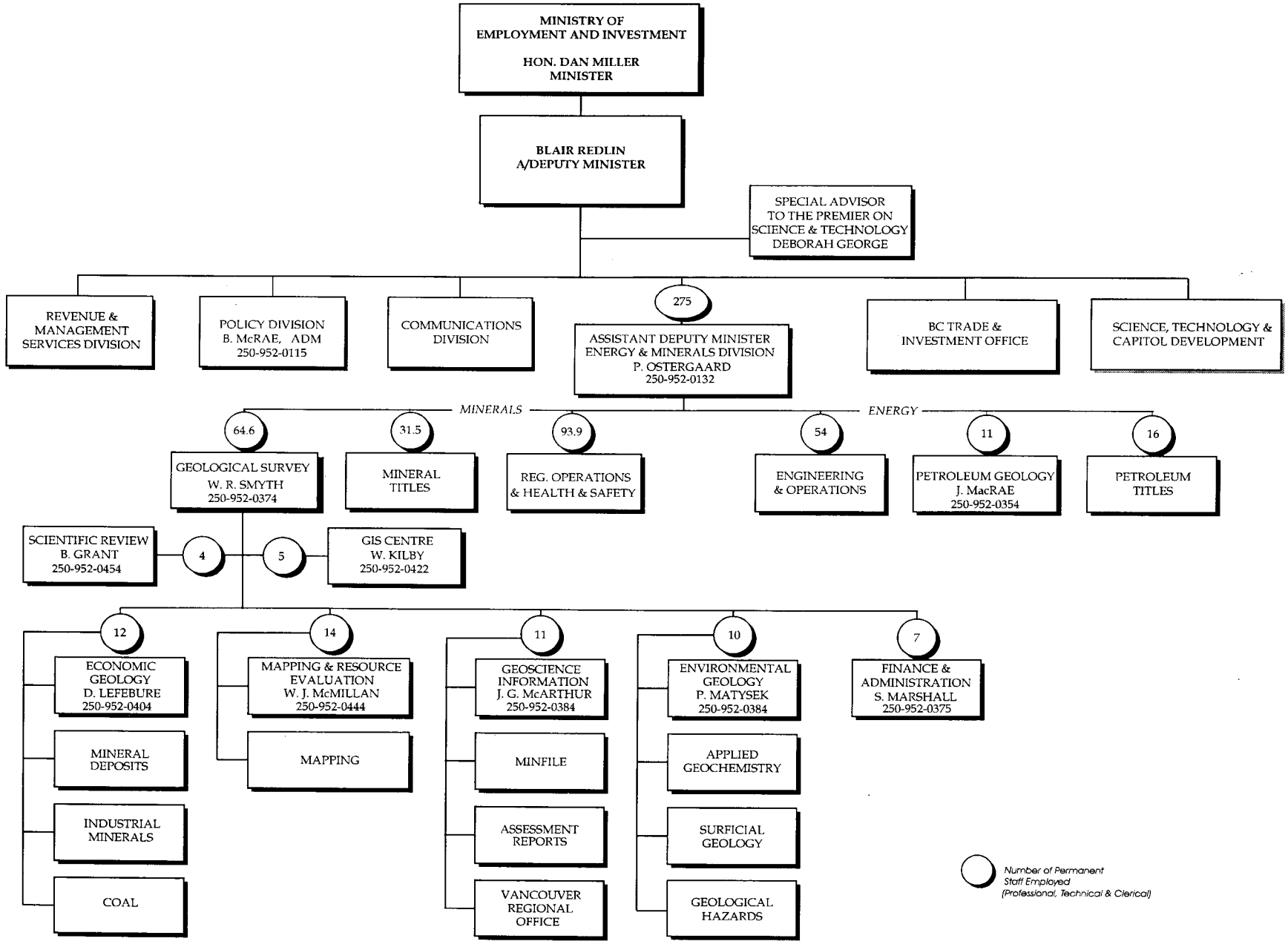
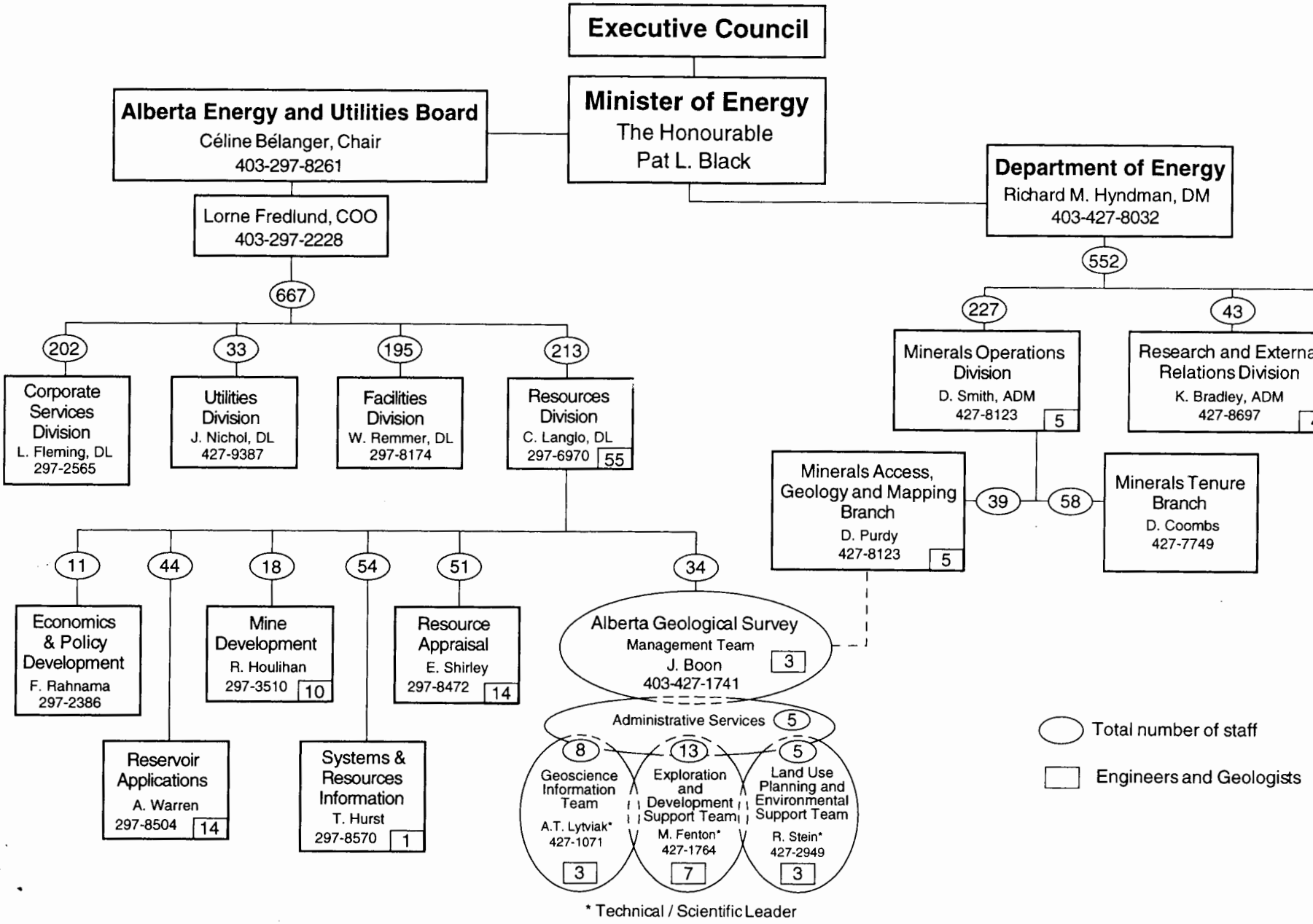
GEOSCIENCE ORGANIZATION CHARTS

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 Employment and Investment has an Energy and Minerals Division, with the bulk of geological survey and research work conducted in the Geological Survey Branch). The following organization charts are set out in standard format to help alleviate confusion among 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, 1996

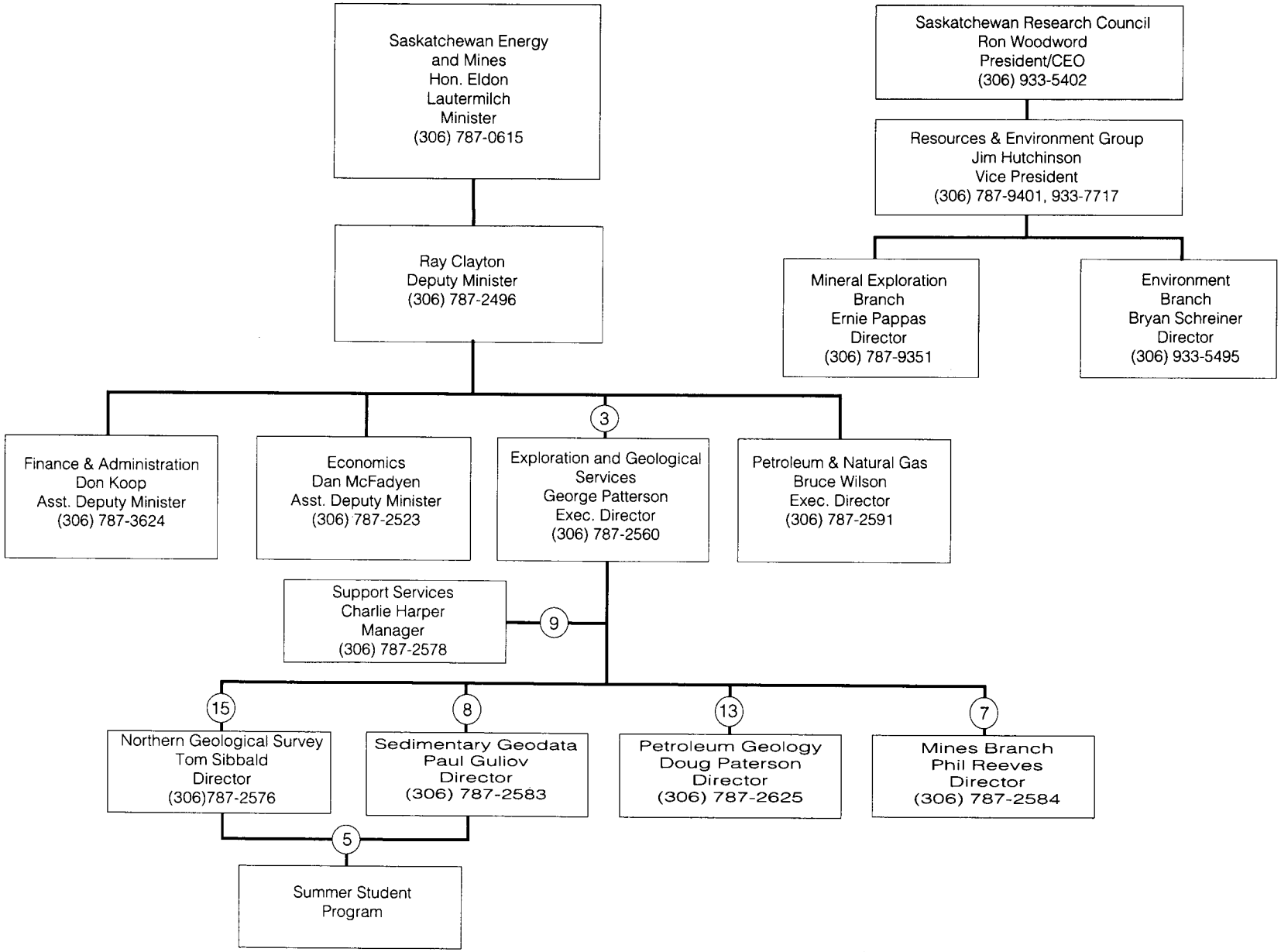


Alberta Geoscience Organization Chart (1996)

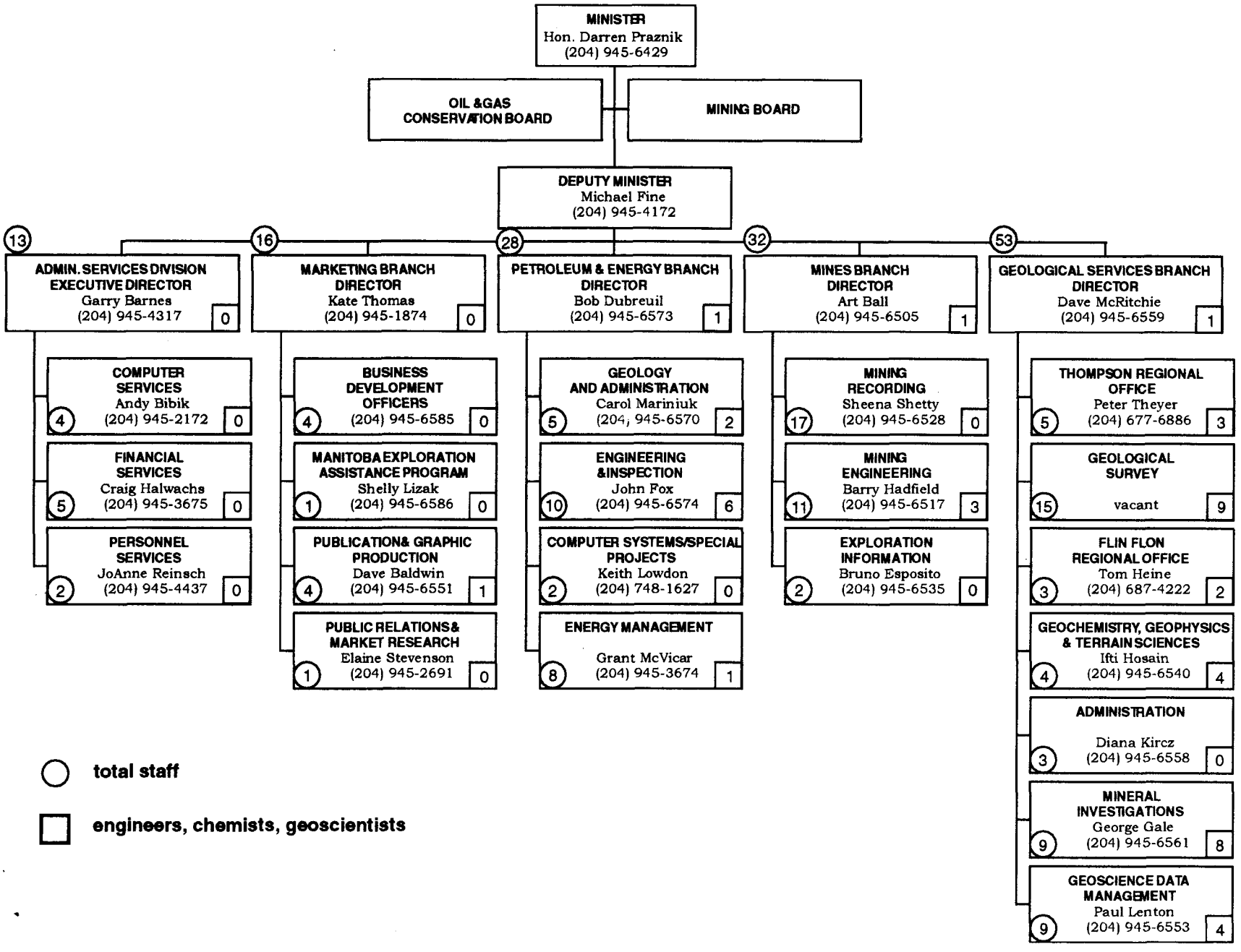


* Technical / Scientific Leader

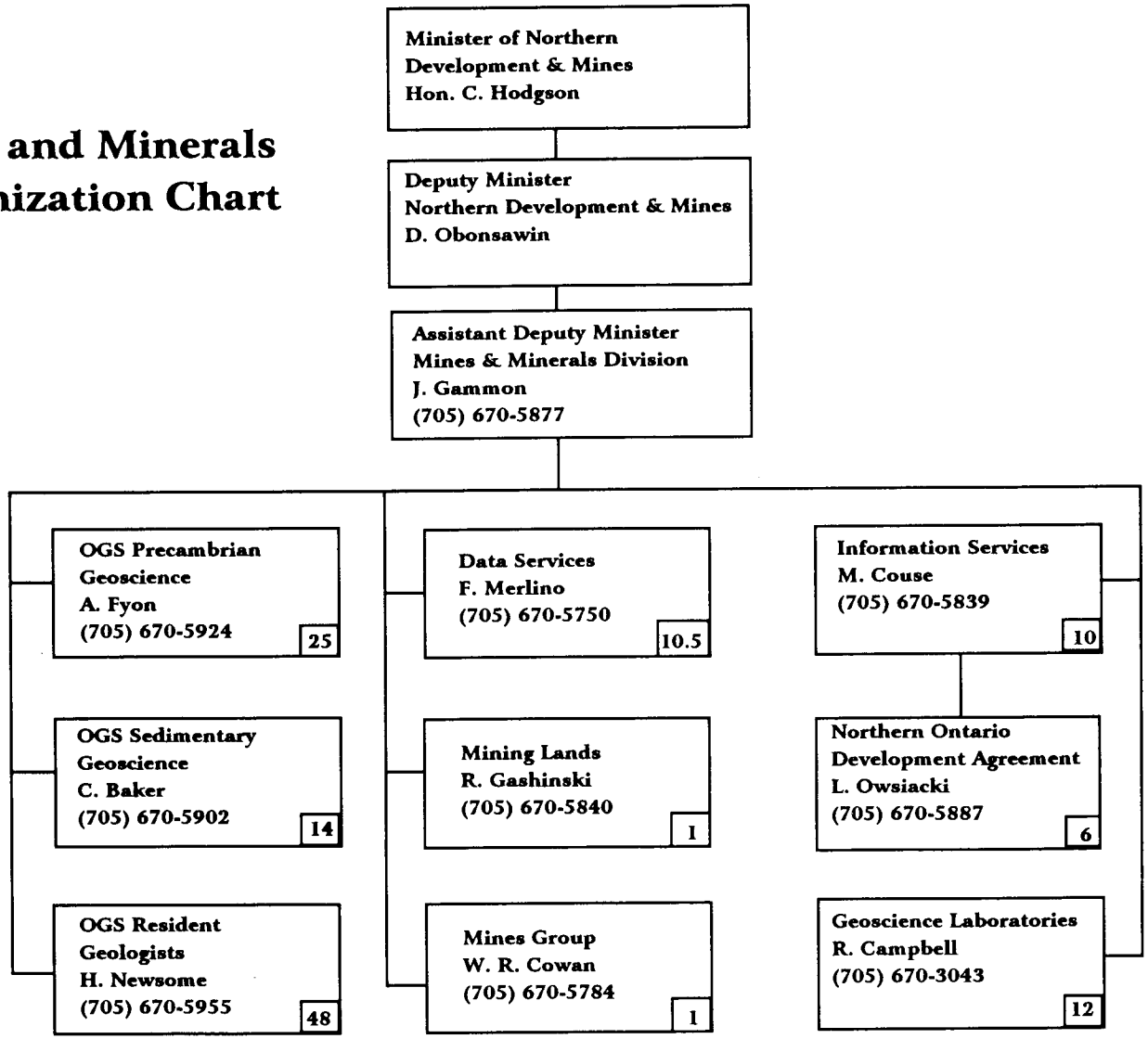
Saskatchewan Geoscience Organization Chart



MANITOBA GEOSCIENCE ORGANIZATIONAL CHART

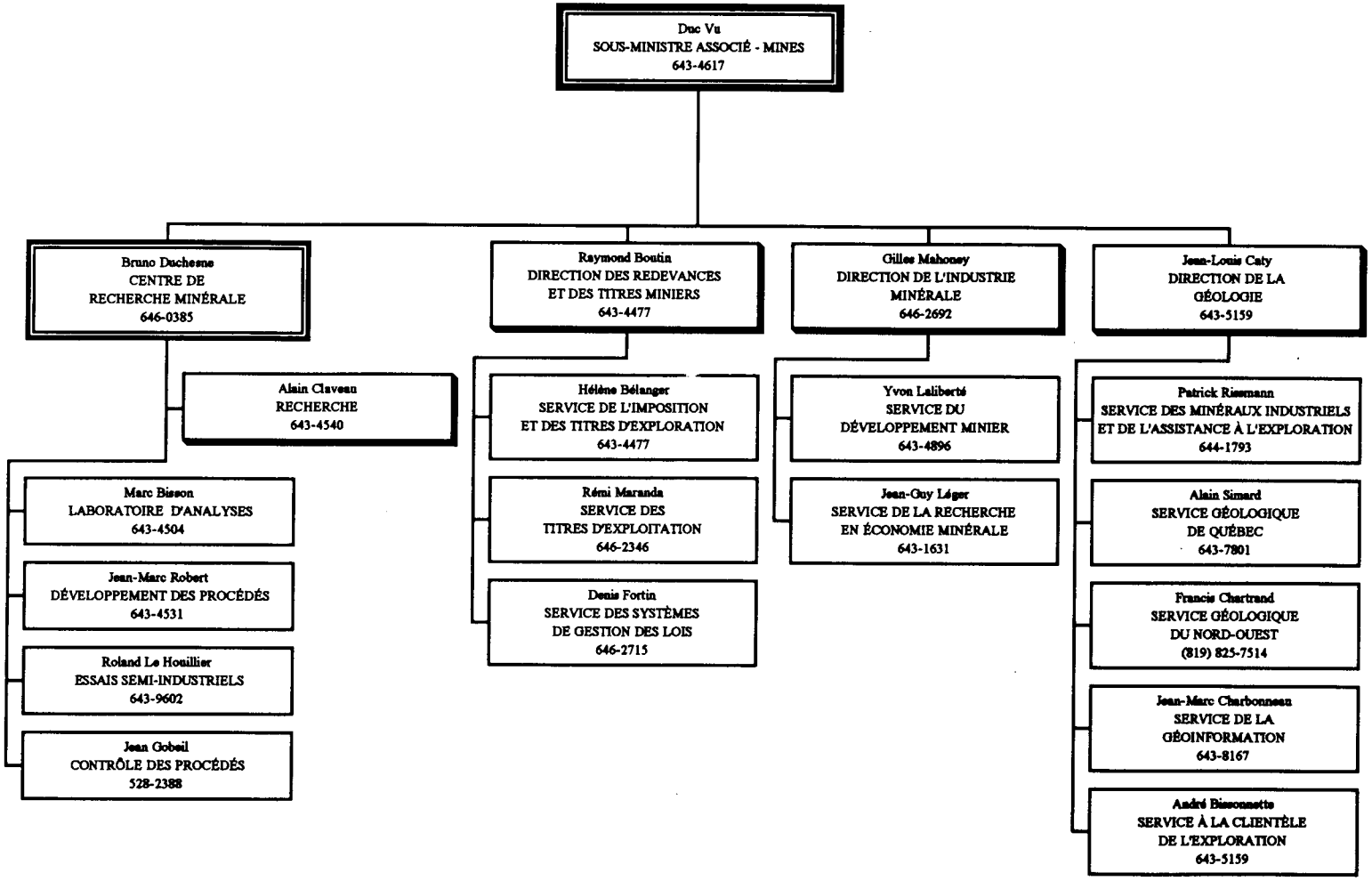


Ontario Mines and Minerals Division Organization Chart



[8] Number of Permanent Staff Associated with Geoscience Activities (Professional, Technical & Support)

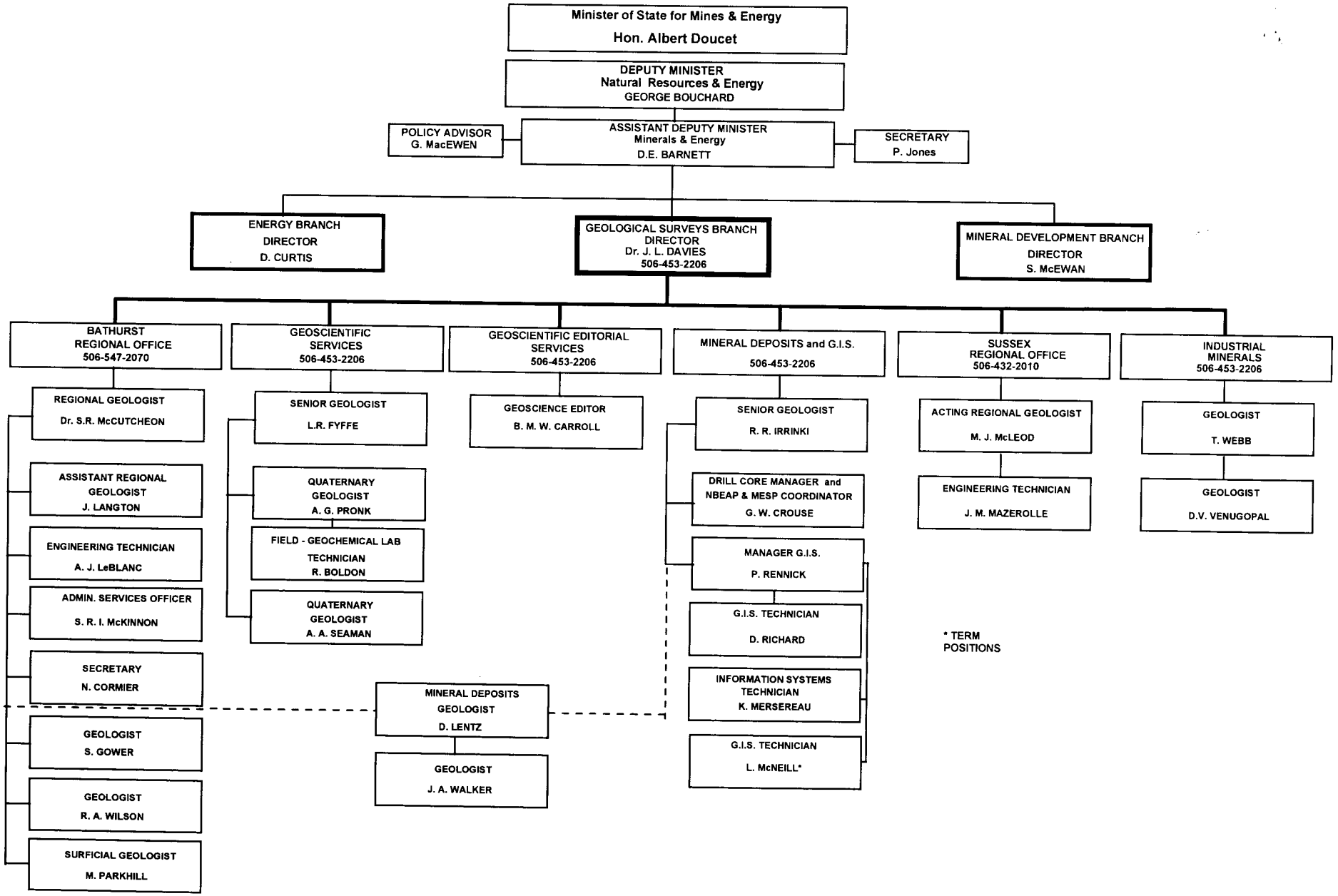
MINISTÈRE DES RESSOURCES NATURELLES - SECTEUR DES MINES



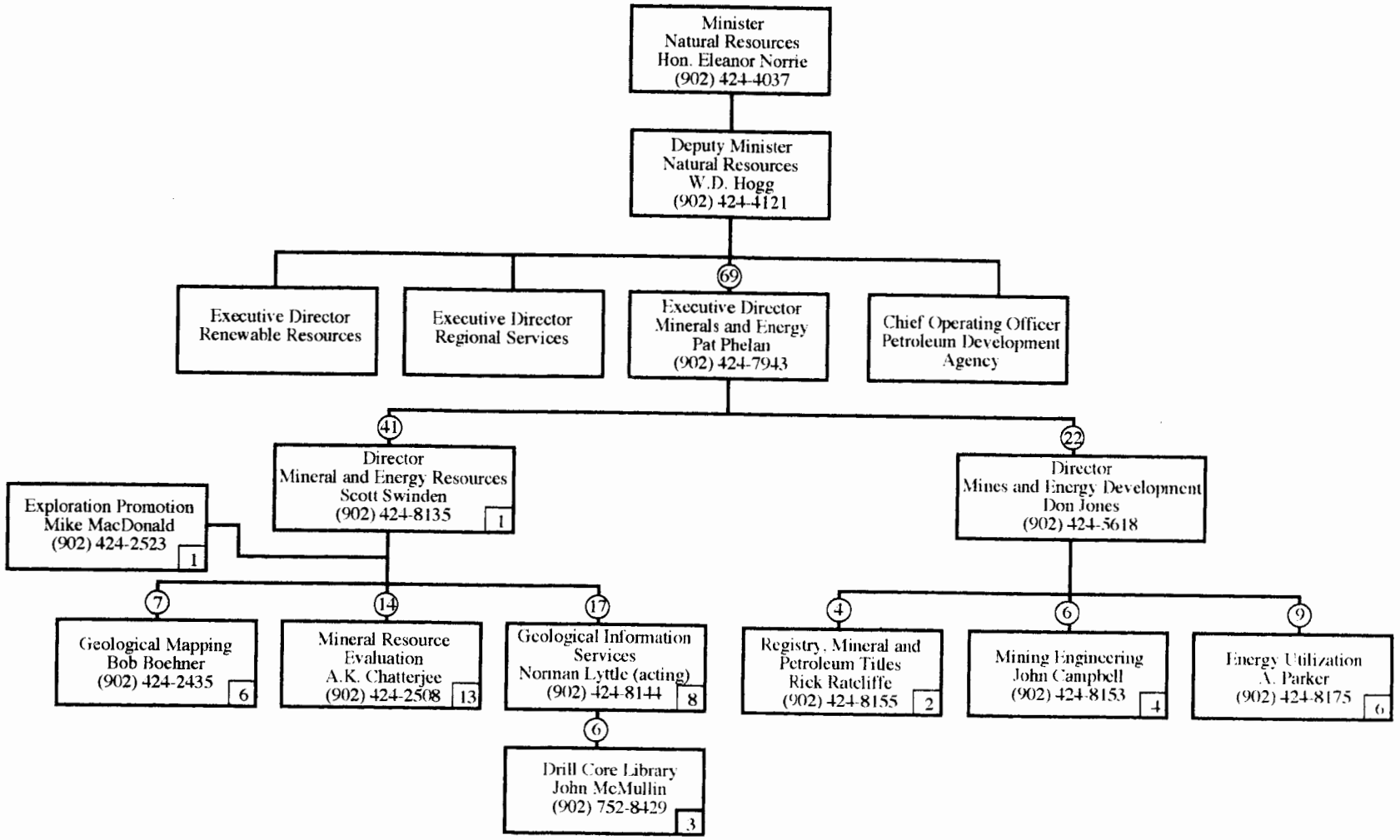
Guy Chevrette, ministre d'État
Denise Carrier-Perreault, ministre déléguée
Michel Clair, sous-ministre

Le 12 août 1996

New Brunswick Department of Natural Resources & Energy
Minerals and Energy Division



NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART

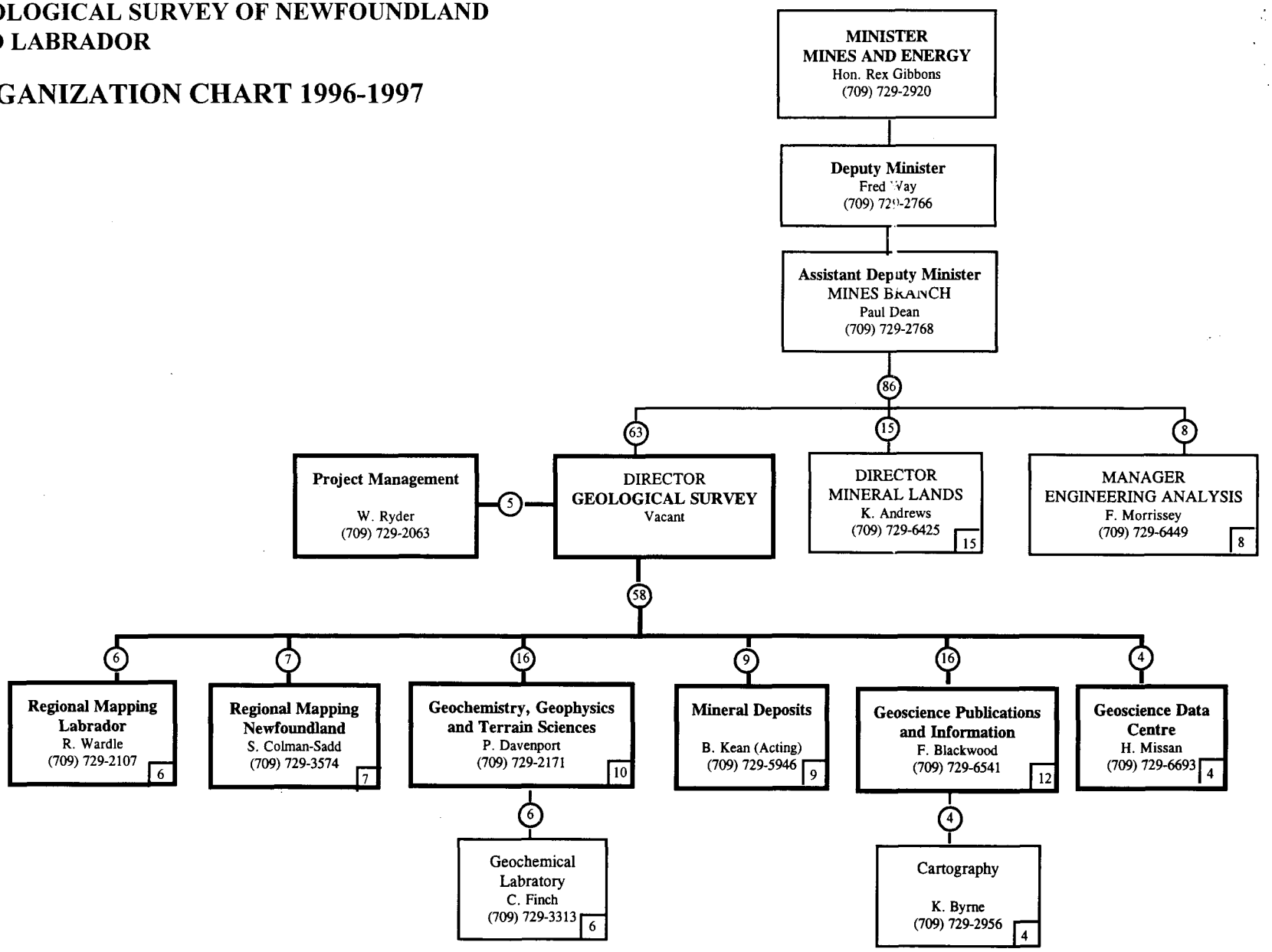


PROFESSIONAL (GEOLOGY, ENGINEERING)

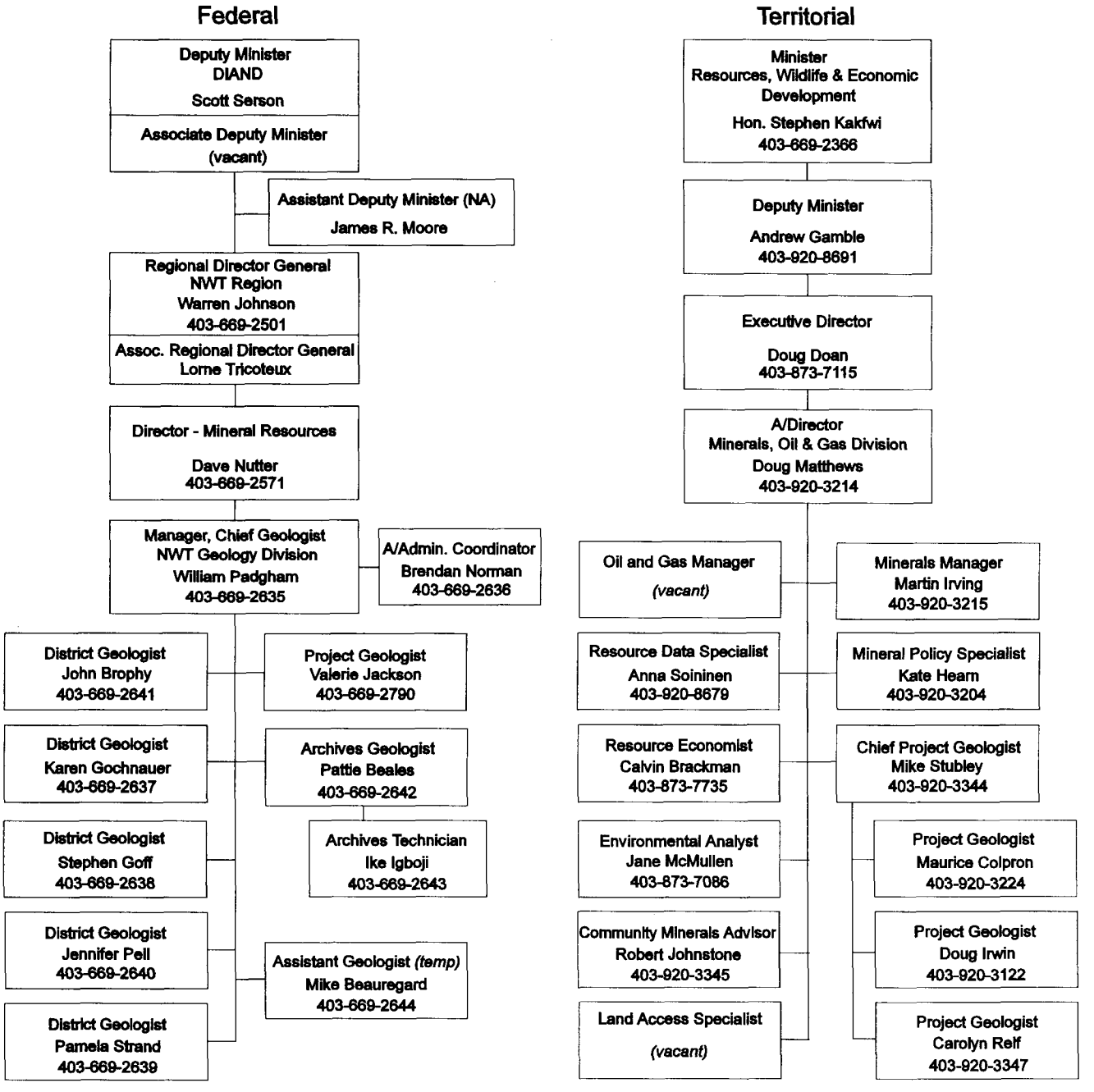
TOTAL STAFF (PROFESSIONAL, TECHNICAL, CLERICAL)

GEOLOGICAL SURVEY OF NEWFOUNDLAND AND LABRADOR

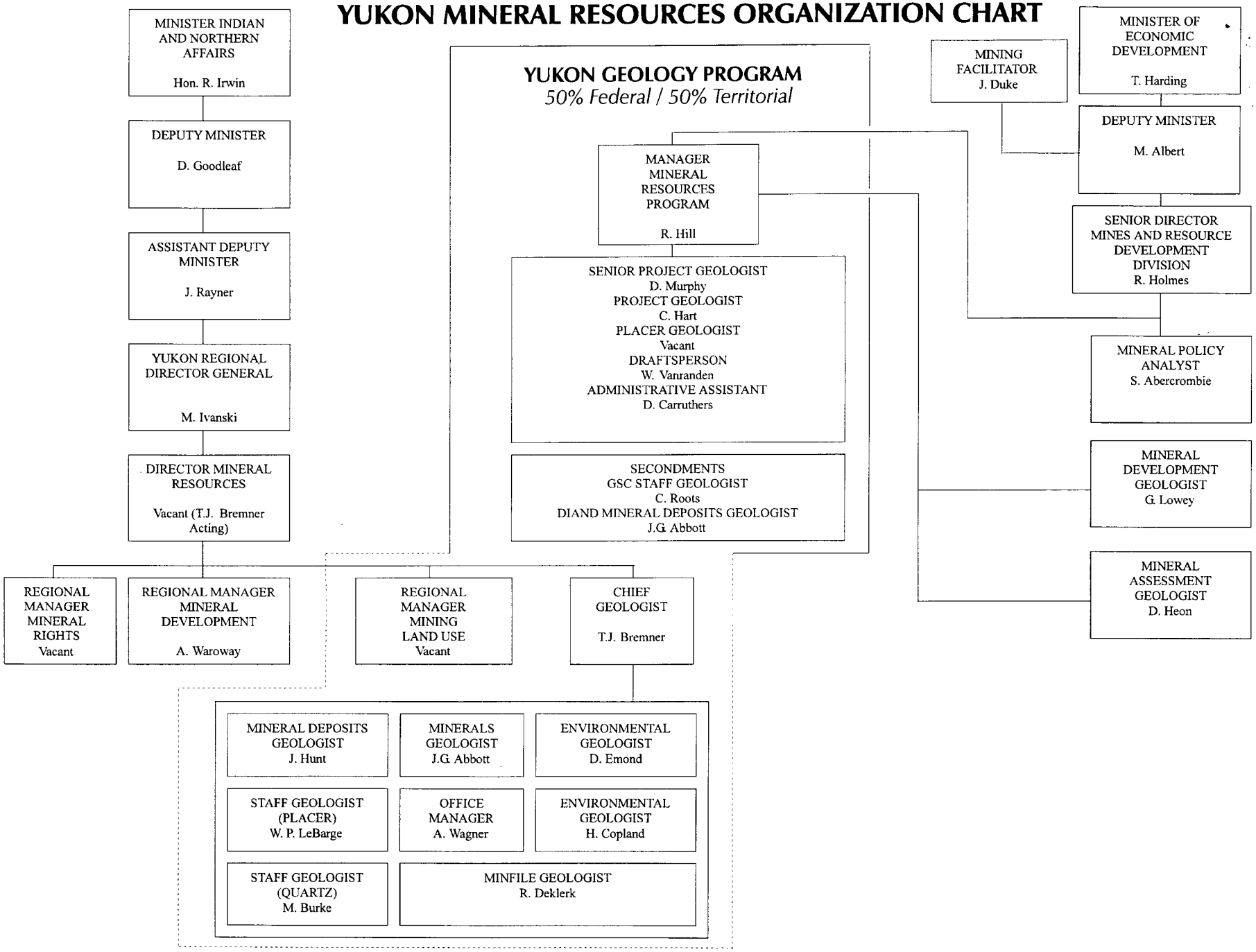
ORGANIZATION CHART 1996-1997



Northwest Territories Geoscience Organization Chart
November 1996



YUKON MINERAL RESOURCES ORGANIZATION CHART



PROVINCIAL GEOLOGICAL SURVEY
EXPENDITURES 1995 - 1996

PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES
1995-1996

PROVINCE/TERRITORY	Survey Expenditures	% of Total	1995 PROVINCIAL MINERAL PRODUCTION‡	Survey Expenditures as Percent of PROVINCIAL MINERAL PRODUCTION	Area Prov/Terr km^2	Survey Expenditures $/km^2$	Population 1991	Survey Expenditures per Capita
NEWFOUNDLAND	$5,480,226	8.8%	$906,051,000	0.60%	405,000	$13.5	568,000	$9.65
NOVA SCOTIA	$2,475,100	4.0%	$360,809,000	0.69%	55,000	$45.0	900,000	$2.75
PRINCE EDWARD ISLAND	—	—	$1,181,000	—	6,000	—	130,000	—
NEW BRUNSWICK	$3,174,189	5.1%	$1,001,964,000	0.32%	73,000	$43.5	724,000	$4.38
QUEBEC	$17,850,115	28.7%	$3,082,140,000	0.58%	1,541,000	$11.6	6,896,000	$2.59
ONTARIO	$11,112,200	17.9%	$5,741,398,000	0.19%	1,069,000	$10.4	10,085,000	$1.10
MANITOBA	$3,779,300	6.1%	$959,033,000	0.39%	650,000	$5.8	1,092,000	$3.46
SASKATCHEWAN	$2,441,063	3.9%	$1,958,939,000	0.12%	652,000	$3.7	989,000	$2.47
ALBERTA	$3,205,616	5.2%	$20,829,984,000	0.02%	661,000	$4.8	2,546,000	$1.26
BRITISH COLUMBIA	$6,942,477	11.2%	$3,512,633,000	0.20%	948,000	$7.3	3,282,000	$2.12
NORTHWEST TERRITORIES	$2,531,300	4.1%	$538,136,000	0.47%	3,380,000	$0.7	58,000	$43.64
YUKON	$3,226,700	5.2%	$166,507,000	1.94%	483,000	$6.7	28,000	$115.24
Canadian Totals:	**$62,218,286**	**100%**	**$39,058,775,000**	**0.159%**				

‡. *Source: Natural Resources Canada; 1995 Canadian Minerals Yearbook: Review & Outlook*

Note: • *Comparisons between jurisdictions are difficult due to the variety of program/budget components and methods of reporting data.*
• *Expenditures column includes a total of A-base funds and MDA funds available to the geological surveys.*
• *Provinces include metals, non-metals, structural materials and coal.*
• *Alberta figures also includes natural gas, natural gas by-products and crude oil.*

Province: BRITISH COLUMBIA 1995-96
Geological Survey Branch

Category	No. of Projects	Permanent Positions	Casual Positions	A-Base Salaries	MDA Salaries	A-Base Operational $	MDA Operational $	Total $
Mineral Activities								
Bedrock Geology Surveys	8	16	3.75	$1,181,188	$149,486	$181,181	$176,621	$1,688,476
Geochemical Surveys	4	5.75	0	$345,001	$0	$270,766	$70,000	$685,767
Surficial Geology Surveys	4	2	1.95	$144,438	$97,506	$47,304	$85,494	$374,742
Mineral Deposit Studies	6	8.5	2.45	$725,213	$35,000	$211,048	$80,396	$1,051,657
Mineral Inventory Compilations	n/a	4.25	0	$254,307	$0	$36,529	$0	$290,836
Industrial Mineral Studies	4	4	0.3	$292,483	$0	$190,879	$0	$483,362
Mineral Resource Assessments	n/a	3	0	$189,367	$0	$164,603	$0	$353,970
District geologists/Vancouver Offic	n/a	8	1	$488,345	$0	$388,270	$0	$876,615
Sub Total=	**26**	**51.5**	**9.45**	**$3,620,342**	**$281,992**	**$1,490,580**	**$412,511**	**$5,805,425**
Energy Activities								
Coal	2	1.5	0	$145,468	$0	$18,500	$0	$163,968
Oil & Gas	n/a	5	0	$438,000	$0	$74,000	$0	$512,000
Subsurface Analysis	n/a	4	0	$319,000	$0	$54,000	$0	$373,000
Sub Total=	**2**	**10.5**	**0**	**$902,468**	**$0**	**$146,500**	**$0**	**$1,048,968**
Other Activities								
Environment (hazards)	2	1.25	0.5	$133,462	$0	$54,178	$0	$187,640
Laboratories		1	0.3	$45,858	$0	$6,685	$0	$52,543
Chief Geologist's Office/Admin		5	0	$338,068	$0	$232,242	$0	$570,310
Sub Total=	**2**	**7.25**	**0.8**	**$517,388**	**$0**	**$293,105**	**$0**	**$810,493**
Misc Details								
Publications		6.64	0	$327,065	$0	$128,236	$0	$455,301
information/Assessment Files		4.25	0	$248,307	$0	$36,529	$0	$284,836
Research Grants		0	0	$0	$0	$94,000	$0	$94,000
Sub Total=		**10.89**	**0**	**$575,372**	**$0**	**$258,765**	**$0**	**$834,137**
Industry Grant Programs								
Prospectors Assistance		1	0	$62,962	$0	$422,141	$0	$485,103
Explora BC Grant Program		2.5	0	$172,726	$0	$1,682,312	$0	$1,855,038
Sub Total=		**3.5**	**0**	**$235,688**	**$0**	**$2,104,453**	**$0**	**$2,340,141**
			Total Mineral Survey Activities (GSB)				**Grand Total=**	**$6,942,477**

Province: Alberta 1995-1996

Category	Agency	Funding	Projects	Person Years Perm.	Person Years Casual	Salaries ($) Perm.	Salaries ($) Casual	Operating Expenditures	Total ($)
Mineral Activities									
Geochemical Surveys	ADoE	ADoE	1	1.00	0.07	$58,212	$1,635	$6,066	$65,913
Bedrock Geology	ADoE	ADoE	2	0.67		$64,973		$65,658	$130,631
Mineral Investigations (field)	ADoE	ADoE	2	2.28		$137,237		$221,088	$358,325
Mineral Investigations	ADoE	ADoE	3	1.75		$92,022		$65,628	$157,650
Industrial Minerals	ADoE	ADoE	4	1.10		$55,585		$51,753	$107,338
Minerals Information System	ADoE	1	2	1.22		$60,954		$22,138	$83,092
Core Repositories	ADoE	ADoE	1	0.50		$32,792		$15,885	$48,677
Laboratories	ADoE	2	2	0.08		$4,093		$9,787	$13,880
Energy Activities									
Oil and Gas	ADoE	ADoE	1	0.64		$30,998		$47,068	$78,066
Other Activities									
Environmental/Land Use	ADoE	3	4	1.76		$85,388		$71,896	$157,284
Hydrogeology	ADoE	ADoE	2	1.69		$85,964		$183,451	$269,415
Information Assessment Files	ADoE	ADoE	4	3.65	0.55	$174,880	$18,261	$94,078	$287,219
Geoscience Information System	ADoE	ADoE	1	2.13		$99,619		$548,315	$647,934
Library	ADoE	ADoE	1	0.78	0.15	$26,633	$8,437	$30,423	$65,493
Publications	ADoE	ADoE	1	1.65		$54,800		$20,449	$75,249
Chief's Office/Administration	ADoE	ADoE	5	10.41	0.53	$460,650	$5,540	$181,735	$647,925
Other	ADoE	ADoE	1	0.19		$9,485		$2,040	$11,525
Totals			**37**	**31.50**	**1.30**	**$1,534,285**	**$33,873**	**$1,637,458**	**$3,205,616**

1 - Federal Government
2 - ADoE and various
3 - ADoE and AEP

ADoE - Alberta Department of Energy
AEP - Alberta Environmental Protection

Province: SASKATCHEWAN 1995-1996

Category	No. of Projects	Positions		Salaries $		Operational $	Total $
		Permanent	Non-Permanent	Permanent	Non-Permanent		
Mineral Activities							
Bedrock Geology Surveys	5	3.9	3.1	$256,022	$105,291	$116,544	$477,857
Geochemical Surveys	1	0.5	0.8	$24,966	$33,229	$52,688	$110,883
Geophysical Surveys	2	0	0.7	$0	$15,072	$9,161	$24,233
Mineral Investigations	1	0	0	$0	$0	$19,991	$19,991
Mineral Deposit Inventory	1	1	0	$51,540	$0	$4,486	$56,026
Industrial Minerals Studies	3	2	0	$129,624	$0	$4,921	$134,545
District Geologists	n/a	2	0	$111,145	$0	$22,429	$133,574
Core Depositories	1	0	0.3	$0	$7,038	$9,198	$16,236
Energy Activities							
Coal/Peat	0	0	0	$0	$0	$0	$0
Oil/Gas	n/a	4	2.6	$131,953	$58,123	$16,555	$206,631
Core Depositories	1	6	2.6	$151,596	$67,296	$88,252	$307,144
Subsurface Analysis	3	4	0	$249,534	$0	$0	$249,534
Other Activities							
Environmental/Land Use	0	0	0	$0	$0	$0	$0
Hydrogeology	0	0	0	$0	$0	$0	$0
Laboratories	0	0	0	$0	$0	$0	$0
Miscellaneous (Service/Support)	0	0	0	$0	$0	$0	$0
Chief's Office/Administration	n/a	3	0.2	$165,066	$2,683	$16,663	$184,412
Miscellaneous							
Library	0	0	0	$0	$0	$0	$0
Publications	n/a	4	1.3	$191,990	$72,578	$51,230	$315,798
Prospector's Assistance	0	0	0	$0	$0	$0	$0
Information/Assessment Files	n/a	0	1.7	$0	$41,334	$17,943	$59,277
Research Grants	0	0	0	$0	$0	$0	$0
Other - GIS/Compurterization	n/a	1	2	$49,279	$69,934	$25,709	$144,922
Totals	**18**	**31.4**	**15.3**	**$1,512,715**	**$472,578**	**$455,770**	**$2,441,063**

Province: MANITOBA - 1995-1996

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS or FACILITIES	PERMANENT SMY	CASUAL/ TERM SMY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING XPENDITURES $	TOTAL
MINERAL ACTIVITIES									
Bedrock Geology Surveys	MGS	MAN	22	9:26	0:46	$538,400	$14,800	$99,800	$653,000
Geochemical Surveys	MGS	MAN	3	1:00	0:13	$63,700	$2,700	$27,300	$93,700
Surficial Geology Surveys	MGS	MAN	3	2:00	0:18	$115,200	$12,500	$25,300	$153,000
Geophysical Surveys	MGS	MAN	1	1:00	-	$61,300	-	$3,300	$64,600
Mineral Investigations (Field)	MGS	MAN	11	7:18	1:47	$422,800	$61,700	$66,700	$551,200
Mineral Deposit Analysis/Inventory	MGS	MAN	1	-	-	-	-	$10,300	$10,300
Industrial Minerals	MGS	MAN	3	1:26	0:13	$81,900	$4,100	$7,900	$93,900
District Geologists	MGS	MAN	1	-	-	-	-	$900	$900
Core Repositories	MGS	MAN	3	1:00	-	$41,000	$8,200	$5,100	$54,300
ENERGY ACTIVITIES									
Coal/Peat	-	-	-	-	-	-	-	-	-
Oil & Gas	-	-	-	-	-	-	-	-	-
Core Repositories	-	-	-	-	-	-	-	-	-
Subsurface Analysis	-	-	-	-	-	-	-	-	-
OTHER ACTIVITIES									
Environment/Land Use									
Hydroloy	MWR	MAN	6	10:00	-	$444,000	-	$346,200	$790,200
Laboratories	MGS	MAN	4	8:00	-	$334,500	$3,600	$96,600	$434,700
Miscellaneous Activities	MGS	MAN	7	3:00	-	$156,400	-	$336,500	$492,900
Chiefs Office/Administration	MGS	MAN	5	6:39	-	$330,200	-	$56,400	$386,600
MISCELLANEOUS DETAILS									
Library	-	-	-	-	-	-	-	-	-
Publications	-	-	-	-	-	-	-	-	-
Prospectors Assistance	-	-	-	-	-	-	-	-	-
Information/Assessment Files	-	-	-	-	-	-	-	-	-
Research Grants	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
TOTALS	**-**	**-**	**64**	**41:05**	**3:33**	**$2,589,400**	**$107,600**	**$1,082,300**	**$3,779,300**

MGS - MANITOBA GEOLOGICAL SERVICES

MWR - MANITOBA WATER RESOURCES

Province: ONTARIO 1996-97

Programs	Funding Agency	No. of Projects or Facilities	Salaries Permanent (person/yrs)	Salaries Contract (person/yrs)	Salaries $	Operating Expenditures (incl salary+benefits)	Totals $
Mineral Activities							
Bedrock Geology Surveys	MNDM	16	14.5	3.5	$1,003,500	$530,000	$1,533,500
Geochemical Surveys	MNDM	3	5.5	1.0	$372,000	$225,000	$597,000
Surficial Geology Surveys	MNDM	6	7.5	1.5	$511,000	$310,000	$821,000
Mineral Investigations (field)	MNDM	3	4.5	1.0	$307,000	$220,000	$527,000
Mineral Deposit Analysis and/or Inventory	MNDM	2	1.5		$81,000	$29,000	$110,000
Industrial Minerals	MNDM	3	4.5	0.5	$261,500	$72,000	$333,500
District Geologists	MNDM	13	48.0		$2,368,000	$707,900	$3,075,900
Core Repositories	MNDM	6	2.0		$95,000	$45,000	$140,000
Other Activities							
Environment/Land Use	MNDM		1.0		$55,000	$27,700	$82,700
Laboratories	MNDM		12.0	12.0	$1,023,000	$713,000	$1,736,000
Library	MNDM		1.0		$35,300	$39,000	$74,300
Publications	MNDM		8.0		$363,500	$245,000	$608,500
Data Services	MNDM		10.5		$511,200	$961,600	$1,472,800
Totals			**120.5**	**19.5**	**$6,987,000**	**$4,125,200**	**$11,112,200**
Prospector's Assistance*	MNDM/OPAP					$2,000,000	$2,000,000
NODA	CAN/ONT	21	6.0	8.0	$653,300	$1,691,000	$2,344,300

**Program administered by Mines Group*
MNDM - Ministry of Northern Development and Mines
NODA - Northern Ontario Mineral Development Agreement
OPAP - Ontario Prospector's Assistance Program

Province: QUEBEC 1995-1996

Programs	Fundings $
Mineral activities:	
* Bedrock geology surveys	$6,368,600
* Geochemical surveys	$183,600
* Mineral investigations (field)	$255,115
* Mineral deposit analysis	$280,000
* Industrial minerals	$450,000
* District geologists	$1,158,400
Other activities:	
* Chief geologist's Office/Administration	$1,885,600
MiscelleaneoMiscelleaneous Details:	
* Publications	$620,000
* Prospectors Assistance	$4,168,800
* Information/ Assessment files	$380,000
* Other (GIS-Sigeom)	$2,100,000
TOTAL :	**$17,850,115**

Province: NEW BRUNSWICK 1995-1996

	No. of Projects	Staff			Salaries	Operating	Total
		Perm.	Casual	Contract			
Geological Surveys Branch							
Bedrock Geology	5	4	1.7		$299,008	$107,837	$406,845
Surficial Geology and Till Geochemistry	2	3			$137,927	$45,045	$182,972
Mineral Deposits	3	2.5	0.7		$189,000	$99,000	$288,000
GIS and Digital Technology	1	2.5			$102,315	$43,597	$145,912
Regional Geologist	2	6			$222,063	$84,320	$306,383
Drill core	3	1	1		$75,000	$23,593	$98,593 **
Editorial	1	1			$48,335	$5,368	$53,507
Directors Office	1	2			$96,087	$5,294	$101,381
Prospectors Assistance	1					$50,000	$50,000
Exploration Assistance	1					$400,000 *	$400,000
Mineral Development Agreement	3			3	$115,000	$10,000	$125,000
Geophysics (Airborne)	1					$450,000 *	$450,000
Research Grant	1					$5,000	$5,000
Mineral Development							
Industrial Minerals	4	4			$230,000	$39,000	$269,000
Publications Education	3	5			$182,000	$39,000	$221,000
Energy Branch							
Oil, Gas, Oil Shale	1	1			$50,000	$20,400	$70,400
Totals:	**33**	**35**	**3.4**	**3**	**$1,746,735**	**$1,427,454**	**$3,174,189**

**Funds derived from NB/Canada Diversification Agreement*

***Includes 3 approximately $35,000 derived from NB Department of Natural Resources Development Fund*

Province: NOVA SCOTIA 1995-1996

	Survey Research Agency	Funding Agency	No. projects or facilities	Employees Permanent	Casual*	Operating Expenditures	Budget Allocation
MINERAL ACTIVITIES							
Bedrock Geology Surveys	MERD	NSDNR	6	4	–	$41,481	$311,112
Geochemical Surveys	MERD	NSDNR	3	1	–	$20,500	$122,100
Surficial Surveys	MERD	NSDNR	2	3	–	$21,439	$168,559
Geophysical Surveys	MERD	NSDNR	–	–	–	–	–
Mineral Investigations (Field)	MERD	NSDNR	3	5	–	$41,751	$239,334
Mineral Deposit Analysis/Inventory	MERD	NSDNR	3	3	–	$39,966	$229,163
Industrial Minerals	MERD/MEDD	NSDNR	4	1	–	$12,645	$73,982
District Geologists	RSD	NSDNR	3	3	–	–	–
Core Repositories	MERD	NSDNR	1	6	0.3	$26,300	$297,500
ENERGY ACTIVITIES							
Coal/Peat	MERD	NSDNR	3	3	–	$33,351	$187,583
Oil and Gas	PDA	NSDNR	–	2	–	–	–
Core Repositories	PDA	NSDNR	–	–	–	–	–
Subsurfact Analysis	PDA	NSDNR	–	–	–	–	–
OTHER ACTIVITIES							
Environmental/Land Use	MERD	NSDNR	2	2		$12,953	$136,223
Hydrology	DOE	–	–	–	–	–	–
Laboratories	–	–	–	–	–	–	–
Misc. Activities	MERD	NSDNR	–	1		$24,805	$84,040
Chief Geol's Office/Admin.	MERD	NSDNR	–	3		$32,438	$193,238
Misc Details							
Library	PS	NSDNR	–	5	1	–	–
Publications	MERD	NSDNR	–	3	0.5	$35,350	$159,205
Public Awareness/Prospectors Training	MERD	NSDNR	–	1		$8,403	$73,023
Information/Assessment Files	MERD	NSDNR	–	4	1	$18,118	$200,038
Research Grants	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	–
Totals				**50**		**$369,500**	**$2,475,100**

Budget figures for MERD only; permanent staff figures include personnel in other divisions
** - not including summer students*
MERD - Mineral and Energy Resources Division
MEDD - Mines and Energy Development Division
RSD - Regional Services Division
PDA - Petroleum Development Agency
PS - Planning Secretariat
DOE -Department of the Envrironment

Province: NEWFOUNDLAND 1995-1996

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	No. of PROJECTS/ FACILITIES	PERM[1] SMY	CASUAL SMY	SALARIES PERM. $	SALARIES CONTRACT[1] $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTALS $
MINERAL ACTIVITIES										
Bedrock geology surveys	GSNL	NDME/NRCan	15	18	4	$567,939	$173,400	$75,443	$385,046	$1,201,828
Geochemical surveys	GSNL	NDME/NRCan	6	7	2	$95,081	$182,306	$7,233	$43,471	$328,091
Surficial geology surveys	GSNL	NDME/NRCan	5	3	1	$91,054	$39,509	$9,258	$28,430	$168,251
Geophysical surveys	GSNL	NDME/NRCan	2	1	–	$47,246	–	–	$4,701	$51,947
Mineral investigations (field	GSNL	NDME/NRCan	6	5	1	$130,964	$95,086	$13,482	$97,490	$337,022
Mineral deposit analysis and/or inventory	GSNL	NDME	1	3	–	$47,494	$72,151	–	$247	$119,892
Industrial minerals	GSNL	NDME	4	5	1	$155,846	$65,331	$3,893	$33,652	$258,722
District geologists	–	–	–	–	–	–	–	–	–	–
Core repositories	MLD	NDME	1	2	1	$97,524	-	$4,311	$43,696	$145,531
ENERGY ACTIVITIES										
Coal/Peat	–	–	–	–	–	–	–	–	–	–
Oil & Gas	EB	NDME	3	15	-	$541,200	$100,000	–	$133,500	$774,700
Core Repositories	–	–	–	–	–	–	–	–	–	–
Subsurface Analysis	–	–	–	–	–	–	–	–	–	–
OTHER ACTIVITIES										
Environment/Land Use	MLD	NDME	1	2	–	$69,836	–	–	$14,987	$84,823
Hydrology	–	–	–	–	–	–	–	–	–	–
Laboratories	GSNL	NDME	1	6	–	$211,279	–	–	$66,467	$277,746
Miscellaneous Activities	–	–	–	–	–	–	–	–	–	–
Director's Office/Admin.	GSNL	NDME	2	7	–	$253,549	$27,487	–	$239,809	$520,845
MISCELLANEOUS DETAILS										
Library	GSNL	NDME	1	3	–	$33,811	$29,445	–	$8,360	$71,616
Publications/Cartography	GSNL	NDME	2	10	–	$238,267	$81,222	–	$64,755	$384,244
Prospectors Assistance	MB	NDME	1	1	–	-	$56,766	–	$233,763	$290,529
Information/Assessment file	GSNL	NDME	4	7	–	$138,303	$94,113	–	$72,225	$304,641
Research Grants	–	–	–	–	–	–	–	–	–	–
Information Technology	GSNL	NDME	1	–	–	–	–	–	$159,798	$159,798
TOTALS			**56**	**95**	**10**	**$2,719,393**	**$1,016,816**	**$113,620**	**$1,630,397**	**$5,480,226**[2]

GSNL *Geological Survey of Newfoundland and Labrador*
MLD *Mineral Lands Division*
MB *Mines Branch*
EB *Energy Branch*
NDME *Newfoundland Department of Mines and Energy*
NRCan *Natural Resources Canada*
1 includes long-term temporary staff
2 includes $277,148 NRCan funding (contracted by the Geological Survey of Canada)

Territory: Northwest Territories

Activity	Funded by:	Projects	PY's	Salary $	O&M $
Mineral Activities:					
Bedrock geology surveys	INAC	2	2.5	$135,400	$142,000
	MI (GNWT)	3	4.5	$245,000	$187,000
	MI (GSC)	7			$115,000
Mineral investigations (field)	INAC	5			$106,400
	MI (GSC)	1			$55,000
Mineral deposit analysis and/or inventory	INAC	1	0.47	$22,600	$25,000
	MI (GNWT)	1	1.5	$100,000	$100,000
	MI (GSC)	1			$5,000
District geologists	INAC	5		$317,400	
Core repositories	INAC	1	0.1	$5,000	$8,200
Other Activities:					
Chief Geologists Office/Administration	INAC	1	2	$111,000	$281,600
	GNWT	1	1.5	$100,000	$50,000
Miscellaneous Details:					
Library	INAC	1			$10,300
Archives/Assessment Files	INAC	1	2.8	$127,000	$14,400
Publications			0.2	$10,000	$5,000
Prospectors Assistance/Support	GNWT	1	1	$65,000	$75,000
Research Grants/Contracts	INAC				$38,000
Other (Education/Information)	GNWT	1	0.5	$25,000	$50,000
Sub-Totals:				**$1,263,400**	**$1,267,900**
				Total Budget:	**$2,531,300**

Territory: YUKON 1995-1996

	Agency	Funding	Projects	Perm	Casual	Expenditure
Mineral Activities						
Bedrock Geological Surveys	YTG	INA/YTG	4	4	2	$353,300
	INA/YTG	INA/YTG	1	1	–	$70,000
	GSC/YTG	INA/YTG/GSC	1	1	0.25	$79,000
Geochemical Surveys	GSC	INA/YTG	1	–	–	$273,100
Surficial Geology	YTG	INA/YTG	1	1	0.5	$79,100
	INA	INA	1	1	0.25	$79,100
	GSC	INA/YTG	1	1	0.25	$58,000
Geophysical Surveys	GSC/YTG	YTG	–	–	–	–
Mineral Deposit Inventory	INA	INA	1	1	–	$83,800
District Geologists	INA	INA	2	2	–	$133,700
Core repositories	INA	INA	1	–	–	$15,600
Energy Activities						
Oil and Gas	NEB	YTG	2	–	–	$60,000
Other Activities						
Environment/Land Use	INA	INA	2	1	0.25	$122,800
Chief Geologist/Administration	YTG	INA/YTG	1	3	–	$410,100
	YTG	YTG	1	1	–	$87,300
	INA	INA	1	1	–	$163,300
Library	INA	INA	1	–	–	$12,000
Publications	INA	INA	1	1	–	$34,000
	YTG	INA/YTG	3	–	–	$10,000
Prospectors Assistance	YTG	YTG	1	1	–	$725,000
Assessment Files	INA	INA	1	–	–	$10,000
Research Grants - Geology	INA	INA	1	–	–	$17,300
	YTG	INA/YTG	5	–	–	$82,500
Research Grants - Technology R&D	YTG	INA/YTG	3	–	–	$71,300
Grants - Information and Communications	YTG	INA/YTG	7	–	–	$124,000
Economic Analysis	YTG	YTG	1	1	–	$72,400
Total			**45**	**21**	**3.5**	**$3,226,700**

Intergovernmental Geoscience Accord
Accord Géoscientifique Intergouvernemental

Hon. Anne McLellan
Minister of Natural Resources
Government of Canada

Hon. Rex Gibbons, P. Geo.
Minister of Mines and Energy
Government of Newfoundland and Labrador

Approved pursuant to the
Intergovernmental Affairs Act by the
Premier as Minister Responsible for
Intergovernmental Affairs or the Secretary
to Cabinet for Intergovernmental Affairs
Government of Newfoundland and Labrador

Hon. Eleanor Norrie
Minister of Natural Resources
Government of Nova Scotia

Hon. Albert Doucet
Minister of State for Mines and Energy
Government of New Brunswick

Hon. Christopher Hodgson
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Northern Development and Mines
Government of Ontario

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Minister of Energy and Mines
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Hon. Eldon Lautermilch
Minister of Energy and Mines
Government of Saskatchewan

Hon. Patricia Black
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Government of Alberta

Hon. Dan Miller
Minister of Employment and Investment
Government of British Columbia

Hon. Stephen Kakfwi
Minister of Resources, Wildlife
and Economic Development
Government of the Northwest Territories

Hon. Mickey Fisher
Minister of Economic Development
Government of Yukon

53rd. Annual Mines Ministers' Conference
Yellowknife, Northwest Territories
17 September 1996

53e. Conférence annuelle des Ministres des Mines
Yellowknife, Territoires du Nord-ouest
17 septembre 1996

Intergovernmental Geoscience Accord
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September 17, 1996

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INTRODUCTION

With the changing demands upon governments for geoscience information, and recent major reductions in support for geoscience in Canada at the federal and provincial levels, including the withdrawal of the Mineral Development Agreement programs, there is a need to review the roles and responsibilities of the federal, provincial and territorial geological survey organizations, and to establish new principles and mechanisms of cooperation that will maximize benefits to Canada.

1. PURPOSE

1.1 The purpose of the Intergovernmental Geoscience Accord (hereafter, the Accord) is to focus the strengths and increase the effectiveness of government geological survey organizations in Canada by:

- defining their different but complementary roles and responsibilities;
- outlining principles of cooperation that will optimize utilization of resources among all of the geological survey organizations;
- establishing mechanisms to optimize cooperation and collaboration among the geological survey organizations.

2. ROLES AND RESPONSIBILITIES

The Accord recognizes the following complementary roles of the Geological Survey of Canada, and the provincial and territorial geological survey organizations:

2.1 The Geological Survey of Canada carries out national geoscience programs to define the geology and resources of Canada. These programs are typically thematically based, and national or broadly regional in scope and significance. They are operated across Canada, and include aspects of fundamental research, technology development

INTRODUCTION

Comme, d'une part, les gouvernements doivent répondre à de nouveaux besoins en matière d'information géoscientifique et que, d'autre part, des compressions majeures ont diminué récemment l'appui consenti aux activités géoscientifiques par les gouvernements fédéral et provinciaux, notamment par l'abolition des ententes sur l'exploitation minérale, il convient d'examiner les rôles et les responsabilités des commissions géologiques fédérale, provinciales et territoriales et d'établir de nouveaux principes et mécanismes de collaboration qui permettront à ces organismes de servir au mieux les intérêts du Canada.

1. OBJET

1.1 Le présent Accord géoscientifique intergouvernemental (ci-après "Accord") a pour objet de concentrer les forces et d'accroître l'efficacité des commissions géologiques au Canada, par les moyens suivants:

- la définition des rôles et responsabilités des diverses commissions, qui sont différents, mais complémentaires;
- l'établissement de principes de collaboration qui permettront une utilisation optimale des ressources de l'ensemble des commissions;
- l'établissement de mécanismes qui permettront d'optimiser la coopération et la collaboration entre les commissions.

2. RÔLES ET RESPONSABILITÉS

L'Accord reconnaît les rôles complémentaires suivants de la Commission géologique du Canada et des commissions géologiques provinciales et territoriales:

2.1 La Commission géologique du Canada (CGC) exécute des programmes géoscientifiques nationaux dont l'objet est de définir la géologie et les ressources naturelles du Canada. Ces programmes sont pour la plupart thématiques et ont une portée nationale ou régionale étendue. Ils sont menés à divers endroits au Canada et portent sur

and information transfer not contained in the programs of all of the provincial and territorial survey organizations. In addition to its activities on land, the GSC operates marine and coastal studies that are unique among the geological survey organizations. The GSC also has a lead role in representing Canada in international geoscience activities.

2.2 The provincial and territorial geological survey organizations carry out programs specific to the economic development and resource management of their own jurisdictions. These programs are carried out at a scale appropriate to addressing provincial or territorial responsibilities, and are geographically limited to the jurisdiction over resources, environment and land of the province or territory. They contribute to a systematic description of the geology of the provinces and territories, including their mineral and energy endowment. Provincial and territorial programs are largely directed toward sustainable economic development and are closely linked to the local needs of clients. They are also related to provincial and territorial land use and social issues.

3. PRINCIPLES OF COOPERATION

The following principles shall guide federal-provincial/territorial cooperation in geoscience:

3.1 All geoscience activities by the GSC within the provinces or territories will be planned in consultation and coordination with the appropriate provincial or territorial organization.

3.2 Geoscience activities proposed by the GSC within the provinces that are directly relevant to the provincial responsibilities for, and territorial interests in, mineral and energy resources and land management, will be conducted with the agreement of the province and in a collaborative manner.

3.3 If a province requests the GSC to undertake geoscience activities with the characteristics of a provincial program, as specified in Section 2.2, these activities will be undertaken through formal agreements with the province.

des aspects de la recherche fondamentale, du développement technologique et du transfert d'information qui ne sont pas couverts par les programmes des commissions géologiques provinciales et territoriales. En plus de ses activités sur la terre ferme, la CGC mène des études uniques sur la géologie marine et côtière. La CGC a aussi pour fonction de représenter le Canada dans le cadre d'activités géoscientifiques internationales.

2.2 Les commissions géologiques provinciales et territoriales exécutent des programmes adaptés au développement économique et à la gestion des ressources de leur région respective. La portée de ces programmes dépend des responsabilités de la province ou du territoire et, du point de vue géographique, elle se limite à l'espace administratif dans lequel la province ou le territoire exerce sa compétence sur les ressources, l'environnement et les terres. Ces programmes contribuent à la description systématique de la géologie des provinces et territoires, ce qui comprend leurs ressources minérales et énergétiques. Les programmes provinciaux et territoriaux sont en grande partie orientés vers le développement économique durable et sont bien adaptés aux besoins des clients locaux. Ils portent aussi sur l'aménagement du territoire et sur des questions d'intérêt social dans les provinces et territoires.

3. PRINCIPES DE COLLABORATION

Les principes suivants guideront la collaboration fédérale-provinciale/territoriale dans le cadre des activités géoscientifiques :

3.1 Toutes les activités géoscientifiques de la CGC dans les provinces et les territoires seront planifiées en consultation et en collaboration avec les commissions géologiques des provinces et territoires concernés.

3.2 Si la CGC se propose de mener dans les provinces des activités géoscientifiques qui ont un lien direct avec les responsabilités des provinces ou les intérêts des territoires en matière de ressources minérales et énergétiques et de gestion du territoire, ces activités seront exécutées avec l'accord des provinces et en collaboration avec elles.

3.3 Si une province demande à la CGC d'entreprendre des activités géoscientifiques ayant les caractéristiques de programmes provinciaux décrites à l'article 2.2, les activités seront réalisées dans le cadre d'ententes officielles avec la province.

4. MECHANISMS FOR COOPERATION AND ACCOUNTABILITY

Cooperation and accountability will be optimized through the following mechanisms:

4.1 Bilateral accords may be negotiated between the GSC and the provincial and territorial survey organizations, where mutually desired. These accords may define mechanisms for the joint development of strategic plans to address the geoscience needs of the province or territory, for collaboration to plan and deliver programs to meet these needs, and for sharing of data.

4.2 The bilateral accords shall be tabled with the National Geological Surveys Committee (NGSC) for information, with the consent of the participating province or territory.

4.3 The NGSC will convene workshops at regular intervals to review the national geoscience program and to gather information to assist the GSC in setting national program priorities. The workshops will address all national program elements and will include participation by all NGSC members, industry clients and the universities.

4.4 The GSC and provincial and territorial survey organizations shall report their work plans to the NGSC annually for comment and discussion.

4.5 The NGSC shall monitor progress in the implementation of the Accord and submit an annual written report to the Intergovernmental Working Group on the Mineral Industry (IGWG) in a format to be specified by IGWG.

4.6 The term of the Accord is five years from the date of signing.

4.7 The Accord imposes no responsibility to assume any additional scientific program costs on any party.

4.8 The Accord does not create legally binding obligations between the parties but expresses their desire to cooperate and coordinate geoscience activities.

4.9 The Accord is entered into, and may be amended, renewed, or terminated by Ministers responsible for geological survey organizations.

4. MÉCANISMES DE COLLABORATION ET DE RESPONSABILISATION

Les mécanismes suivants assureront une collaboration optimale entre les parties et feront en sorte que celles-ci assument leurs responsabilités respectives.

4.1 Si elles le souhaitent, la CGC et les commissions géologiques des provinces et territoires peuvent négocier des accords bilatéraux. Ces accords peuvent définir des mécanismes s'appliquant à des activités comme l'élaboration conjointe de plans stratégiques pour répondre aux besoins géoscientifiques de la province ou du territoire, la collaboration dans la planification et l'exécution des programmes répondant à ces besoins et, enfin, l'échange de données.

4.2 Les accords bilatéraux doivent être portés à la connaissance du Comité national des commissions géologiques (CNCG), avec le consentement de la province ou du territoire participant.

4.3 Le CNCG tiendra des ateliers à intervalles réguliers pour revoir le programme géoscientifique national et recueillir de l'information en vue d'aider la CGC à fixer les priorités de son programme national. Les ateliers porteront sur tous les éléments de ce programme. Y assisteront tous les membres du CNCG ainsi que des clients de l'industrie et des représentants d'universités.

4.4 La CGC et les commissions géologiques des provinces et territoires soumettront leurs plans de travail au CNCG chaque année pour commentaires et discussion.

4.5 Le CNCG surveillera la mise en oeuvre de l'Accord et présentera un rapport annuel au Groupe de travail intergouvernemental sur l'industrie minérale (GTIGIM) sous la forme précisée par le Groupe.

4.6 L'Accord a une durée de cinq (5) ans. Il entre en vigueur lorsqu'il est signé par les parties.

4.7 L'Accord n'impose aux parties aucune responsabilité quant à des coûts additionnels pouvant découler de programmes scientifiques.

4.8 L'Accord ne crée aucune obligation légale entre les parties. Il ne fait qu'exprimer leur volonté de collaborer et de coordonner ensemble des activités géoscientifiques.

4.9 L'Accord est conclu par les ministres responsables des commissions géologiques, qui peuvent aussi le modifier, le renouveler ou le résilier.

Annex: Background Information for the Intergovernmental Geoscience Accord.

1. *What is geoscience information and how is government geoscience data used?*

Geoscience information comprises a range of earth science data and interpretations derived from geological, geophysical, geochemical, and mineral studies. This information is used by governments to manage their lands, mineral, energy and water resources, to protect the environment and human health, and to assess risks due to geological hazards such as earthquakes, landslides, volcanic eruptions and floods.

A major use for government geoscience information in Canada is to promote and assist energy and mineral exploration and development by the private sector. Government geoscience programs of interest to the private sector are generally regional in scale, "pre-competitive" in nature, and produce data in the public domain to attract and serve multiple users. In contrast, industry geoscience programs are generally concerned with specific commodity targets and lead to the development of resources through the construction of mines and quarries, and the drilling of oil and gas wells. Industry data are also protected by confidentiality for varying time periods.

2. *Which organizations are responsible for government geoscience programs in Canada?*

In Canada, geoscience information is provided by federal, provincial and territorial mines and/or energy or natural resource departments through geological survey organizations. These organizations conduct diverse programs of field and laboratory research, compile information and data from public and private sector sources, create, maintain and interpret geoscience knowledge bases, release information in printed and electronic forms, and provide expert advice.

Federal geoscience programs in Canada are delivered by the Geological Survey of Canada (GSC). The GSC carries out research programs and surveys to create and maintain a comprehensive knowledge

Annexe: Renseignements généraux sur l'Accord géoscientifique intergouvernemental

1. *Qu'entend-on par «information géoscientifique» et à quoi les données géoscientifiques gouvernementales servent-elles?*

L'information géoscientifique comprend un large éventail de données et d'interprétations dérivées d'études sur la géologie, la géophysique, la géochimie et les minéraux. Les gouvernements utilisent cette information pour gérer leurs terres et leurs ressources en minéraux, en énergie et en eau, pour protéger l'environnement et la santé humaine et pour évaluer les risques associés à des phénomènes géologiques comme les séismes, les glissements de terrain, les éruptions volcaniques et les inondations.

Au Canada, l'information géoscientifique gouvernementale est beaucoup utilisée pour promouvoir et faciliter la recherche et l'exploitation des ressources énergétiques et minérales dans le secteur privé. Les programmes géoscientifiques gouvernementaux qui intéressent le secteur privé sont en général des programmes de portée régionale et de nature pré-concurrentielle qui produisent des données du domaine public afin d'attirer et de servir des utilisateurs multiples. Les programmes géoscientifiques de l'industrie, en revanche, sont généralement axés sur des produits bien précis et mènent à l'exploitation des ressources par la construction de mines et de carrières et le forage de puits de pétrole et de gaz naturel. De plus, les données de l'industrie sont gardées confidentielles pour des périodes variables.

2. *Quelles organisations sont responsables des programmes géoscientifiques gouvernementaux au Canada?*

Au Canada, l'information géoscientifique provient des ministères responsables des mines, de l'énergie et des ressources naturelles aux niveaux fédéral, provincial et territorial, plus précisément des commissions géologiques qui relèvent de ces ministères. Les commissions géologiques ont plusieurs fonctions: elle exécutent divers programmes de recherche sur le terrain et en laboratoire, recueillent de l'information et des données de sources publiques et privées, créent, maintiennent et interprètent des base de connaissances géoscientifiques, diffusent de l'information sous forme imprimée et électronique et fournissent des conseils d'experts.

Les programmes géoscientifiques fédéraux sont réalisés par la Commission géologique du Canada (CGC). La CGC mène des programmes de recherche et fait des levés dans le but de créer et de maintenir une base de connaissances exhaustive sur la géologie continentale et marine et les ressources minérales et énergétiques du Canada. Ces travaux donnent une vue

base of the geological framework of Canada's onshore and offshore territories, and their mineral and energy resources. These studies have a national perspective, providing a vital comparative reference beyond the scope of the provincial and territorial organizations. The GSC also operates programs to address national issues about the environment and geological hazards. It provides expertise, special skills, and laboratory and other facilities capable of addressing problems in any geoscience discipline in Canada. It represents Canada in international geoscience activities.

The provinces maintain geological survey organizations to fulfil their responsibilities under the Canadian constitution for the ownership and management of their non-renewable mineral and energy resources. They do this by defining mineral and energy endowments in order to promote mineral and energy exploration and development by the private sector, and by managing the provincial resources. The provincial survey organizations were generally strengthened during the 1970s and 1980s with support from federal-provincial mineral development agreements (MDAs).

Provincial survey organizations vary considerably in size and range of activities, depending on a number of factors including size of population, area, and present knowledge of the mineral endowment. The smaller of the provincial and territorial organizations do not generally engage in every geoscience discipline, such as airborne surveys and specialized laboratories, which are better provided by the larger GSC.

3. What are the new demands and restraints upon government geoscience?

New factors are affecting the conduct of government geoscience in Canada:

1. Canada's mineral and energy industries now operate in a global environment. This necessitates a more competitive approach to attract exploration. As well, it provides new opportunities, for the GSC in particular, to enhance Canada's role in international geoscience.
2. There are new demands for geoscience information for environmental and land use management including involvement in land claim negotiations.

d'ensemble et des points de comparaison essentiels qui sont impossibles à obtenir dans le cadre d'une étude à l'échelle provinciale ou territoriale. La CGC exécute aussi des programmes qui portent sur des questions d'intérêt national liées à l'environnement et aux dangers naturels. Elle met à profit son expertise, ses compétences spéciales, ses laboratoires et ses autres installations pour trouver des solutions à des problèmes touchant toutes les disciplines géoscientifiques. Enfin, elle représente le Canada dans le cadre d'activités géoscientifiques internationales.

Les provinces maintiennent des commissions géologiques pour s'acquitter des responsabilités que leur confie la Constitution canadienne en matière de propriété et de gestion des ressources minérales et énergétiques non renouvelables. Elles définissent leurs ressources minérales et énergétiques afin d'en faciliter la recherche et l'exploitation par le secteur privé, et elles gèrent leurs ressources. Dans les années 70 et 80, le rôle des commissions géologiques provinciales a été accentué par les ententes fédérales-provinciales sur l'exploitation minérale.

La taille et les activités des commissions géologiques varient considérablement d'une province à l'autre en fonction d'un certain nombre de facteurs comme la population, la région et l'étendue des connaissances sur les richesses minérales de la province. Généralement, les commissions provinciales et territoriales les plus petites ne touchent pas à toutes les disciplines géoscientifiques. Par exemple, la CGC, parce qu'elle est plus grande, est mieux placée pour effectuer des levés aériens et offrir les services de laboratoires spécialisés.

3. À quelles exigences et contraintes nouvelles sont soumises les activités géoscientifiques gouvernementales?

De nouveaux facteurs guident la réalisation des activités géoscientifiques gouvernementales au Canada:

1. Les activités des industries canadiennes des minéraux et de l'énergie se mondialisent, ce qui nécessite l'adoption d'une approche plus compétitive pour attirer des projets d'exploration. Cela crée aussi, en particulier pour la CGC, des occasions de renforcer le rôle du Canada dans le cadre d'activités géoscientifiques internationales.
2. L'information géoscientifique a de nouvelles applications dans le domaine de la gestion de l'environnement et de l'aménagement du territoire, notamment en ce qui concerne la négociation des revendications territoriales. Cela représente un rôle additionnel d'importance pour les commissions géologiques des provinces et territoires.

This is a significant added role for the provincial and territorial geological survey organizations.

3. Geological survey organizations are heavily involved in the transition to the new world of digital data handling and packaging.

4. Much of Canada's geology is known only from geoscience maps and databases which are in need of upgrading to meet changing client demands.

5. Major deficit-reduction programs have significantly reduced government geoscience expenditures for federal and provincial programs across Canada.

4. In the face of the new challenges facing government geoscience, how will the Accord provide better program delivery?

The new demands upon government geoscience, coupled with the reductions in funding, require new ways to ensure optimal delivery of geoscience programs, particularly through cooperation. Although there has been significant cooperation in designing and mounting geoscience programs through the MDAs and programs such as the National Geoscience Mapping Program (NATMAP), there are presently no overall guidelines in place for cooperation between the federal, and the provincial and territorial organizations.

The Accord provides a framework for improved cooperation between the organizations. It establishes better mechanisms for exchange of ideas, joint planning and program delivery. It confirms the need for joint planning of all GSC programs within the provinces or territories, and eliminates the possibility, real or perceived, of overlap in program delivery.

The Accord defines the complementary roles of the GSC, the provincial and territorial geological survey organizations. It recognizes the national and international mandate of the GSC, its position as a hub for geoscience in Canada, and its value in providing specialized expertise and facilities. It asserts the responsibilities of the provinces and territories in providing geoscience programs for their economic development and resource management, distinguishing these from the GSC role. It confirms the role of a province in approving any geoscience activity undertaken within its boundaries that is relevant to its provincial responsibilities.

The Accord also provides a basis for the negotiation of bilateral agreements between the GSC and the provinces and territories.

3. Les commissions géologiques vivent intensément les changements provoqués par la numérisation du traitement et de la présentation des données.

4. Une grande partie de la géologie du Canada n'est connue que grâce aux cartes et aux bases de données géoscientifiques, lesquelles doivent être mises à jour pour répondre aux besoins des clients.

5. Les grandes initiatives de lutte contre le déficit ont forcé les gouvernements fédéral et provinciaux à réduire de beaucoup leurs dépenses dans les programmes géoscientifiques.

4. Compte tenu des nouveaux défis qui se posent dans le domaine des activités géoscientifiques gouvernementales, comment l'Accord permettra-t-il une meilleure exécution des programmes?

Les nouveaux besoins et la réduction des fonds disponibles exigent que l'on trouve de nouvelles façons d'assurer la meilleure exécution possible des programmes géoscientifiques, en particulier par la collaboration. Même si la conception et la mise sur pied de plusieurs programmes ont bénéficié de la collaboration rendue possible par les ententes sur l'exploitation minérale et des initiatives comme le Programme national de la cartographie géoscientifique (CARTNAT), il n'existe à l'heure actuelle aucune ligne directrice sur la collaboration entre la Commission géologique du Canada (CGC) et les commissions géologiques provinciales et territoriales.

L'Accord crée le cadre nécessaire à l'amélioration de la collaboration entre ces organisations. Il établit de meilleurs mécanismes pour l'échange d'idées, la planification conjointe et l'exécution des programmes. Il confirme le besoin de co-planification de tous les programmes de la CGC qui se déroulent dans les provinces et les territoires et élimine le risque de chevauchements.

L'Accord définit les rôles complémentaires de la CGC et des commissions géologiques des provinces et territoires. Il reconnaît le mandat national et international de la CGC, sa fonction de pivot géoscientifique au Canada et la valeur de son expertise et de ses installations spécialisées. Il affirme que les provinces et les territoires ont pour responsabilité de mener des programmes géoscientifiques visant le développement de leur économie et la gestion de leurs ressources, ce qui distingue leur rôle de celui de la CGC. Il confirme que chaque province a pour rôle d'approuver toute activité géoscientifique que l'on propose d'entreprendre sur son territoire et qui relève de sa compétence.

Enfin, l'Accord prévoit la négociation d'ententes bilatérales entre la CGC et les commissions géologiques des provinces et territoires.

GEOLOGICAL PROGRAM HIGHLIGHTS

BRITISH COLUMBIA MINISTRY OF EMPLOYMENT AND INVESTMENT GEOLOGICAL SURVEY BRANCH

INTRODUCTION

The exploration focus in British Columbia continued to be gold-enriched porphyry, VMS and gold deposits. 1996 expenditures increased about 15% to almost $100 million.Three mines (Kemess, Mount Polley and Huckleberry) are under construction representing more than $600 million of new investment; all of them are open pit porphyry copper deposits. Both the Kemess and Mount Polley deposits will also produce significant amounts of gold. Coal mines in the province had the highest production levels ever and coal companies were showing considerable interest in exploration.

The past year was a turbulent one for the Geological Survey Branch (GSB) due to government streamlining and downsizing. The main impacts of these changes were:

The former Ministry of Energy, Mines and Petroleum Resources was merged in March 1996 with the Ministry of Employment and Investment. The GSB became one of six Branches in the new Minerals and Energy Division of the Ministry of Employment and Investment.

In the 1996-97 budget the GSB was allocated a 1-year budget lift of $1.1 million to offset the termination of funding from the Canada-British Columbia Mineral Development Agreement. As a result the Branch delivered one of the largest programs in years. At the same time, to maximize field efforts, six non-field positions were eliminated in March 1996.

A cross-government program review conducted in the fall of 1996 led to major budget cutbacks in many areas of government, including the GSB, for fiscal year1997-98. Next year's budget will be $3.6 million, down from $6.6 million in 1996-97 andthe number of staff will drop to 45, down from 65. These cuts, which have necessitated elimination of the in-house drafting and publications groups, will reduce the overall capability of the Branch.

PROGRAM HIGHLIGHTS FOR 1996

Economic Development Program

The Branch's economic development surveys focused on under-explored frontier regions (Gataga North, Tatogga Lake, Cambria) and on areas with established mining infrastructure (Goldstream). The field component of the Tatogga Lake project located south of Dease Lake was completed and a major, helicopter-supported program in the Gataga area southeast of Watson Lake completed a bedrock mapping and lake geochemical sampling program. Southeast of Stewart, work continued on mapping and mineral deposit studies (Cambria project). North of Revelstoke, bedrock mapping was completed in the northern Selkirks project area near the now inactive Goldstream mine.

In addition, several reconnaissance projects were undertaken. The first assessed several target areas in poorly known rock packages in northern British Columbia for their potential to host Devono-Mississippian volcanogenic massive sulphide (VMS) deposits of the Kudz Ze Kayah or Wolverine type. The second checked reports of felsic members in the Cache Creek Group in the region west and north from Dease Lake to assess VMS potential for deposits of the Kutcho type. The third studied the potential of Gambier Group rocks near Bella Coola for VMS deposits, and the fourth considered the potential for bulk tonnage gold deposits in the province.

In the Kootenay region, release of data from the joint GSB-GSC geophysical survey (magnetics, electromagnetics and radiometrics) flown in 1995 took place July 11, 1996. A workshop was held prior to the release to make clients familiar with the datasets and their uses. Flying for the remainder of the survey area was completed during 1996; data will be available in 1997. The $1.1 million lift to the Branch budget provided funding for regional geochemical silt sampling programs for the Toodoggone River (94D) and McConnell Creek (94E) map-sheets in north-central British Columbia, where epithermal gold and copper-gold porphyry deposits are known. Significant claim staking activity followed the July 1996 release of geochemical data for samples collected from the Cry Lake sheet (104I) in 1995.

In central British Columbia, the Nechako Plateau NATMAP program continued into year two and involved the Branch heavily. Bedrock geology, surficial geology, till and lake geochemical sampling, geochemical research, remote sensing and mineral deposit studies are underway. Much of our work focused on the Babine porphyry Belt which contains two past producing porphyry copper-gold mines, Granisle and Bell Copper. This is a joint project with

the Geological Survey of Canada and various universities to understand the tectonic evolution and mineral deposits of this largely drift-covered, under-explored area. A second multidisciplinary project with surficial geology, geochemistry and mineral deposit components began in the Eagle Bay area in the Kootenay Terrane, where new Cambrian to Devonian volcanogenic massive sulphide deposits of the Kuroko, Besshi and Sedex types are the key exploration targets.

The Branch continued to be active with respect to developing the province's industrial minerals potential. Three issues of a newsletter aimed at an international audience were published that advertise industrial mineral opportunities in the province. Field studies of gemstones and dimension stone continued. GSB staff played an important role in the delivery of a 4 day short course on industrial minerals in Nelson.

A modest coal deposit studies program was highlighted by seminars at Sparwood and Tumbler Ridge that involved the local geological communities. Studies are underway on aspects of coal quality that affect coal utilization, specifically geological controls of phosphorous distribution, coalbed methane and oxidation.

Resource Management Program

The database for the Branch's Mineral Potential mapping initiative was largely completed in 1996-97 with completion of the important northwest region. Many of the datasets are posted on the Internet (http://natural.gov.bc.ca/geosmin/minpot.htm) and they are being used by a wide variety of clients involved in land planning. Completion of the Queen Charlotte Islands and development of a common legend for the geological database will be done in 1997-98. Progress continues to be made toward completion of modern MINFILE coverage for the entire province; more than 90 percent has now been coded and released. As well, a new version of MINFILE/pc, the software used to work with the data was released.

Environmental Program

Building on successful completion of an earthquake hazard map of the Chilliwack area, the GSB received funding from the Capital Regional District to prepare a hazard map of the Greater Victoria area.

The Forest Practices Code requires terrain stability mapping to be conducted before any work is done that will cause surface disturbance in the forests. The Branch has undertaken to produce a digital map library by converting existing analogue terrain maps and incorporating new digital data produced by forest companies. Data in the library will be made available on the internet.

Publications

In response to staff reductions, the Branch will continue its move to print-on-demand for its geoscience publications. As well, in future, maps will be readied for publication by the geologists as professional drafting will no longer be available. There will be a strong move to making reports and maps available through the Internet. The Ministry's home page is:

http://www.ei.gov.bc.ca/

Prospector's Assistance

The government continued to issue grants to aid prospectors conduct grassroots prospecting in the province, Sixty-eight prospectors received grants worth more than $400,000 during the year.

Joint Planning with the Geological Survey of Canada

The GSC continue to be a key partner in providing geoscience data in the province. The federal-provincial National Geoscience Accord signed at the 1996 Mines Minister's Conference in Yellowknife clearly defines the roles and responsibilities of each organization and reduces the likelihood of overlap or duplication. As well, ongoing liaison between the two organizations has improved cooperation with respect to implementing the terms of the 1994 joint strategic planning report on BC's geoscience needs. The Nechako NATMAP program is one example of this cooperation.

ALBERTA ENERGY AND UTILITIES BOARD
ALBERTA GEOLOGICAL SURVEY

The Alberta Geological Survey (AGS) was part of the Alberta Department of Energy for the 1995-96 fiscal year, and transferred to the Alberta Energy and Utilities Board (EUB) April 1, 1996, as a Group in the Resources Division. There has been a decrease in the staff complement of AGS, especially in the energy field. AGS may be able to partly alleviate this loss through synergies within its new parent organization, the EUB.

AGS delivers its mission and responsibilities through a team-based organizational structure. This structure currently is comprised of technical teams (Exploration and Development Support, Land Use Planning and Environmental Management Support, and Geoscience Information Systems) in charge of the technical parts of the AGS program, and which are supported by the Management and Administrative Support teams.

AGS PROGRAM

To optimize the use of AGS' resources it was decided to focus on integrated studies of two well-defined geographic areas (the Kakwa-Wapiti area in western Alberta and the Birch Mountains area in northeastern Alberta). These studies are linked tightly with ongoing activities such as data base and computing support, information sales, assessment report reviews, and external relations. Selection of the areas was made in consultation with government departments and agencies, and with industry.

HEAVY OIL, OIL SANDS, AND BIRCH MOUNTAINS AREA

Introduction

The National Task Force on Oil Sands Development projected accelerated development of Alberta's oil sands resources, most of which are located in the northeastern part of the province. The projection is based on reduced mining costs, the new Steam Assisted Gravity Drainage (SAGD) technology, and the introduction of a generic royalty system. Industry activity in the area is on the increase. With increased development, there is an increased demand for groundwater for steam generation, and for construction materials such as sand and gravel. Also, the oil sands operations produce large quantities of residual water which have to be stored in tailings ponds or be disposed of by deep injection, even if partially recycled. The choice of plant site and design of in situ processes require a thorough understanding of the factors controlling geological reservoir characteristics, as well as knowledge of the distribution of formation water and groundwater zones, to avoid losing steam pressure to these zones. Significant environmental concerns need to be addressed.

The oil sands not only represent a vast resource of bitumen, but also have the potential for co-product minerals such as titanium, zirconium, vanadium, nickel, aluminum, gold and rare earth elements. In addition, gold occurrences have been reported in drill core from Devonian carbonates in the Fort MacKay area, Cretaceous oil sands from the Firebag River area, and Cretaceous shales from the Birch Mountains. Gold also occurs in river sediment from the Athabasca, Clearwater, and McIvor Rivers of northeastern Alberta.

AGS projects in northeastern Alberta on Quaternary geology and stratigraphy, hydrogeology, and aggregate and other industrial minerals are designed to help address requirements for groundwater supply, residual water disposal, construction materials, limestone for sulphur dioxide scrubbing, steam loss avoidance, and environmental impact mitigation. A project on reservoir characterization has started to help support plant siting and in situ process design. A study of the complexities of the geological structure of the oil sands and surrounding area provides a context for the determination of metallic mineral and diamond potential, and also for SAGD applicability studies. The Quaternary geology project mentioned above also helps determine metallic mineral and diamond potential. The results of all these studies will be combined with cultural, topographic, hydrographic, environmental, first nations land claims and other information in a Geographic Information System (GIS) through a land use compilation mapping project. The GIS allows spatial analysis and modelling to identify potential land use conflicts, and provides comprehensive information to decision makers.

Progress In 1996

A report "The Diamond Potential of Alberta" was released and well received with a lot of media interest. A draft bi-lateral agreement between AGS and GSC-Calgary was prepared and the Cooperation Committee has started work on joint planning. AGS received a Special Award of Merit by the NW Mining

Association at its Annual Meeting, Spokane in December.

Six hundred and seventy-eight pieces of information on mineral aggregate deposits were gathered and digitized. A draft map showing the potential deposits, prospective sites, and dispositions was prepared and used in the field to evaluate the soundness of the existing data and establish parameters for mapping next year. Some primary producers and managers were identified and contacted in the region and a survey of mineral aggregate producers and lease holders was prepared and mailed. Information on 14 commodities in the study area was extracted from the AGS data base.

Digital data were compiled and integrated on the mapping system for the reservoir characterization of the Athabasca oil sands project. Outcrops in the study area were documented on video tapes as well as detailed photos taken during field trips, and detailed cross-sections were constructed. A reservoir characterization computer program was developed to study reservoir heterogeneity using log analyses. As a result of a better understanding of the bedrock geology, the Geological Map of Alberta has been correspondingly modified.

Literature compilation was completed on the Quaternary geology and stratigraphy of the Athabasca Oil Sands. A series of maps were produced in GIS format showing distribution of data types and a base map was prepared. During a reconnaissance field survey, samples were collected and lab analyses are underway. Preliminary maps were prepared of Quaternary sections and sample locations.

Collection and assimilation of existing hydrogeology information and data of the Athabasca Oil Sands study area got underway. For the Paleozoic and Mesozoic successions, all picks from petrophysical logs were obtained, and data density and distribution, structure-contour and isopach maps were prepared. All groundwater and geologic information was digitized and an electronic file created, and maps of the distribution of the data were prepared. A new data set of water levels and hydrochemical analysis for a series of existing wells and piezometers was obtained from a private consulting firm. Springs and selected surface waters were sampled and hydraulic test, water level monitoring and hydrochemical sampling were performed on three nests of piezometers and water table wells near the Underground Test Facility.

For the land use compilation mapping project in northeastern Alberta, data, such as base map, digital elevation model, bedrock geology, oil, gas and water well distribution, leases and licences, were gathered and standardized into the GIS data base, Some digital data were provided to other projects and a series of maps based on the available data were produced.The Alberta Lexicon of Stratigraphy was imported into the relational data base.

KAKWA-WAPITI AREA

Introduction

The selected area is equivalent to the proposed Kakwa-Wapiti subregional Integrated Resource Plan. In addition to being a popular recreation destination, there is active coal, petroleum and diamond exploration going on in the region, and a number of requests for protection under the Special Places 2000 program have been made. The metallic mineral potential of this area is not well known. Repeated external requests and comments have identified this area as requiring additional information for land use planning.

Bedrock geology, regional geochemical sampling and stratigraphic mapping, and Quaternary geology studies of the area will develop a framework of the stratigraphy and structural geology, and help establish target areas for exploration. The mineral aggregate and industrial mineral potential of the area will be determined. AGS will develop an approach that maximizes the amount of information which can be obtained from a combination of existing small scale maps, subsurface data, and limited field work, to produce information at the 1:50 000 scale that is most useful for land use planning and resource development.The results of all studies will be combined with other information in a Geographic Information System, and provide important input to provincial land planners.

Progress In 1996

At a sand and gravel workshop in Grande Prairie, a list of producers in the region was obtained and contacts made with forestry and wildlife officers dealing with the mineral aggregate resource on the consequences of its extraction. Three hundred and ninety-eight pieces of information on mineral aggregate deposits were gathered and digitized. A draft map showing the potential deposits and dispositions was prepared and used in the field to evaluate the soundness of existing data and establish parameter for mapping next year. Twenty-two deposits were altered or added. A survey of mineral aggregate producers and lease holders was prepared and mailed. Information on 13 commodities in the study area was extracted from the AGS data base.

Diamond and metallic mineral potential field work in the Kakwa-Wapiti area was completed. Samples were collected and are being analyzed. The samples will evaluate stream sediment diamond indicator minerals, geochemical analysis and rare earth elements. Data have been entered into spread sheets.

Data from GSC geological maps, EUB well information and from industry, were integrated in structural geology system for the bedrock geology study in the Kakwa-Wapiti area. The bedrock was sampled for diamond indicator minerals, and vitrinite reflectance data were gathered.

Existing information on surficial geology and shallow ground water was compiled for the Quaternary geology study of the Kakwa-Wapiti area. The existing surficial geology map has been digitized into ARCINFO and McadContour. Tills are distinguished by their cobble petrology and preliminary information reveals multiple tills in the west along the Narraway River.

For the land use compilation mapping in the Kakwa-Wapiti area, data imported into the GIS data base included base map, digital elevation model, bedrock geology, surficial geology, oil and gas well distribution, water well distribution, petroleum and natural gas leases, natural gas licences, metallic mineral leases, and natural regions and subregions. Field maps and guide for a Kakwa-Wapiti field trip and a listing of reference documents were produced. Data were provided to other projects.

ONGOING ACTIVITIES

Introduction

Work continues on the production of a revised and updated geological map of Alberta. Data bases and data base management systems are being updated as needed and a complete inventory of AGS data holdings (both digital and hard copy) is being developed. The Mineral Core Research Facility (MCRF) continues to receive core that is made available for examination by the private and public sectors. AGS' information dissemination mechanisms will be reviewed, in the context of its transfer to the EUB. The AGS newsletter "Rock Chips" is produced twice a year.

Progress In 1996

In the 1996/97 fiscal year a total of 36 assessment reports valued at $10 722 523 will be released by the AGS to the public. This total includes reports submitted in 1995 and 1996. Reports were indexed in a spreadsheet and a record of their status of completion maintained. Assessment reports were indexed, microfiched, filed in the library and made available for purchase in AGS Information Sales.

The Mineral Core and Rock Sample Research Facility (MCRF) received core from the Mountain Lake kimberlite and four pallets of Greggstone were received as part of a building stone exploration in the Smoky River area. About 20 000 rock samples were identified and sample numbers were recorded in a spreadsheet. The sampling location for 13 000 stored specimens was entered into a GIS. The facility was used by a number of companies.

Revision of the geological map of Alberta continues with new mapping information from EUB, GSC and AGS. Geological boundaries have been revised, a new map legend has been developed and the data were integrated into ARCINFO GIS.

In the general computing support area, AGS staff are working on the completion of linkage with EUB. AGS data bases were updated to keep proper linkages with EUB. A data base management system is in place to provide functional electronic data bases.

Meta data in the Mineral Information System has been updated and loading of data for two projects was completed. The Windows4GL application to browse the Mineral Information System and to build subsets of the data was completed.

The AGS World Wide Web site is:

http://www.energy.gov.ab.ca/ags/ags1/ags.html

Funding for the Geoscience Program remained unchanged in 1996-97 at $2.44 million inclusive of professional and support staff salaries, summer student hiring and field and office operational expenditures. Program delivery was designed to meet priorities identified by a geoscience audit, completed in early 1996.

GEOSCIENCE AUDIT

An evaluation of the provincial geoscience database was undertaken in-house to identify information gaps. In respect to the northern and industrial minerals sectors, multiyear programs designed to address some of these gaps, were referred to the Saskatchewan Mining Association for discussion. On this basis a questionnaire was developed to poll the broader industry and set priorities, immediately for 1996-97 activities and also for subsequent years. The polling showed, in addition, the need for the government to develop techniques for mineral assessment to meet increasing pressure for identification of protected lands for biodiversity. Staff has been hired to develop methodology and work with the mineral industry in addressing this need Also identified was an increasing demand for digital products, although not at this stage as a wholesale replacement of traditional outputs.

PRECAMBRIAN GEOLOGY

A new mapping program involving two field parties was initiated in the northern La Ronge Domain with the objective of completing within 5 years, 1: 20 000-scale coverage of this Early Proterozoic greenstone belt to the Manitoba-Saskatchewan border. Field parties were also active in the Wollaston Domain, evaluating stratigraphic controls of sediment hosted copper and lead-zinc mineralization, and in the Kisseynew Domain evaluating VMS potential in high metamorphic grade extensions of the Flin Flon greenstone belt. A study of a metasediment-hosted gold occurrence in the southeastern La Ronge Domain was also undertaken.

INDUSTRIAL MINERALS

Regional sampling for diamond indicator minerals was completed in the Precambrian Shield region in partnership with Monopros Ltd. Work continued on a compilation of the clay digital database incorporating, deposit descriptions, ceramic test results, and chemical data obtained from sources dating to the early 1900s. A GSC-SGS-industry consortium completed aeromagnetic coverage of the province with a high-resolution magnetic gradiometer survey in the Swift Current area. The survey will be of interest for both diamond and oil and gas exploration.

PETROLEUM GEOLOGY

Three subsurface projects were ongoing, respectively on the Cretaceous Medicine Hat Sand, on the Silurian Interlake Formation, and on the production of a series of digital 1:2 000 000-scale stratigraphic structure/isopach maps covering the Phanerozoic.

Oil exploration activity remained high as a result of continuing emphasis on horizontal drilling, but also because of new deep drilling plays. Accordingly, there was high demand placed on the Petroleum Geology Sector, Subsurface Laboratory and Geodata Branch for core and sample examinations, for well information, and for processing of industry submitted drill cuttings and well log data.

COMPUTERIZATION

The survey continues to develop a range of digital products. All current preliminary Precambrian bedrock maps are produced using FieldLog and AutoCAD and printed in house on digital bases provided by SaskGeomatics. Compilation Quaternary and bedrock geology maps of the province at 1:1 000 000-scale are anticipated for release in 1997. Digital maps of assessment work areas and of mineral claims have been compiled using IRMIS-GIS software and will be available for release, when price negotiations for the digital geographic bases are completed with SaskGeomatics.

An Internet home page for the department has been established at:

www.gov.sk.ca/enermine

The site contains general information on Saskatchewan's mineral resources through a series of fact sheets. The department posts lapse lists and other regulatory information on the net at the same time as posted in claims offices. The Mineral Deposits Index can also be sorted on line. Use of the web page has averaged 300 visits per month since opening. We are in the process of adding databases on assessment work, claim ownership, and publications.

OPEN HOUSE 1996

The Open House was held in Saskatoon on November 19 and 20, in conjunction with the two day,

MinExpo'96 Symposium on November 21 and 22 organized by the Saskatchewan Geological Society. The Open House featured presentations and posters by the Saskatchewan Geological Survey, the Geological Survey of Canada, the Universities of Saskatchewan and Regina, the Saskatchewan Research Council, and by the mineral exploration industry. A public lecture entitled "Target Earth" was delivered by Dr. Richard Grieve of the Geological Survey of Canada. The Symposium focused on Saskatchewan Precambrian and mineral deposit geology with sessions on advances in Trans-Hudson geology and on gold and uranium deposits. Particularly well received was the uranium geology session, a topic absent from conference agendas for over a decade and a subject of renewed interest as uranium markets improve. Some 270 registrants attended the Open House and some 195 registrants the MinExpo'96 Symposium. A school program at the MinExpo'96 Symposium, featuring the Canadian Museum of Nature's display "From Crystals to Gems", Dinosaur remains from the Eastend Fossil Research Station, Earthquake and Volcano displays from the University of Saskatchewan, and a video theatre was visited by some 500 students from Saskatoon schools during the two day Symposium.

NATIONAL GEOSCIENCE ACCORD

Saskatchewan has signed the national Geoscience Accord defining the relative roles of the Geological Survey of Canada and the Saskatchewan Survey. The Accord enables a Bilateral Agreement to be negotiated which will establish roles for the two Surveys and planning and consultation processes with our clients.

Saskatchewan's signature was with some reluctance due to concerns about the low activity level of the Geological Survey of Canada.

SURVEY REORGANIZATION

This year has been a year of change with staff. Long term members of the department, Bob Macdonald and Paul Guliov have or are about to retire, other staff have taken jobs in industry. This has allowed the department to continue reorganizing. The number of branches will drop from six to four. The organization will consist of a Geological Survey, a Petroleum Division, Mining Lands, and Support Services. Five new permanent staff have been hired for positions in mineral assessment, Precambrian bedrock mapping, resident geologists' office, and industrial minerals.

SASKATCHEWAN RESEARCH COUNCIL

The Saskatchewan Research Council undertook a corporate restructuring in 1996 designed to reflect the Council's new place in the market. Geological activities previously undertaken by the Resources Division were allocated to two Branches, Mineral Exploration and Environment, the former incorporating Precambrian mineral deposit research activities and the Geoanalytical Services Laboratory and the latter Quaternary geology, groundwater and geoenvironmental studies.

Research activities were conducted to assist in the exploration, development and protection of the province's resources. One resource of particular importance, uranium, was the primary focus of the mineral deposit research effort, both in terms of identifying the best area for uranium exploration and in building a model that will assist in deposit discovery. Monitoring of groundwater aquifers near potash mines and working on the development of decommissioning plans to eliminate environmental problems was a high priority for the Environment Branch which also undertook Quaternary drift prospecting investigations.

The geoanalytical laboratory provides support to exploration companies in analyzing for uranium, gold and diamonds. Technology for diamond sampling processing was upgraded during the year along with the spectrum and quality of analytical services available.

EXPLORATION AND DEVELOPMENT

Surface mineral exploration expenditures are estimated at $33 million in 1996, an increase of $4.5 million or 16 percent over the 1995 figure. Although grassroots uranium exploration expenditures will increase by 20 percent this year, they will still be dwarfed by those for underground exploration and development. Expenditures related to the Cigar Lake and McArthur River properties alone are four times the exploration figure. In addition, construction of the McClean Lake mine/mill and new production developments at Cluff Lake are projected to add a further $144 million to uranium activity in 1996. Expenditures on gold and base metals exploration remain low.

The Komis gold mine will reach full production by year end, however, the Goldfields gold deposits and the Konuto Lake copper deposit developments are on hold.

Diamond exploration expenditures will increase as drilling and sampling of the Fort-a-la-Corne

and Candle Lake diamondiferous kimberlites continues. There is currently high interest in evaluating silica sands of the Cretaceous Manville Formation and Ordovician Winnipeg Formation for "frac sand", high tech, and other applications.

Uranium production in 1996 is projected to be some 15% higher than in 1995 at around 11 00 t U and gold production could exceed 100 00 oz.

Potash production and sales are anticipated to be down somewhat from record values established in 1995 at 7.925 Mt K_2O equivalent and $1.219 billion. Demand for sodium sulphate is high and rising in response to the need for detergent grade product in developing nations. Markets for potassium sulphate are also expanding.

High levels of oil and gas production and exploration continue, reflecting the application of horizontal drilling techniques which lead to higher production and lower cost in exploiting existing pools. A recent discovery of a substantial oil pool in Ordovician Red River strata has stimulated much neglected deep drilling programs in Saskatchewan. An additional stimulus for deep exploration will be provided by new legislation - Deep Rights Reversion

Regulations - which will take effect in 1998. Companies producing from upper level strata will be required to explore lower levels, or forfeit the mineral rights to the deeper strata to the government for potential resale. There is also increased exploration activity in west central Saskatchewan, in the area of the Primrose Lake Weapons Range, where prospects for shallow gas from Cretaceous formations are good.

MANITOBA GEOLOGICAL SERVICES BRANCH HIGHLIGHTS 1996

The Department of Energy and Mines has moved rapidly over the last two years to introduce a broad array of new initiatives designed to stimulate increased investment in Manitoba's mineral sector. These have included more favourable taxation policies, an enhanced Mineral Exploration Assistance Program, Prospector assistance, one window permitting procedures and increased funding for geological surveys to build the database that the exploration industry needs to target its efforts. The budget during 1996/97 was expanded to $3.7 million dollars and reporting lines for the Flin Flon and Thompson regional offices were transferred to the Geological Services Branch.

During the winter of 1995/96, the GSB tabled a broad array of programs for review by the Mineral Exploration Liaison Committee (MELC). Feedback was used to expand the range of geological programs mounted by the Branch giving special emphasis to improving geological documentation in the relatively underexplored northern Superior Province. Under the general name Operation Superior, these initiatives included new geological mapping in the Stull-Kistigan region, multi-media geochemical surveys of the greenstone complexes and intervening granitoid terranes (Geological Survey of Canada-GSC), upgrades to the mineral deposits database with special focus on gold mineralization, an intensive evaluation of anorthosite complexes with their attendant potential to contain titanium and vanadium oxide concentrations, and an evaluation of past geophysical surveys. This review included an assessment of the residual mineral potential for selected areas that may become candidates for Endangered Spaces designation. During the Summer, geological mapping was initiated on Edmund and Margaret lakes, the anorthosite investigation sampled and mapped bodies on Cauchon, Hairy, Butterfly and Cuthbert lakes, amongst others, and a new staff geologist assigned to the Thompson Office conducted an initial reconnaissance of gold occurrences in selected areas as a presursor to a more intensive program planned for 1997. A new NATMAP program in the cross border region between Manitoba and Ontario is also being planned for initiation in 1997 and active discussions between the Ontario Geological Survey and the GSC are taking place.

Elsewhere in the province, considerable emphasis was given to concluding the initial five year thrust of geological mapping in the Flin Flon/Snow Lake region in support of base and precious mineral exploration. This Shield Margin federal/provincial National Mapping program has made remarkable advances in improving the geological database and resulted in radical changes to the understanding of this region's mineral potential and how the major concentration of greenstone belts was assembled. This cooperative effort has proved highly productive with a prolific flurry of new reports, technical papers and maps, many of which were released in symposia, poster sessions, short courses and field tours at the joint annual general meeting of the Geological Association of Canada and Mineral Association of Canada in Winnipeg in May. Currently an emphasis is being placed on compiling the results from this program with staged publication of results planned in November 1996, in the Spring of 1997 and CD ROM releases later in 1997.

During the summer, geological projects concluded mapping at Dow/Martell, North Kississing Lake, Webb Lake, and Reed Lake and a cooperative endeavour with HBED at Photo Lake was completed. New mapping commenced in the Lac Aimee/Naosap area. Liaison and field tours took place with numerous prospectors in the region as well as Canmine Resources and Aur Resources. Discussions were held with TVX to lay the foundation for detailed geological mapping, mineral deposit studies and structural work between Squall and Snow lakes in 1997.

With strong encouragement from Senior exploration companies active in the Thompson Nickel Belt (Inco, Falconbridge, Cominco and HBED), a series of discussions and planning sessions have developed a longer term strategic plan for improving geological mapping along the Churchill/Superior Boundary. Over the next three years, emphasis is being given to developing a new 1:50 000 geological map for much of the region between Moak and Gormley lakes using detailed surface mapping, conducted by the GSB, together with subsurface drillhole and geophysical information provided by the companies. A broad array of geochronological, isotopic, structural and petrological investigations is planned that would involve the GSC and Universities, with overall coordination provided potentially through MITEC.

Compilation of drill core from the sub-Paleozoic basement, to upgrade documentation of the Nickel Belt extension in the Ponton region as well as the adjacent Kisseynew gneisses and Snow Lake greenstones in NTS area 63J, continued.

Mapping of Silurian and Ordovician carbonates continued in the Grand Rapids region. Spring water and marl geochemical sampling was concluded and augmented by a regional structural study that compared fractures in the Paleozoic dolostone exposures with those inferred in the underlying basement. South of The Pas Moraine, several new holes were drilled to basement in an area of generally sparse information. Additional holes were drilled in the Stonewall and Garson areas to provide depth to bedrock and other information required to improve resource documentation in the Capital Region area.

In the south of the province, field investigations upgraded the inventory of bentonite occurrences in the Pembina Valley region, and generated new maps for the Capital Region north of latitude 50° as part of a broader strategy to improve land-use decision making in a region of rapid urban expansion.

Field work and compilation activities, focussed on surficial deposits, continued in the southwest and southeast corners of the Province under the federal/provincial Southern Prairies initiative. New GPS elevations were determined for several Lake Agassiz beaches in order to improve the constraints governing the rate of post-glacial rebound. The GSC also conducted geophysical surveys in selected areas to evaluate the ability of new instrumentation to detect and map near-surface irregularities in the carbonate bedrock, including karst channels, structural anomalies on the Precambrian surface and post-Paleozoic faults.

The Geological Survey of Canada completed Phase II of the Lake Winnipeg Survey, adding substantially to the geophysical database initiated in 1994. This year's cruise provided new information from the north and south basins, as well as new lake bottom sediment samples and near-shore profiles that will add significantly to the understanding of shoreline erosion processes.

The new surge of field programs has been supported by rapid increases in the Branch's ability to process the data using new GIS capabilities. Acquisition of an ARC/INFO system in late 1995 followed by subsequent in-house training of key personnel has permitted the Branch to produce a broad array of new digital full colour geological compilation maps in support of the final drive to complete work in the Shield Margin region. This enhanced capability also enabled the Branch to complete four new compilation maps published this year as an integral component of Gold Deposits Of Manitoba released by the Marketing Branch in conjunction with the September MINExpo Convention in Las Vegas.

Work on the 1:1 000 000 Wetlands Map, produced in concert with the University of Alberta and LINNET corporation, is near completion, with release scheduled for early 1997.

Good progress was made in completing reports in the Mineral Deposit Series that cover the exposed and Shield marginal sectors of the Churchill Province. Compilation of information was initiated for parts of the Superior Province as a backdrop to field programs planned for 1997.

Eight of the eleven field guidebooks published as part of the GAC/MAC technical program were authored or co-authored by GSB staff.

The ongoing Bedrock Geology Compilation program has brought the Cross Lake (NTS 63I) compilation to completion. Work is continuing on the Norway House (NTS 63H) and Selkirk (NTS 62I) sheets. A digital GIS-based 1:500 000 scale compilation of the northern Superior has been added to the program in support of Operation Superior programming.

A new Intergovernmental Geoscience Accord governing the future roles and relationships of the federal and provincial survey organizations was signed at the Mines Ministers Conference in Yellowknife, September 17th. This and Bilateral Accords between the GSC and each of the provinces will replace the coordinating mechanisms that guided geological programming in Canada under the recently demised Mineral Development Agreements. Discussions toward developing a new strategic plan for coordinated geological programming in Manitoba, together with industry input channeled through the Mineral Exploration Liaison Committee, are well advanced.

Throughout the year Branch staff provided ongoing advice to other agencies and clients on a broad range of mineral-related matters. These included land-use issues, the new Parks' Systems Plan, the Mineral Exploration Assistance Program and Manitoba Hydro's search for new rip-rap at Grand Rapids. The Branch also continues to work closely with the Marketing Branch and the private sector (Arborg Kaolin, Gossan Resources) on matters pertaining to industrial minerals, such as peat, potash and ilmenite.

Field tours of recently mapped mineral deposits were given for various companies and prospectors, and new geochemical sampling procedures were demonstrated in the Osborne Lake and Lynn Lake regions, the latter to assist Black Hawk (Granduc) Mining.

As an adjunct to its main programs, Branch staff also devoted time to investigating the potential for new mineral deposit types. Samples of black shales from Precambrian and more recent settings were collected, and carbonate exposures in the Mafeking area were investigated with staff of the GSC familiar with Prairie Gold type mineralization, recently recognized in Alberta.

The Regional Offices at Flin Flon and Thompson continued to be active, by conducting geological mapping programs, mineral deposit investigations, and property evaluations, as well as responding to enquiries and requests from local explorationists. Staff at Thompson have been especially active in developing a new strategic plan for survey work in that region, a task that has entailed in-depth discussions with industry explorationists as well as the GSC and university researchers in various parts of Canada. The Flin Flon Office continued to provide claim status, registration and consultative and advisory services to the mining and mineral exploration industries. The library of publications available for research continues to be expanded and the claim status service has been upgraded with the installation of the LINNET Geomatics Windows 95-based Claims Enquiry program in a dedicated PC to replace the old UNIX-based terminal and system. At the Centennial site, the new heated drill core examination facility and unheated short-term core storage area that also houses a diamond saw, were completed matching services provided at Thompson. The regional geologist at The Pas moved to Flin Flon to replace one staff person who resigned early in the year.

The GSC and coworkers from the universities of Regina and Saskatchewan and the GSB continued work on the interpretation of seismic profiles across the Thompson Nickel Belt conducted in 1994 under the LITHOPROBE Trans Hudson Orogen Transect initiative. New insights into the three dimensional geometry of the Churchill/Superior boundary zone and the age and structural relationships of the major crustal elements under this region, from the Superior Craton to the neighbouring juvenile components of the Hudsonian Orogen, are being developed.

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

INTRODUCTION

Reorganization and budget constraints during the 1995-96 fiscal year severely affected the Mines and Minerals Division, Ministry of Northern Development and Mines and resulted in staffing level adjustments. Those more obvious changes included the elimination of all Director positions and the creation of seven program units, each with a Senior Manager who reports directly to the Assistant Deputy Minister. The Mines and Minerals Division program units consist of:

- Mining Lands Section;
- Mines Group;
- Sedimentary Geoscience Section (OGS-SGS);
- Precambrian Geoscience Section (OGS-PGS);
- Resident Geologist's Section (OGS-RGS);
- Information Services Section; and
- Data Services Section.

The program units are focused on delivering core business functions, augmented by partnerships with private sector. The geoscience program in the Ontario government is now delivered through:

- Sedimentary Geoscience Section;
- Precambrian Geoscience Section;
- Resident Geologist's Section;
- Part of the Information Services Section (namely, Publications Services); and
- Data Services Section.

While the Ontario Mineral Incentive Program (OMIP) was terminated, the Ontario Prospectors Assistance program (OPAP), administered by the Mines Group, continues to support economic development in Ontario during 1995-1996.

Mineral exploration activities in Ontario in 1996 continued to accelerate. Expenditures for general and mine site exploration in 1996 are estimated at $159 million compared to actual expenditures of $136 million in 1995 and $113 million in 1994. Total expenditures for both mineral exploration and mine site development are forecast to be $373 million in 1996, comparable to 1995 preliminary figures. This represents a 12% increase over 1994 expenditures of $333 million.

Several advanced exploration projects are ongoing, including: the Victor Deposit of Inco; the Victoria Creek project of Sudbury Contact Mines Ltd. and Agnico-Eagle Mines Ltd.; the Montcalm nickel deposit of Outokumpu Mines Ltd.; and the Armistice gold mine of Armistice Resources Ltd.

Announced capital expenditures for mine development and mine expansion projects between 1996 and 1999 are approximately $800 million and include: Falconbridge Ltd. put their Lockerby Mine into production in December 1995; Hemlo Gold Mines Inc. and Teddy Bear Valley Mines Ltd. put their Holloway gold mine into production in 1996; Madsen Gold Corp. reopened the Madsen Mine in 1996; Inco Ltd. has planned to put their McCreedy East mine into production late in 1996, with full production scheduled for 1999; Royal Oak Mines Ltd. put their Nighthawk Lake gold mine into production during 1996; Placer Dome and 32% joint venture partner TVX Gold announced that production will begin at their Musselwhite gold property in early 1997; Placer Dome also plans to have the Paymaster gold mine, located in the Timmins camp, in production by the end of 1996. Kinross Gold Corp. is expanding shaft and mill facilities at their Hoyle Pond Mine near Timmins; and Inmet Mining Corp. is developing the Pic Lake base metal deposit from the existing Winston Lake Mine, north of Schrieber. These are but a selection of ongoing activities.

BUDGET

The 1995-96 budget for the Sedimentary Geoscience Section, Precambrian Geoscience Section, Resident Geologist's Section, and related services (Data Services Section and Publications Services) was approximately $12,805.50. The allocated budget supporting only the minerals-related activities for 1996-1997 is $11,112.20. External to the base operating budget of the OGS are two programs - Northern Ontario Development Agreement (NODA- $2.34 million) and Ontario Prospectors Assistance program (OPAP- $2.0 million).

GEOSCIENCE PROGRAM

The geoscience functions focus on the provision of basic geological information gathering and interpretation in support of exploration in Ontario. Field mapping conducted by head office staff focused

on the following areas: 1) Abitibi Subprovince (Abitibi greenstone belt); 2) Wawa Subprovince (Hemlo greenstone belt in cooperation with researchers sponsored by CAMIRO (formerly MITEC)); 3) Wabigoon Subprovince (Central Wabigoon area, Onaman - Tashota greenstone belt, western Wabigoon greenstone belt); 4) Sachigo Subprovince (Stull Lake area); 5) Paleozoic rocks of south-central Ontario; and 6) aggregate mapping of southern and northeastern Ontario. The western part of the Superior Province within Ontario is under investigation in conjunction with Lithoprobe-sponsored university and GSC researchers. A planned culmination of the bedrock investigations in the Abitibi greenstone belt is the construction of 100 000-scale geological bedrock map collaboratively by the Ministere des Ressources Naturelles, Gouvernment du Quebec and the OGS. In addition, plans are maturing for a collaborative study of northwestern Ontario involving Manitoba Geological Survey, Geological Survey of Canada and the OGS under the auspices of NATMAP.

ECONOMIC DEVELOPMENT

The focus of the Precambrian Geoscience, Sedimentary Geoscience and Resident Geologist sections is on providing support to the minerals sector. During the summer, a significant rare metal pegmatite discovery led to the rapid release of an Open File Report that described the discovery north of Kenora. The new pegmatite field in Ontario appears to be an extension of the Cat Lake-Winnipeg River pegmatite field in eastern Manitoba which contains the world-class Bernic Lake pegmatite. This release stimulated staking, negotiations between the property holder and possible partners, and the likely commitment of significant exploration funds.

The release of two Open File Reports also spurred exploration activity in the Peterlong-Radisson lakes area, south of Timmins. The reports, one on gold in till and the other on the geochemistry of lake sediment, lake water and glacial sediments, identified areas of potential mineralization that had not previously been explored in detail.

The results of surficial sampling and Quaternary mapping continued to attract exploration investment to the Wawa area. Kimberlite indicator minerals recovered from alluvial sediments encouraged work in the area and led to the discovery of diamond-bearing dikes.

In September 1996, the first set of reprocessed airborne magnetic and electromagnetic geophysical that had been collected by the OGS over the last 15 years were released. As a result of the reprocessing to modern standards, many hithertofore unrecognized magnetic and electromagnetic anomalies have been identified. These important and affordable data sets form the basis for the next generation of exploration and investment in Ontario.

The 1996 field season had eight geologists doing regional bedrock mapping, including bedrock compilation, one working on base and precious metal projects in conjunction with regional bedrock mapping, one working on kimberlites, three doing surficial geology mapping, two doing surficial geochemistry surveys, and two working on aggregate inventories. Other Head Office geologists are completing maps and reports for multi-year projects. All projects have support of mineral exploration as the primary focus. The resident geologists continue to focus on the mineral exploration clients by providing expert knowledge and insight on the geology of their regions, linking property owners with prospective partners and providing descriptions to update the popular Mineral Deposit Inventory.

As a result of a partnership involving private sector (Teck Exploration, Falconbridge Ltd., Inco Exploration and Technical Services, Noranda Limited, and Outokumpu Mines Limited), the Geological Survey of Canada, and the Precambrian Geoscience Section of the OGS, a study by Dr. T. Barrie is being sponsored in the Abitibi greenstone belt in Ontario. This study involves bedrock mapping, compilation and geochemical investigation of nickel and copper-zinc-bearing rocks. The project is integrated with the ongoing OGS projects in the Abitibi and will provide a better understanding of the setting in which known komatiite-hosted and VMS mineralization occurs.

RESOURCE MANAGEMENT AND PUBLIC INFORMATION/EDUCATION

The Resident Geologist Program is providing a greater focus on in-field consultative services and stewardship of databases (*e.g.*, Mineral Deposit Inventory-MDI) and assessment files. Much time has historically been invested by the staff of the Resident Geologist Program to minimize the alienation of land in Ontario and to maximize land available for exploration. As a result of refocusing on to core functions, fewer OGS services are devoted to doing Mineral Resource Appraisals (MRA).

Public education no longer forms a core component of OGS services. Therefore, the public education and prospector courses traditionally offered by the resident geologists are being eliminated to ensure core services to the mineral exploration clients are preserved. The Survey's Aboriginal Geologist Pro-

gram continues to serve the First Nation communities in northern Ontario by providing background information on exploration, mining, and associated issues.

ENVIRONMENTAL APPLICATIONS

Previous work and investigations by the OGS formed the basis of numerous private sector and government environmental studies. As a result, staff of the Sedimentary Geoscience and Resident Geologist programs responded to a variety of requests for geoscience information that was used to address environmental problems. Given the narrowing of the Survey's mandate, future environmental studies by the OGS will be restricted to providing a basis for mineral development leading to economic growth in Ontario.

INFORMATION SERVICES SECTION

Publication Services Section

A total of 71 geoscience publications, 25 digital data sets, and 1 index publication were released during the 1996 calendar year.

The transition to electronic distribution and print-on-demand was the subject of considerable interest at the Annual meeting of the Association of Earth Science Editors, hosted by the Ministry in September. Many American geological surveys are only starting to look at options to address cuts in publishing budgets and wanted to learn from our experiences, both good and bad.

Electronic distribution of the complete publication release on CD-ROM has been delayed until mid-1977 due to problems in the selection of suitable viewing software. We moved to a fully electronic system for notification of publication releases in January 1997, to coincide with the launch of the Ministry's World Wide Web site.

Data Services Section

Full operations were in course at the four ERLIS sites thus providing on-line search and access to assessment files, summary records of mineral deposits, Geology of Ontario Maps, and the newly integrated drill-hole and geochemical analyses databases.

A more functional and expanded Mineral Occurrences Database was implemented to include records from the precursor Mineral Deposits Index. A microcomputer application is used in the regional offices for data capture, local searches and to up-load new records to the province wide ERLIS facilities.

A first batch of 10 reprocessed and re-mastered aeromagnetic and electromagnetic surveys was issued in September along with viewing and import/export facilities to popular industry data formats. These and other digital data releases have become items of increased demand.

Finally, the Automated Claim Maps application for digital recording and display of claim maps was successfully completed for the Sudbury Mining Division. Province wide implementation is in the planning stage.

GEOSCIENCE LABORATORIES

Provision of analytical services for the Mines and Minerals Division has remained the core of the Laboratories' activities, although recent new initiatives are providing analytical services to a variety of Ontario universities, research organizations and private industry, both within Canada and overseas. At the core of the operational program has been the development of new analytical methods, and the ongoing refinement and improvement of the higher volume existing methods.

The new methods under development were dominantly multi-element methods that focused on analytical requirements or methodologies for specific sample types. These methods included validation of a protocol for Hg quantification at the low-ppt to low-ppb and ppm levels for waters, sediments and rocks. New methods for analysis of aqua regia extracts and total digests of sediments and tills were developed, with analysis of between 50 and 60 elements using a combination of ICP-AES and ICP-MS. New protocols for both the electron microprobe (EMA) and the scanning electron microscope (SEM) were developed, including the implementation of a combined energy dispersive (EDS) - wavelength dispersive (WDS) package on the microprobe and development of an EDS analytical protocol for elemental quantification of polished sections on the SEM. Also developed were techniques for quantification of phase-distribution analysis based on chemical composition as determined by EDS, with successful applications to complex samples containing sulphides (pyrite, chalcopyrite, pentlandite, pyrrhotite), oxides (magnetite, ilmenite, Mg-Al spinels) and silicates (albite, chlorite). Continued progress was made with the quantitative modal analysis using Rietveld analysis by x-ray diffraction (XRD). A major thrust of the Laboratories' quality assurance program has been the completion of the documentation suitable for ISO Guide 25 accreditation.

The co-operative program initiated last year between Laurentian University and the Laboratories has continued. No fewer than five M.Sc. students in departments ranging from Geology to Biology and Chemistry, as well as Ph.D. graduates in Geology, are currently working on research projects using data obtained from the Laboratories' instruments. Collaborations also exist with Canadian Network of Toxicology, the Universities of Guelph, Saskatoon, Montreal and Laval, as well as Health Canada.

MINISTÈRE DES RESSOURCES NATURELLES
GOUVERNEMENT DU QUÉBEC
SECTEUR DES MINES

LA DIRECTION DE LA GÉOLOGIE

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

Dans ce contexte, la Direction de la géologie est l'unité administrative du MRN responsable de l'acquisition, du traitement et de la diffusion de connaissances géoscientifiques nécessaires à l'établissement et à la promotion du potentiel minéral du Québec, informations indispensables au bon fonctionnement de l'exploration minérale au Québec. La Direction de la géologie du Secteur des mines du MRN regroupe l'ensemble des processus liés à la livraison du programme 04-01 Exploration du MRN.

La Direction de la géologie compte, en 1996-1997, 115 employé(e)s permanent(e)s dont 52 géologues en plus du personnel de soutien et d'encadrement. Ce personnel est présent au bureau central de Québec (69), ainsi que dans 7 bureaux régionaux : Montréal (6), Sherbrooke (4), Sainte-Anne-des-Monts (3), Sept-Îles (3), Rouyn-Noranda (6), Val-d'Or (17) et Chibougamau (7).

Afin de mieux livrer ses produits et services liés à l'acquisition et la diffusion des connaissances géoscientifiques à sa clientèle de l'exploration minérale, la Direction de la géologie a développé depuis 1992 et est en voie de terminer l'implantation, au coût de 17 M$, d'un système d'information à référence spatiale appelé SIGÉOM.

Au cours de la même période, la Direction de la géologie a revu sa mission et a entièrement révisé ses processus, ce qui lui permet aujourd'hui de livrer des P/S de qualité à sa clientèle tout en assurant un maximum d'efficience et d'efficacité, le tout en conformité avec les orientations stratégiques du MRN.

Sur une base annuelle, le personnel de la Direction réalise plus de 50 projets allant du levé géologique de territoires nouveaux, en passant par diverses compilations (ex. : données sur les forages), à la production de cartes d'évaluation du potentiel minéral. Toutes ces informations sont rendues disponibles à la clientèle de l'exploration minérale sous forme numérique ou sous format papier.

Mission et objectifs

La mission de la Direction de la géologie est d'acquérir, traiter et diffuser des connaissances géoscientifiques sur les ressources minérales du Québec dans le but d'évaluer et de promouvoir le potentiel minéral des régions dans une perspective de développement durable.

Cette mission est réalisée en acquérant et en rendant disponibles auprès des intervenants en exploration minérale :

- une information géoscientifique intégrée, accessible et de qualité ;
- une expertise technique en matière de connaissances géoscientifiques.

De plus, la Direction de la géologie peut fournir une assistance financière à la prospection et à l'exploration dans le cadre de programmes spéciaux.

Cette mission est accomplie avec le souci constant de satisfaire les besoins de sa clientèle et de développer l'expertise du personnel.

La mission situe les orientations à long terme de la Direction. Cependant, compte tenu de certains éléments de l'environnement externe, notamment la décroissance des investissements en exploration, la mondialisation de l'exploration, la diminution des réserves minérales et l'évolution des connaissances, la Direction s'est fixé une cible qui devrait contribuer à la relance de l'exploration minérale et au renouvellement des réserves actuelles.

Cette cible est d'améliorer la connaissance géoscientifique du territoire afin de fournir à l'industrie de l'exploration minérale une connaissance suffisante des contextes géologiques susceptibles de contenir une ou des substances exploitables.

SOMMAIRE DES ACTIVITÉS 1996-1997

L'année 1996-1997 a été marquée par la continuité dans nos actions visant à livrer à nos clientèles les produits et services demandés dans les meilleurs délais possibles.

Rapports d'inventaires géoscientifiques

Ainsi, 5 921 000 $ ont été consacrés à la réalisation de 22 nouvelles cartes géologiques dont 20 à l'échelle de 1:50 000 et 2 à l'échelle de 1:250 000. La majorité de ces cartes ont été produites dans le cadre du programme d'exploration minière du Moyen-Nord et toutes étaient disponibles à la clientèle dès le séminaire d'information de la fin novembre, soit trois mois après la fin des travaux de terrain. C'est dans le cadre de l'un de ces levés qu'a été découvert, au nord de Sept-Îles, l'indice de sulfures massifs (Cu-Ni-Co) du lac Volant qui a suscité tant d'intérêt. Le MRN a aussi entrepris un vaste levé électromagnétique héliporté couvrant 4 000 km^2 autour de l'indice afin de faciliter le travail des nombreuses compagnies d'exploration qui s'intéressent maintenant à cette région.

Compilations géominières

Nous avons continué au cours de l'année, le chargement des données de forages, des localisations de travaux et des indices minéralisés dans le SIGÉOM. Nous prévoyons terminer la numérisation des forages dès l'an prochain. Nous aurons alors avoir grandement progressé dans la numérisation des autres données de compilation.

Service à la clientèle

La réorganisation administrative de la Direction de la géologie a mené à la création d'un service à la clientèle regroupant les géologues résidents et le personnel dédié aux services au comptoir de nos sept bureaux régionaux. Ce changement permettra d'offrir un service encore mieux adapté aux besoins des clients régionaux.

Études géoscientifiques

Les études géoscientifiques regroupent diverses activités liées aux domaines de la cartographie, de la gîtologie et des minéraux industriels. En ce qui concerne les minéraux industriels, nous avons continué d'inventorier et de caractériser l'ensemble des exploitations du Québec, tandis qu'en gîtologie, l'étude du gisement Louvicourt situé à Val-d'Or s'est poursuivie. Le projet d'étude structurale et stratigraphique de la Formation de Val-d'Or s'est continué en collaboration avec les principaux intervenants miniers du secteur. À la Baie James, le projet de synthèse métallogénique s'est aussi poursuivi.

Assistance financière

Au cours de la dernière année, le MRN a consacré 5 744 400 $ à l'assistance financière à la prospection et l'exploration. Dans le cadre du programme d'exploration du Moyen-Nord près de 2 100 000 $ ont été accordés à des compagnies pour y mener des travaux d'exploration. Ailleurs au Québec, 3 M$ ont été accordés aux compagnies, aux fonds miniers régionaux et aux prospecteurs.

Autres faits saillants

La découverte par les géologues du MRN d'un important indice de Cu-Ni-Co au lac Volant près de Sept-Îles demeure l'événement marquant de l'année. Déjà, plus de 10 000 claims ont été jalonnés dans le secteur et on estime à près de 6 M$ les dépenses d'exploration réalisées dans les mois qui ont suivi la découverte.

Le développement du SIGÉOM est presque complété. Le système est entièrement opérationnel à Québec ainsi que dans nos principaux bureaux régionaux. Nous avons déjà entrepris la migration du SIGÉOM sur Windows NT ainsi que le développement d'un système-expert pour l'évaluation du potentiel minéral.

Au point de vue administratif, les démarches visant à faire de la Direction de la géologie une unité autonome de service dès le 1er avril 1997 vont bon train.

NEW BRUNSWICK
DEPARTMENT OF NATURAL RESOURCES AND ENERGY
MINERALS AND ENERGY DIVISION
GEOLOGICAL SURVEYS BRANCH

INTRODUCTION

The Geological Surveys Branch (NBGSB) is the main agency delivering geoscience programs in New Brunswick. It is the oldest organization of its type in Canada, dating from the appointment of Abraham Gesner as Provincial Geologist in 1838. Major concerns at that time included documentation and assessment of mineral resources within the Province's boundaries, and the promotion of investment in New Brunswick's mining industry. The industry itself, however, is much older; coal was mined in the Minto field and shipped to Boston in 1639. New Brunswick's mining industry of today is a significant factor in the Province's economy and, if it is to be sustained into the twenty-first century, more ore reserves must be found. It is to this end that, in 1993, the Province adopted a new Mineral Policy that emphasizes geoscience programs in the Bathurst mining camp (Figure 1).

GEOSCIENCE PROGRAMS

In 1993, the NBGSB signed a memorandum of agreement with the Geological Survey of Canada in order to meet the Province's geoscience needs.

In 1994, the five-year EXTECH-II program was lauched for the Bathurst mining camp. This cooperative program, which entails a total expenditure of $6 800 000, involves twenty-eight geoscientists from the Geological Survey of Canada led by Wayne Goodfellow, and nine from the NBGSB under the coordination of Stephen McCutcheon. John Langton, Reginald Wilson, and Susan Gower make up the Provincial bedrock mappers (1:20 000 scale mapping); Michael Parkhill is the surficial geology mapper; David Lentz and James Walker are the mineral deposit experts; and Rao Irrinki and Paul Rennick are responsible for the digital data bases and their management. A special session reporting some of the results of EXTECH-II will be included in the 1997 Geological Association of Canada meeting in Ottawa.

The results of a multi-parameter helicopter geophysical survey (Figure 1) released in August 1996 generated a claim-staking flurry in the Bathurst camp that, when added to the staking throughout the preceding 18 months, brought the total number of new claims staked to nearly 5000. Based on an average annual expenditure of $680 for each claim, an increase of $3 400 000 in exploration expenditures can be attributed to the airborne survey. Frank Kiss of the Geological Survey of Canada and Rao Irrinki of NBGSB worked tirelessly to ensure the integrity of the data and the timely release of the maps.

In southeastern New Brunswick, Susan Johnson, Malcolm McLeod (both of NBGSB), and Clint St. Peter (Energy Branch) completed field work for the NATMAP Magdalen Basin project (Figure 1). A final report is in preparation.

Sandra Barr (Acadia University) continued her 1:20 000 scale geological mapping of the Queen Brook and New River belts (Figure 1) and Les Fyffe resolved several structural and stratigraphic problems that will lead to a revision of the geology of the Rollingdam (NTS 21 G/6) map area (Figure 1).

Surficial geology and till geochemistry mapping by Allen Seaman and Toon Pronk continued in the Millville (NTS 21 J/3 East) and Sussex (NTS 21 H/12) map areas of southern New Brunswick (Figure 1).

Emphasis on drill-core management shifted to the Sussex repository (Figure 1) in 1996 despite uncertainties regarding the future of the regional office. Under the supervision of Greg Crouse, storage racks were constructed to house several thousand metres of core.

Following the conclusion of the the Canada–New Brunswick Cooperation Agreement on Mineral Development, the geoscience editing staff has been reduced to one person, Barbara Carroll.

New data gathered on the St. Stephen nickel prospect in Charlotte County (Figure 1) confirmed the tenor of 0.05% Co in addition to the previously known nickel and copper content. Several mineralized zones have been outlined in an Early Paleozoic ultramafic pluton that underlies an area of approximately 24 km^2. The three best zones are estimated to contain 706 900 tonnes grading 0.98% Ni and 0.44% Cu. This reserve has been calculated from 27 000 m of shallow drilling.

MINERAL INDUSTRY REVIEW

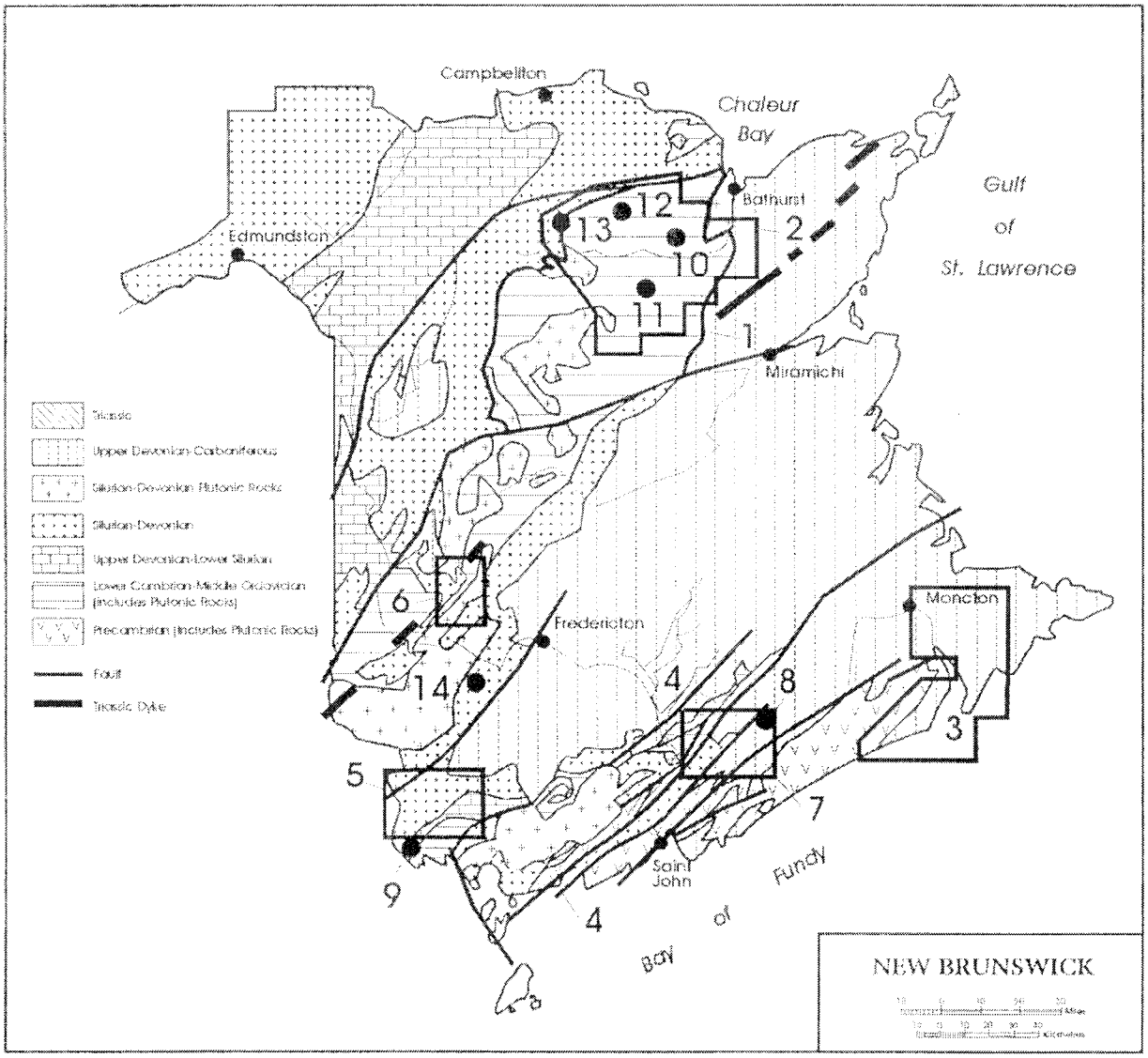
For the first time, the value of New Brunswick's mineral production rose above $1 000 000 000. Roughly 60% of this was derived from zinc, lead, silver, and copper ores mined at the Brunswick No. 12 and Heath Steele mines (Figure 1) both owned by Noranda Mining and Exploration Inc.

Breakwater Resources Ltd. raised $60 000 000 to upgrade the mill capacity at its Caribou mine (Figure 1). Production of 3000 tonnes of zinc–lead ore is expected to begin in 1997. Some of the production will be derived from the Rectigouche deposit (Figure 1), 20 km to the west.

The Lake George antimony mine (Figure 1), owned by APOCAN Inc., re-opened in November of 1996. Reserves are reported to be 600 000 tonnes grading 5.17% Sb.

Figure 1. Geoscience projects and mineral properties in New Brunswick.

1. Bathurst mining camp
2. Multi-parameter helicopter geophysical survey, Bathurst camp
3. NATMAP Magdalen Basin project\
4. Mapping, Queen Brook and New River belts
5. Geological studies, Rollingdam (NTS 21 G/6)
6. Surficial geology and till geochemistry, Millville (NTS 21 J/3 East)
7. Surficial geology and till geochemistry, Sussex=(NTS 21 H/12)
8. Sussex core repository
9. St. Stephen nickel, copper, cobalt
10. Brunswick No. 12 mine
11. Heath Steele mine
12. Caribou mine
13. Restigouche deposit
14. Lake George antimony mine



NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES
MINERAL AND ENERGY RESOURCES DIVISION

The Mineral and Energy Resources Division (MERD) is the geoscientific arm of the Department of Natural Resources. Divisional programs are delivered through three sections, Geological Mapping, Mineral Resource Evaluation, and Geoscience Information Services.

MERD is presently in the process of a major program review and planning process, as part of our commitment to our memorandum of Agreement with the GSC under the Intergovernmental Geoscience Accord. On May 13 and 14, a joint 2 day Needs Workshop was held in Halifax, attended by more than 100 participants, more than 50 of whom were NSDNR/GSC clients. The Clients represented a very broad spectrum of geoscience users from mineral exploration to municipal planners. The workshop was very successful with useful discussions and many ideas presented. A report has been published and forms the basis for program planning, which is now underway.

GEOSCIENCE ACTIVITIES

Geological Mapping

The work of the Geological Mapping Section ranges from reconnaissance to detailed geological mapping of bedrock and surficial materials, including the study of selected geological units at surface and in the subsurface.

Continued detailed mapping of the central Meguma area has produced significant advances in documentation of the stratigraphy, structure and aeromagnetic character of the Meguma Group, which hosts significant gold, lead, zinc and antimony. One of the Meguma Project scientists, Bob Ryan, visited the Victoria gold districts of Australia during 1996 and a comparison of geology, mining methods and economics is in progress.

Surficial mapping of the Hants-Colchester Lowlands near Shubenacadie and Musquodoboit coupled with seismic surveys by the GSC have established the presence of extensive deposits of Cretaceous clay and silica sand in the Musquodoboit and Shubenacadie valleys. This has resulted in a large amount of new staking during 1995 and 1996 and exploration is underway to evaluate and delineate the deposits. NSDNR staff continue to cooperate and provide information and advice to the companies involved in the work.

Mineral Resource Evaluation

The Mineral Resource Evaluation Section provides information specific to the province's mineral deposits and resource appraisal.

Base metal programs are presently in a write-up year. A detailed study of the East Kemptville tin deposit and projects at the Gays River and Walton Zn-Pb deposits in conjunction with Geological Survey of Canada (basal Windsor project) are complete and final reports are in progress. The basal Windsor project will be the subject of a series of papers in a special issue of Economic Geology.

Precious metal programs focussed on the settings of gold in the Meguma Group of eastern Nova Scotia and particularly the potential for large tonnage, low grade deposits in several gold districts in the eastern Meguma terrane. Gold occurs in high grade veins and locally as low grade disseminations in the greywacke country rocks. A number of exploration programs are underway in an attempt to develop economic targets.

Geoscience projects aimed at coal resource evaluation were conducted in a number of areas. As in past years, these projects involved a high degree of collaboration with government and university colleagues locally, nationally and internationally. Regional mapping and detailed mapping and sedimentological studies were carried out in the Cumberland, Debert-Kemptown and Stellarton Basins aimed at regional stratigraphic and structural modelling of the basins, predictive modelling of coalbed methane resources, predictive stratigraphic modelling of coal beds and paleo-ecological research to refine predictive coal exploration models. Detailed mine studies including detailed sedimentology and structural geology of strata overlying the Foord coal seam, western Stellarton Basin, and continuation of detailed sedimentological modelling of strata comprising the roof of the Phalen Colliery, Sydney Basin

The Mineral Inventory Program reached a milestone in 1996 with public release of the database. At present there are approximately 1800 occurrences in the database and a user-friendly, menu-driven run time module has been written in FoxPro® for Win-

dows® version 2.6 that allows easy search and query of the database.

Industrial minerals programs were focussed mainly in southern Nova Scotia. The aggregate program focused primarily on the Annapolis Valley, continuing a three year field study to evaluate and document the aggregate potential in the region. The dimension stone potential of several promising sites in the South Mountain Batholith were evaluated via field investigations and diamond drilling. A study to evaluate the potential of rock dust as fertilizer has been brought to a conclusion. After a year of greenhouse and field trials using basalt, metagraywacke and granite fines, it was concluded that the materials promote plant growth in certain crops.

Geoscience Information Services

The Geoscience Information Section is accountable for the management and delivery of geoscience information and publication services and products, educational programs and prospecting courses, mineral land-use planning, drill core and sample storage facilities and services, and monitoring of mineral exploration activities in Nova Scotia.

GIS development in support of mapping and integrated resource management continued. The public access GIS is ready for release and will be available to the public through a terminal in the Halifax DNR library in late 1996. This is a display and query system for staff and clients to produce hard copy, colour geoscience maps.

The Division maintains an active and productive land-use planning group, an important component in a province where ~75% of the land is privately owned and municipal governments are pervasive and take a keen interest in resource-based development. The land use planning group has been very involved with the Department's production of the province's Mineral Policy, which was released at the Review of Activities in early November. A number of land-use maps have been produced including a preliminary 1:500 000 Land Designation and Ownership Map of Nova Scotia. Work continued on the development of several land-use data layers and associated databases. The data layers that constitute this map have been used in several derived map products as well, such as Land Access for Mineral Exploration in Nova Scotia 1:500 000) and a map depicting Areas Closed to Mining in Nova Scotia.

Helping various audiences understand and appreciate the importance of minerals and mining is the key objective of the education and public awareness group. This objective was met by preparing and delivering a variety of programs such as National Mining Week, prospecting courses, teachers' workshops, class presentations, articles and newsletters, and public interpretive walks.

The Drill Core Library in Stellarton houses extensive collections of drill core and other sample media. A total of 7858.4 m of additional drill core was received and 90.7 m of core were disposed of in 1995-96, bringing the cumulative fiscal-year-end total to 634 277 m. All core is maintained on a non-confidential basis and may be accessed for study and sampling on request.

GEOLOGICAL SURVEY
DEPARTMENT OF MINES AND ENERGY
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

INTRODUCTION

The Geological Survey of Newfoundland and Labrador (GSNL) program for 1996-97 consisted of some 35 projects having a total budget of $3.4-million. The budget was drawn entirely from A-base funds, as the final Mineral Development Agreement expired on March 31, 1996. The Survey maintained a significant field presence in Labrador, including the initiation of a Nickel Metallogeny Project. Overall, reduced and less-expensive field work on the Island, along with office-based projects and report writing, allowed greater support for the field projects.

The Survey experienced two momentous events in 1996-1997. Executive Director Bryan Greene retired at the end of March 1996, after providing exemplary leadership to the Survey for the past twenty years. The Committee of Provincial Geologists complimented Mr. Greene for his contribution to Canadian geoscience. And in August 1966, the Survey (along with the rest of the Department of Mines and Energy) moved into its new quarters in the just-completed Natural Resources Building, 50 Elizabeth Avenue, St. John's.

The exploration boom continued in Newfoundland and Labrador during 1996. Most of this was due to activity in Labrador generated by the Voisey's Bay discovery, but significant new prospects and targets were pursued on the Island as well. Total exploration expenditure for 1996 is projected at $100-million. Approximately 185 000 claims were in good standing at the end of the year, of which 25 000 were on the Island. Exploration expenditure for 1997 is anticipated to be somewhat less than that for 1996.

PROGRAM HIGHLIGHTS

Bedrock Geology Surveys

A joint effort by Bruce Ryan of the GSNL and Ingo Ermanovics and Ron Emslie of the GSC resulted in 1:100 000-scale mapping of the Alliger Lake area, Labrador. Archean gneisses in the region are intruded by Paleoproterozoic intrusions and the Mesoproterozoic Nain Plutonic Suite. Several sulphide prospects occur in the mafic rocks of the Nain Plutonic Suite, and are interpreted to be epigenetic with respect to the host rocks.

Detailed 1:25 000-scale mapping was carried out by Don James in the Archean Hunt River Greenstone Belt, Labrador, as part of the continuation of the Hopedale multidisciplinary project. The belt is mainly underlain by foliated amphibolite-facies mafic rocks, probably derived from volcanic rocks. Also, there are probable ultramafic flows and these are a target for komatiite-associated Ni - Cu sulphide deposits. Iron formation and other metasedimentary rocks in the sequence may host mesothermal gold mineralization.

The western part of the Exploits Subzone of central Newfoundland was mapped at 1:50 000 scale by Brian O'Brien. The principal unit of economic interest is the Ordovician Wild Bight Group, which contains several stratabound alteration zones in silicified turbidites.

The stratigraphy of the Harbour Main Group and its relationship to overlying rocks have been the focus of 1:50 000-scale mapping by Sean O'Brien on the Avalon Peninsula, Newfoundland. Sean O'Brien and Cyril O'Driscoll have demonstrated a stratigraphic control on mineralization across the central Avalon, and have recognized different levels of hydrothermal systems, including porphyry-style mineralization.

Geochemical Surveys

Detailed lake-sediment and water sampling was carried out by John McConnell in the Archean Hunt River Greenstone Belt, as part of the Hopedale multidisciplinary project. Work was focussed on areas where high gold values are present in the regional surveys and gold occurrences have been recently discovered by industry. A soil survey was also done in the Marion Lake area of western Labrador to follow up high lake-sediment gold and copper values over metasedimentary rocks of the Churchill Province.

Surficial Geology Surveys

The area around Goose Bay, Labrador, was mapped at 1:50 000 scale by Dave Liverman. Knowledge of the thick Quaternary cover in the area has major significance for understanding groundwater, slope stability and aggregate resources, important factors in community development and possible developments related to the Lower Churchill.

A stratigraphic study of Quaternary coastal exposure was carried out in the Stephenville area, Newfoundland, by Martin Batterson. The stratigraphy indicates deposition adjacent to the grounding line of a tidewater glacier, resulting in impermeable beds within the section that cause episodic landslides and rapid coastal erosion. Other geological hazards are being addressed in a study of the coastline between Portugal Cove and Holyrood, Newfoundland, by Dave Liverman. He has identified erosion problems that must be considered during construction and community development.

Geophysical Surveys

The total area covered by airborne geophysics as a result of exploration activity following the Voisey's Bay discovery is estimated at close to 50 000 km^2, equivalent to 17 percent of the total area of Labrador. Because of timely changes to the Mineral Regulations, these data have been or will be submitted digitally for mineral-assessment purposes. Gerry Kilfoil checks the submission for quality, archives them, and is compiling a digital index. When the data become non-confidential, the digital files will be made available, along with shaded-relief images.

Mineral Investigations

A new project has been initiated in Labrador to study mineralization related to mafic intrusions. Under project leader Andy Kerr, its aim is to develop a metallogenic model to aid exploration. The focus this past summer was on areas being actively explored by junior mining companies between Voisey's Bay and Okak Bay. The two main types of mineralization are truly syngenetic magmatic segregations in sills and dykes and discordant pod-like zones that may represent sulphide liquids migrating into partly consolidated cumulates or fully solidified rocks.

An examination of the regional setting of gold mineralization in the Avalon Zone of Newfoundland was a joint effort by GSNL's Sean O'Brien and Cyril O'Driscoll and GSC's Benoît Dubé. They are investigating hydrothermal alteration zones (especially their structure) and are applying the results of studies on the Hope Brook gold deposit to similar geology on the Burin and Avalon peninsulas.

Mineral Deposit Inventory

The Mineral Occurrence Data System (MODS) is currently being extended into the Nain area of Labrador, using press releases in lieu of still-confidential assessment reports.

Industrial Minerals

Possible dimension-stone resources in the Long Range Grenvillian inlier, western Newfoundland, were investigated by Ambrose Howse. Prospects include banded marble and gabbro. In eastern Newfoundland, Ambrose examined the Smith Point red algal limestone, which has dimension-stone potential because of its colour and texture. Other studies included an examination of sillimanite and garnet concentrations in the northeastern Gander Zone, as part of an ongoing evaluation of refractory- and abrasive-mineral localities.

A detailed assessment of bedrock-aggregate resources in the Norris Arm area, Newfoundland, was carried out by Dan Bragg. His field work is supported by laboratory work to determine geotechnical parameters important in ensuring construction of stable and durable road beds. Work was also done on bedrock aggregate used for bridge construction on the Avalon Peninsula, to help prevent deterioration of concrete as a result of alkali reactivity.

Geographic Information Systems

GIS developments are a part of several of the Survey's program activities. These include the preparation of a file of surficial-aggregate resources for Newfoundland and Labrador. The file will be available with GIS-viewing software and have information on all the main transportation corridors.

A geoscience atlas is now available for the Buchans - Robert's Arm Belt, Newfoundland, on CD-ROM. It shows bedrock geology, surficial geology, geophysics, geochemistry, mineral occurrences, drill-hole data and locations of exploration surveys, all in a format where datasets can be overlain and searched interactively using GIS-viewing software on a PC. Also, Version 2 of the Geochemical Atlas for the Island of Newfoundland will be released shortly on CD-ROM. It will contain the complete lake-sediment analytical set, together with a Mineral Occurrence Data layer, glacial striation data, and 1:1-million-scale bedrock geology. Meanwhile, work on a digital geology map of the Island of Newfoundland continues.

A joint project by the GSNL and the GSC is gathering together geoscientific information for the section of northern Labrador between Hopedale and Hebron and combining it in a GIS for publication on CD-ROM. The final product will include bedrock geology, surficial geology, lake-sediment geochemistry, geophysics from both regional government data

and more detailed industry surveys, mineral occurrences, and indexes to industry assessment reports.

Open House 1996

The Mines Branch hosted another successful Open House or Review of Activities in November 1996, which attracted some 400 delegates. As usual, it was held in conjunction with the annual meeting of the Newfoundland Branch of the CIM. The Open House included reviews of GSNL and GSC activities, mining and exploration activities, and earth-science research at Memorial University. Technical presentations consisted of talks and some 40 poster displays by GSNL and GSC geoscientists.

NWT GEOLOGY DIVISION
DEPT. OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT AND MINERALS, OIL AND GAS DIVISION
RESOURCES, WILDLIFE AND ECONOMIC DEVELOPMENT, GOVERNMENT OF THE NORTHWEST TERRITORIES

INTRODUCTION

The Northwest Territories comprises approximately one third of Canada's landmass (but houses less than 1% of her population). At present, the Northwest Territories geoscience programs are delivered by two agencies: Department of Indian Affairs and Northern Development (DIAND), and the Government of the Northwest Territories (GNWT). Both are housed in Yellowknife with a total of 13 professional geological staff and combined operating budgets of approximately $2.36 million for 1995-1996.

The mineral exploration industry in the NWT has experienced major growth since the discovery of diamonds in the Lac de Gras area in 1991. Exploration expenditures jumped from less than $50 million in the years 1990, 91 & 92 to a high of $180 million in 1995. For 1996, industry expenditures are estimated to be $135 to 140 million.

Nwt Geology Division, DIAND - Responsibilities

The NWT Act assigns to the Minister of the Department of Indian Affairs and Northern Development (DIAND) responsibility for science and mineral resources in the north. The Department has undergone restructuring and now the NWT Geology Division functions within the Mineral Resources Directorate, DIAND, as the Federal Departmental geoscience organization for NWT. The Division has a primary role in fostering the orderly development of NWT mineral resources, in part through the collection and interpretation of geological data. It provides information and geological advice to prospectors, explorationists, other government organizations, native groups, and the public, including media organizations who regularly seek first-hand information on mineral developments in NWT.

The NWT Geology Division has been assigned responsibility, under the Canada Mining Regulations (CMR), for the review and acceptance of the assessment reports that are required to keep mineral claims and Prospecting Permits in good standing. We maintain and provide public access to an Archive containing data, both digital and paper, on the geology and mineral deposits of the Territories. This includes the assessment records, geological maps and reports produced by governmental geoscience programs in the NWT, Geological Survey of Canada publications and some texts and journals. The Geology Division has also been assigned responsibility for monitoring diamond drilling; this includes the review of drilling proposals and the issuance and monitoring of Authorities for mineral exploration drilling in non-Precambrian sedimentary basins. The latter type of drilling is controlled by the Canada Oil and Gas Act and pursuant regulations that deal with drilling safety and the maintenance of the integrity of permeable strata.

Minerals, Oil And Gas Division, RWED, GNWT - Responsibilities

In August, 1996 the Department of Resources, Wildlife and Economic Development (RWED) was created from the amalgamation of the three departments of Energy, Mines and Petroleum Resources, Renewable Resources and Economic Development and Tourism. This new department will provide a stronger, more focused approach to resource management and development in the NWT.

The Minerals, Oil and Gas Division within RWED has the responsibility to deliver geoscience and mineral programs for the Government of the Northwest Territories, including geological mapping, prospector support and educational programs. Within RWED, and with other GNWT departments, the Division is developing policies in support of issues facing the mineral industry, such as land access, infrastructure and regulatory efficiency.

NWT GEOLOGY DIVISION, DIAND - ACTIVITIES 1996

In 1996, Geology Division staff initiated 1:10,000-scale geological mapping of the Bell Lake Supracrustals (85 J/16) north of Yellowknife, and completed 1:30,000-scale mapping in the Kathawachaga Lake area (76 L), the Labrish Lake area (85 N/9), and the northern Napaktulik Lake area (86I), all of which are in the Slave Structural Province.

The Geology Division's five District Geologists spent about 1/3 of their time reviewing claim and permit assessment report submissions which must be inspected to ensure that they contain information of reasonable quality and comply with the Canada Mining Regulations. Data that is incomplete or unintelligible is of little use in future interpretation of mineral resource potential. They also worked on various mineral showings throughout the territories. Studies included: geology of kimberlites in the Slave Province; geology and economic potential of undersaturated alkaline igneous rocks in the Slave Province and the Keewatin; compilation of a GIS-compatible database and examinations of mineral showings in the Bear Province and in the East Arm of Great Slave Lake; and, studies of gold and Cu-Ni prospects in the Keewatin.

Two of the Geology Divisions PY's are spent on management of the NWT Mineral Exploration Database (Geology Archives). The Archives Geologist and Archives Technician check that information in or flowing into the Archive is properly indexed and stored so it can be recovered for use. They ensure that database users find what they are seeking and documents are returned to proper storage after use.

The Geology Division has now taken responsibility for completion of the Northwest Territories Mineral Deposits Database (NTMINFILE) which began as a Mineral Initiative (MI) project under the former Canada-NWT Economic Development Agreement (EDA). NTMINFILE is designed to allow ready access through a personal computer to a part of the information in the Geology Archives knowledge base. It is expected that three person years of work will be required to input the "historical record" now lodged in the Archives. Mineral Industry Reports (MIRs) which were historically produced by the District Geologists and contained a summary of exploration work and results submitted in assessment reports, will be replaced by printing out (or providing in digital format) an index to the newly released assessment work which is captured in NTMINFILE.

Twelve contracts, worth over $500,000, were awarded by the Geology Division to University and other researchers to conduct specific studies on the geology and mineral deposits of the NWT. These include: a 1:50,000 scale mapping project in the Angikuni-Henik Lake area of the Keewatin (65G, H, J) and a mapping project in the Slave Province (85I, J); geological compilations in the Slave Structural Province and south-central Keewatin districts; studies of selected clastic deposits in the Slave; sedimentological comparisons of Precambrian platformal and basinal sedimentary assemblages in the Slave and western Churchill provinces; two geochemical studies on the growth and evolution of the Slave Province; a study of the structure of granite bodies and their host rocks in a corridor along the SNORCLE lithoprobe transect; a study on dating gold mineralization in the Yellowknife and Lupin mine areas; a study on the age of, and mantle xenoliths in, newly discovered kimberlites on Somerset Island and Brodeur Peninsula, Baffin Island; and, the development of a World Wide Web site for the NWT Geology Division.

MINERALS, OIL AND GAS DIVISION, RWED, GNWT - ACTIVITIES 1996

The Mineral Initiatives (MI) program under the Canada-NWT Economic Development Agreement (EDA) came to an end in March, 1996. With its termination, the GNWT continued many of the geoscience and mineral programs started under the MI. Three 1:50,000 bedrock geological mapping projects were continued (two in the Keewatin and one in the Slave Structural Province). A fourth project, in the Cordillera, began in 1996. A Community Minerals Advisor was hired to work with NWT prospectors, providing technical support as well as administering a grubstake program. The educational initiative, Project Rocks, was completed and delivered to NWT schools. Training workshops and resource updates continued to be provided.

JOINT ACTIVITIES

An expediting service was operated jointly by the NWT Geology Division, DIAND, the Minerals, Oil and Gas Division, RWED and the GSC. This provided service to government and university supported geological operations in areas tributary to Yellowknife.

Maps and reports resulting from Minerals, Oil and Gas Division, RWED and NWT Geology Division, DIAND mapping and research are made available in the EGS Open File Series available from the NWT Geology Division, DIAND, Box 1500 Yellowknife, NT, X1A 2R3.

MINING & MINERAL EXPLORATION - 1996

Eight mines operated in the NWT in 1996. Six were gold mines in the Slave Structural Province: Con, Giant, Lupin, Colomac, Ptarmigan and the Mon mine, which operates seasonally. Production was generally lower from all the gold mines, and it is anticipated that about 16 tonnes of gold will be produced this year compared to 18.7 tonnes in 1995. Two mines produce zinc and lead from carbonate-hosted deposits in the high Arctic, Polaris & Nanisivik. Zinc-lead

production this year should be about the same as in 1995; about 175kt Zn and 30 kt Pb.

The NWT once again appears to have set the national pace for exploration. In 1996, at least 124 exploration projects for diamonds, gold, base metals and uranium were conducted at a minimum cost of $130 million. Many of these projects, especially the diamond programmes, typically involve extensive land holdings and multiple targets. At least 280,000 metres of exploration drilling was completed and 15 projects involved drill programmes of 5000 metres or more. An additional 69,000 metres of ore-definition drilling was completed at the operating mines.

As in previous years, the bulk of exploration was in the Slave Structural Province, which included at least 65 projects totalling over $100 million in expenditures. Diamonds were the main target, followed by gold and distantly by base metals. The most advanced diamond projects are those of BHP/Diamet (BHP Diamonds), Kennecott/Aber (Diavik) and Canamera (Jericho), all of which are at the underground exploration or development stage. On November 4, 1996, the federal government gave BHP Diamonds approval to proceed with development to bring Canada's first diamond mine into production. The mine is scheduled to be operational by mid-1998. Meanwhile, the Diavik project continues to report encouraging results that augur favourably for the eventual development of a second diamond mine. On the gold scene, Quest International obtained spectacular gold assays from their underground exploration program at the Horseshoe Zone, Damoti Lake, although the tonnage potential remains to be evaluated. BHP Minerals commenced underground exploration at the Boston Project in the Hope Bay Belt, Echo Bay went underground at ULU, and GMD Resources Corporation continued underground exploration of the Orsmby Zone near the old Discovery Mine, a project that included 14,500 m of surface drilling.

There were at least 13 projects in the Keewatin, where $12.4 million was expended. Targets were gold, base metals ± diamonds and uranium. All of the gold prospects are hosted in banded iron formation. There were at least 22, generally lower-cost, projects in the Bear Province where nearly $5 million was spent to explore mainly for polymetallic Cu-Co-Bi-Zn-Ag-Au Olympic Dam style mineralization. In the Arctic Islands, 18 programmes which cost at least $5.5 million were completed, principally to assess base-metal properties and, to a lesser extent, diamonds.

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

1.Mineral Resources Directorate,
Northern Affairs Program
#345 - 300 Main St.
Whitehorse, Yukon, Y1A 2B5

a)Exploration and Geological Services Division
(403) 667-3203 (T.J. Bremner, Chief Geologist)
(403) 667-3204 (Geoscience Information & Sales)
(403) 667-3198 (FAX)

b)Mineral Development Division
(403) 667-3153 (A. Waroway, Regional Manager)
(403) 667-3193 (FAX)

c)Mineral Rights Division
(403) 667-3260 (R. Ronagan, Regional Manager)
(403) 667-3193 (FAX)

2.Energy and Mines Branch
Department of Economic Development
Government of Yukon
Box 2703, Whitehorse, Yukon, Y1A 2C6

a. Mining Facilitator:
#400-211 Main Street
(403) 667-3422 (J. Duke, Mining Facilitator)
(403) 667-8601(FAX)

b. Mineral Resources Program and
Canada/Yukon Geoscience Office
2099 Second Avenue,
(403) 667-5884 (R. Hill , Manager)
(403) 667-8516 (D. Murphy, Senior Project Geologist)
(403) 667-7074 (FAX)

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

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

STAFF ACTIVITIES

Staff presently includes T.J. Bremner (Chief Geologist), J.G. Abbott (Minerals Geologist), D. Emond and H. Copeland (Environmental Geologists), R. Deklerk (Manager, Map Sales), W.P. LeBarge and M. Burke (Staff Geologists), and A. Wagner (Office Manager).

Stephen Morison (Director, Mineral Resources) was appointed permanently to the position of Director of Mineral Resources in mid-1994. Among other duties, Mr. Morison has been involved in the planning and implementation of the Geoscience Element of the Canada/Yukon Mineral Development Agreement as co-chair of the Geoscience Technical Committee. Grant Abbott (Minerals Geologist) is chiefly responsible for mapping projects and in 1994 worked on the east half of the Lansing map area in conjunction with Charlie Roots (GSC), S. Gordey (GSC) and M. Cecile (GSC). . Grant is currently located at the MDA Geoscience office where he has taken on the role of scientific advisor. Trevor Bremner (Chief Geologist) carried out 1:50,000 scale mapping on the Brewery Creek deposit (MINFILE #116B 160) east of Dawson before assuming his role as Chief Geologist . Mike Burke (Staff Geologist) is responsible for visiting mining properties and approving quartz assessment reports for all mining districts. William LeBarge (Staff Geologist) returned from completing his M.Sc. thesis, Sedimentology of Placer Gravels near Mt. Nansen, central Yukon Territory, and will be concentrating his efforts toward placer-related pro-

jects in Yukon. He is responsible for visiting active placer mining properties and approving placer assessment reports for all mining districts. Mike Burke continues to coordinate renovations to the H.S. Bostock Core Library which will improve the core logging, sampling and viewing areas as well as the laboratory facilities. D. Emond and H. Copeland (Environmental Geologists) are members of the Technical Group of the Regional Environmental Review Committee (RERC) which reviews projects that are subject to the Environmental Assessment and Review Process (EARP) and the Canadian Environmental Protection Act (CEPA) which has replaced EARP.

PUBLICATIONS

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

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

GEOSCIENCE INFORMATION AND MAP SALES

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

LIBRARY

Northern Affairs Library Services maintains a library of geological texts and journals along with material from other departments in Indian and Northern Affairs Canada. The public is welcome to view these materials.

H.S. BOSTOCK CORE LIBRARY

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

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

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

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

YUKON MINING INCENTIVES PROGRAM

The Yukon Mining Incentives Program (YMIP) is designed to promote and enhance mineral prospecting, exploration and development activities in the Yukon. The program's function is to provide a portion of the risk capital required to locate and explore mineral deposits. Grassroots programs (Pros-

pecting and Grubstake categories) are conducted on open ground (crown land) and Target Evaluation programs are conducted on undeveloped mineral claims. Technical assistance is offered to prospectors upon request.

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

CANADA/YUKON MINERAL DEVELOPMENT AGREEMENT

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

1.Geoscience Element

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

Canada/Yukon Geoscience Office

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

Mapping programs in 1993 included:

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

Regional Surveys

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

Other Geoscience Programs

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

2.Technology Element

The objective of the Technology Element is to increase the economic and environmental efficiency

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

3.Information Element

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

SURVEY OF HARD ROCK DRILL-CORE PROGRAMS 1995-1996

SURVEY OF HARD ROCK DRILL CORE PROGRAM IN CANADA
FISCAL YEAR 1995-96

PROVINCE	B.C.**	ALBERTA	SASK.	MAN.	ONT.	QUEBEC	N.B.	N.S.	Nfld & Lab	P.E.I.	YUKON	N.W.T.	*Totals*
No. of Facilities	1	1	1	4	6	5	3	3	6	1	1	1	33
Staff Person Days Worked 95-96	10	96	106	90	***	9	600	1369	580		60		2920
Capital Cost 95-96	$5,400	$9,140	$2,700	*NIL*	*NIL*	*N/A*		$26,100			$20,000	$1,500	$64,840
Operating Cost 95-96	$5,000	$23,200	$19,200	$10,600	$60,000	$92,000	$75,000	$20,000	$35,000		$15,600	$8,000	$363,600
Core Collected and/or Delivery 1995-96		440	3653.8	10797	20440	2000	65 000	7858.4	36 651		1 000	2120.5	47309.7
Core Reduction*	*NIL*	*NIL*	*NIL*	*NIL*	*NIL*	*NIL*	*NIL*	91.7	*NIL*	*NIL*	*NIL*	*NIL*	91.7
Use of Facilities Person Days (pd) 95-96 Visits (v)	20 pd	20	67 pd	15 v	575 v	29 pd	250-300 pd	242 pd	192 pd		106 pd	20 v	630 v 956 pd
Total Core in Storage (from all years in metres)	15,000	32,000	84,211	216,500	1,058,400	224,000	513,000	634,276	913,967		124,400	32,638	3,848,392
Total Exploration Drilling 95-96 (in metres)	8061	*onfidential*	221 188	147 759	500 000 *est*	270 000	110 074	10 700	129 000		69 793	318 824	8061

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

1996 COMMITTEE OF PROVINCIAL GEOLOGISTS

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