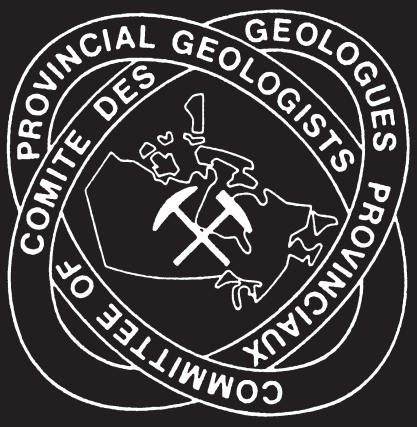

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1998 **VOLUME 16**

Compiled by the
British Columbia Geological Survey Branch

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1998 Committee of Provincial Geologists · · · · · · · · · · · · · · · · · *inside back cover*

COMMITTEE OF PROVINCIAL GEOLOGISTS
CHAIRPERSON'S REPORT 1998

The Committee of Provincial Geologists met as a Committee twice: in Toronto in March 1998, in conjunction with the PDAC Convention, and in Calgary in July, in conjunction with the Energy and Mines Ministers' Conference. Each of these meetings flowed into a National Geological Surveys Committee as the Geological Survey of Canada joined the discussions.

Many of the activities of the Committee were carried out in cooperation with the GSC, through the National Geological Surveys Committee. They included the Team Canada exhibit at the PDAC Convention, a contribution to the PDAC-IGWG report on Alternative Funding Arrangements for Geological Surveys, an initiative to establish a National Geoscience Knowledge Network, a workshop on the national geoscience program and a geological field trip in conjunction with the Energy and Mines Ministers' Conference. A workshop involving staff and management of the GSC and provincial and territorial surveys on the National Geoscience Knowledge Network is planned for late 1998 or early 1999.

British Columbia professionally produced the 1998 Provincial Geologists Journal, and the Committee contributed an article to Geoscience Canada describing the activities of each member survey.

The Committee established the Provincial Geologists Medal of Merit, which will be awarded each year to a provincial or territorial geological survey staff member in recognition of outstanding contributions.

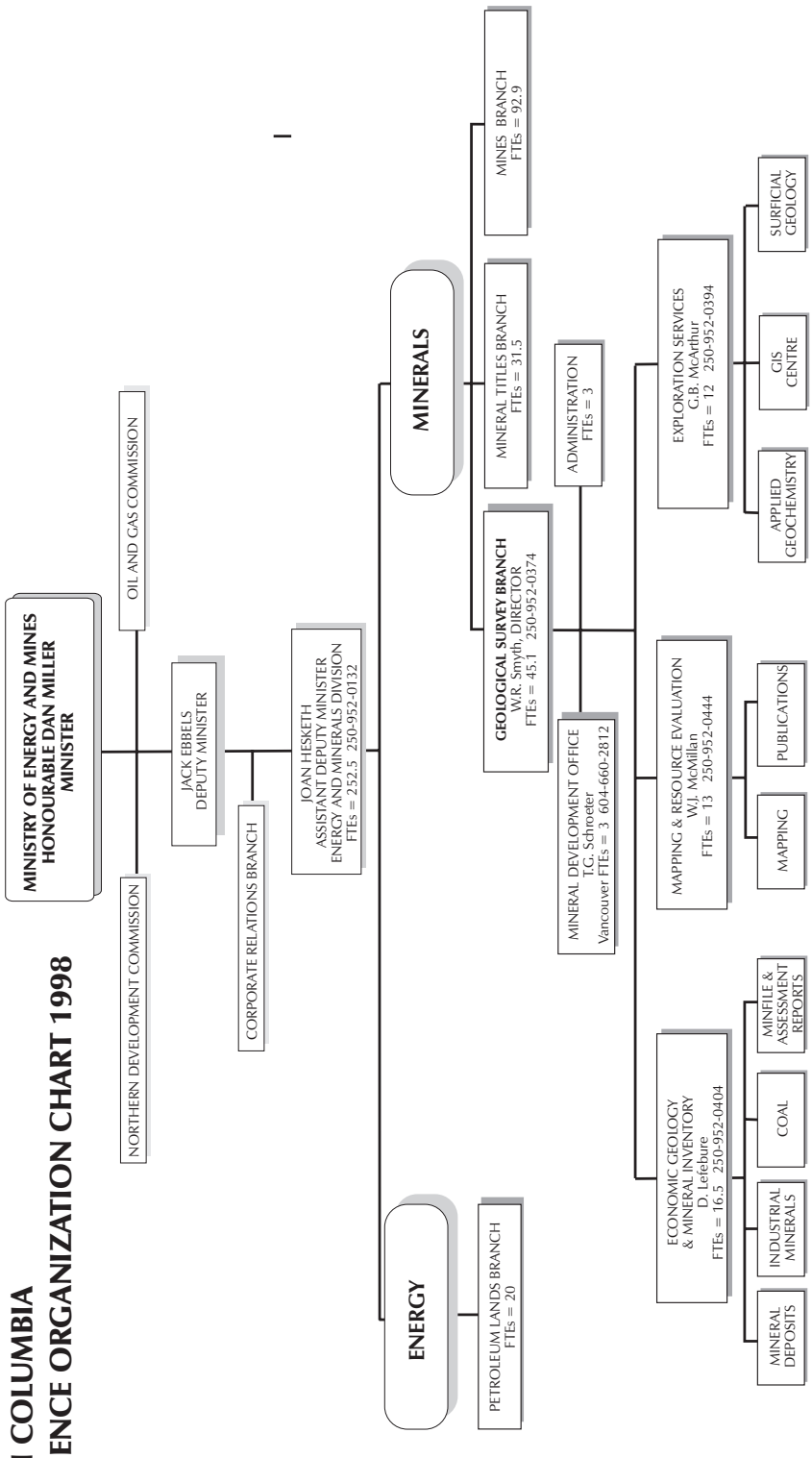
The Committee contributed to geoscience in Canada through its representation on various boards and committees. Jan Boon served on the Minister's National Advisory Board on Earth Science; Andy Fyon represented CPG at the Canadian Geoscience Council; Jean-Louis Caty attended the meeting of the Council of Chairs of Canadian Earth Science Departments; Ron Smyth was involved in Lithoprobe; and, Scott Swinden and Carolyn Relf in NATMAP.

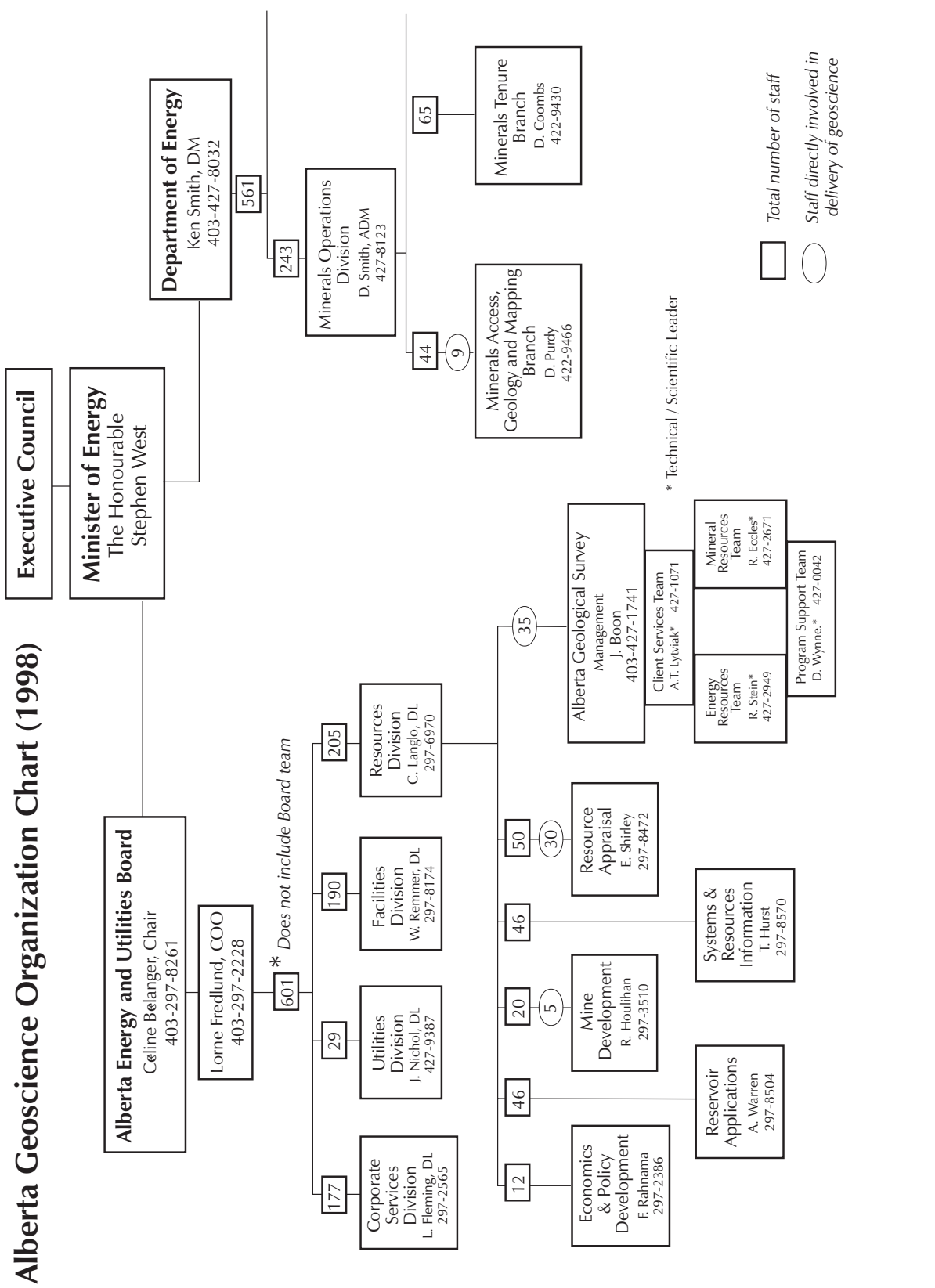
In summary, the Committee has had an active year, with continually increasing federal-provincial cooperation.

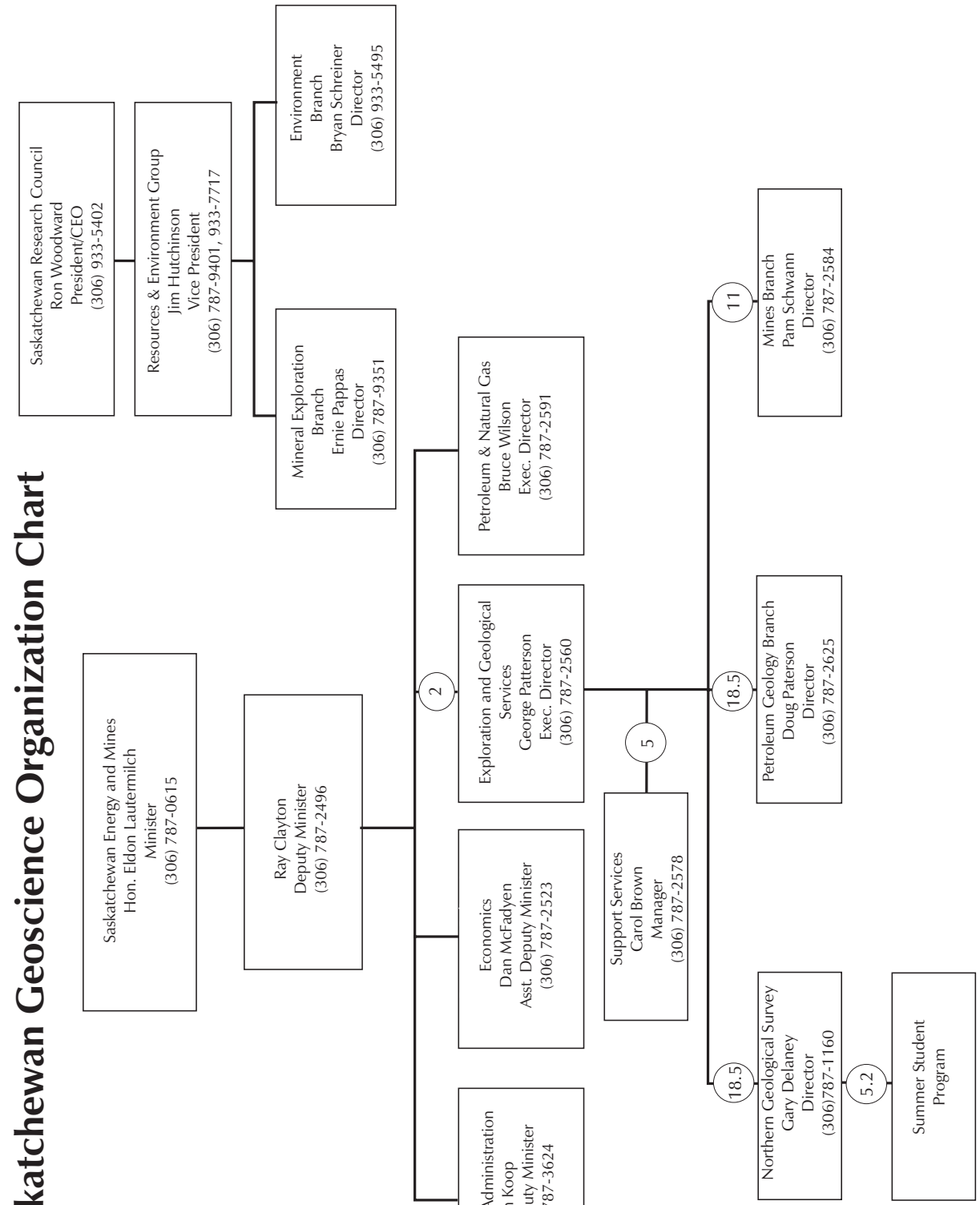
Jan Boon
CPG Chair, 1998

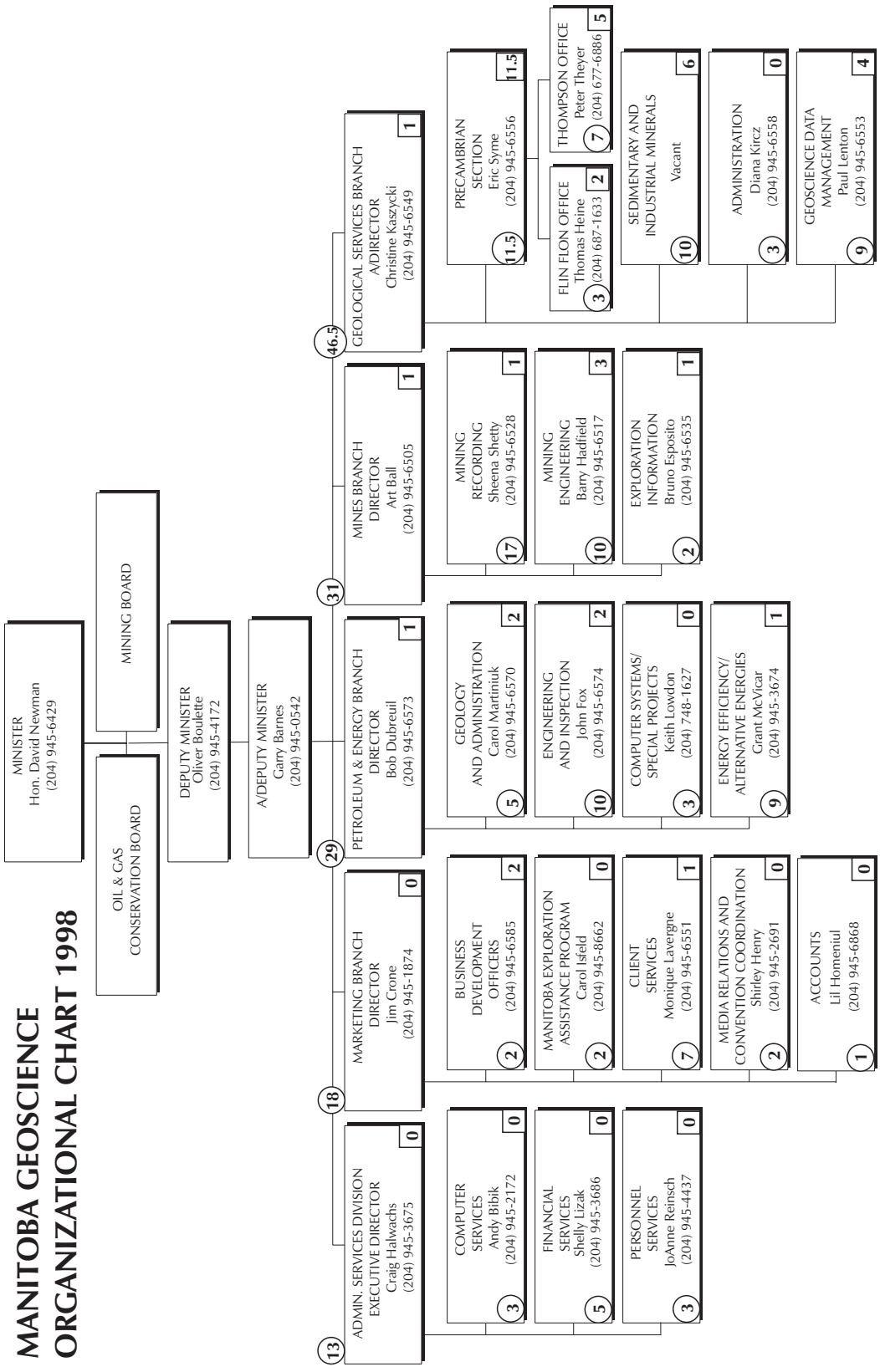
GEOSCIENCE ORGANIZATION CHARTS - 1998

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

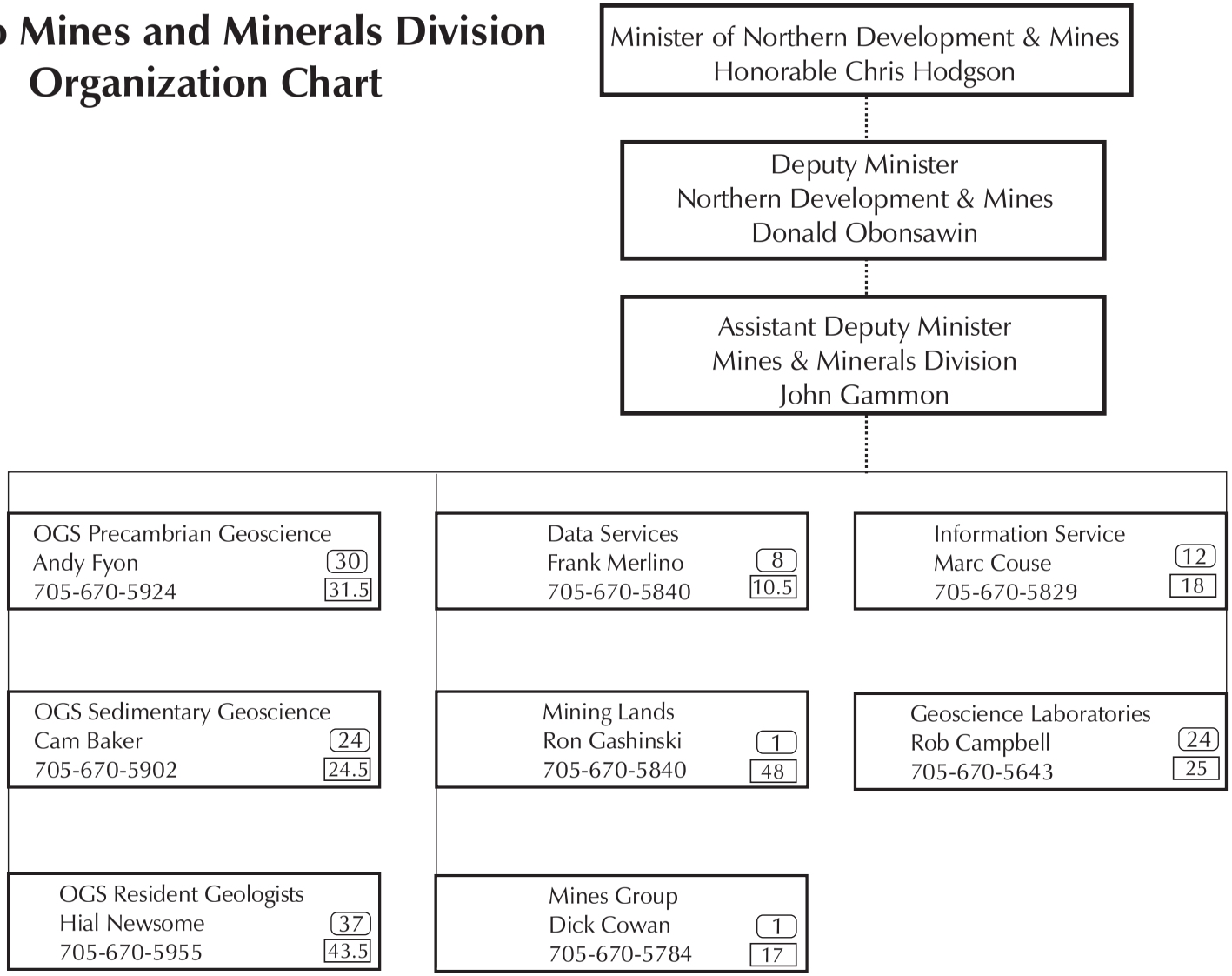

BRITISH COLUMBIA
GEOSCIENCE ORGANIZATION CHART 1998
MINISTRY OF ENERGY AND MINES
HONOURABLE DAN MILLER
MINISTER
NORTHERN DEVELOPMENT COMMISSION
OIL AND GAS COMMISSION
JACK EBBELS
DEPUTY MINISTER
CORPORATE RELATIONS BRANCH
JOAN HESKETH
ASSISTANT DEPUTY MINISTER
ENERGY AND MINERALS DIVISION
FTEs = 252.5 250-952-0132
ENERGY
PETROLEUM LANDS BRANCH
FTEs = 20
MINERALS
GEOLOGICAL SURVEY BRANCH
W.R. Smyth, DIRECTOR
FTEs = 45.1 250-952-0374
MINERAL TITLES BRANCH
FTEs = 31.5
MINES BRANCH
FTEs = 92.9
ADMINISTRATION
FTEs = 3
MINERAL DEVELOPMENT OFFICE
T.G. Schroeter
Vancouver FTEs = 3 604-660-2812
ECONOMIC GEOLOGY
& MINERAL INVENTORY
D. Lefebure
FTEs = 16.5 250-952-0404
MINERAL DEPOSITS
INDUSTRIAL MINERALS
COAL
MINFILE & ASSESSMENT REPORTS
MAPPING & RESOURCE EVALUATION
W.J. McMillan
FTEs = 13 250-952-0444
MAPPING
PUBLICATIONS
EXPLORATION SERVICES
C.B. McArthur
FTEs = 12 250-952-0394
APPLIED GEOCHEMISTRY
GIS CENTRE
SURFICIAL GEOLOGY


Alberta Geoscience Organization Chart (1998)
Executive Council
Minister of Energy
The Honourable
Stephen West
Department of Energy
Ken Smith, DM
403-427-8032
561
Alberta Energy and Utilities Board
Celine Bélanger, Chair
403-297-8261
Lorne Fredlund, COO
403-297-2228
601
* Does not include Board team
243
Minerals Operations Division
D. Smith, ADM
427-8123
65
Minerals Tenure Branch
D. Coombs
422-9430
44
9
Minerals Access, Geology and Mapping Branch
D. Purdy
422-9466
205
Resources Division
C. Langlo, DL
297-6970
190
Facilities Division
W. Remmer, DL
297-8174
29
Utilities Division
J. Nichol, DL
427-9387
177
Corporate Services Division
L. Fleming, DL
297-2565
35
Alberta Geological Survey
Management
J. Boon
403-427-1741
Client Services Team
A.T. Lyviak* 427-1071
Energy Resources Team
R. Stein*
427-2949
Mineral Resources Team
R. Eccles*
427-2671
Program Support Team
D. Wynne.* 427-0042
* Technical / Scientific Leader
50
30
Resource Appraisal
E. Shirley
297-8472
46
20
5
Mine Development
R. Houlihan
297-3510
Systems & Resources Information
T. Hurst
297-8570
12
46
Economics & Policy Development
F. Rahnama
297-2386
Reservoir Applications
A. Warren
297-8504
Total number of staff
Staff directly involved in delivery of geoscience


Saskatchewan Geoscience Organization Chart
Saskatchewan Research Council
Ron Woodward
President/CEO
(306) 933-5402
Resources & Environment Group
Jim Hutchinson
Vice President
(306) 787-9401, 933-7717
Environment
Branch
Bryan Schreiner
Director
(306) 933-5495
Mineral Exploration
Branch
Ernie Pappas
Director
(306) 787-9351
Saskatchewan Energy and Mines
Hon. Eldon Lautermilch
Minister
(306) 787-0615
Ray Clayton
Deputy Minister
(306) 787-2496
2
Petroleum & Natural Gas
Bruce Wilson
Exec. Director
(306) 787-2591
Exploration and Geological
Services
George Patterson
Exec. Director
(306) 787-2560
Economics
Dan McFadyen
Asst. Deputy Minister
(306) 787-2523
5
Support Services
Carol Brown
Manager
(306) 787-2578
18.5
11
Mines Branch
Pam Schwann
Director
(306) 787-2584
Petroleum Geology Branch
Doug Paterson
Director
(306) 787-2625
Finance & Administration
Don Koop
Asst. Deputy Minister
(306) 787-3624
18.5
Northern Geological Survey
Gary Delaney
Director
(306)787-1160
5.2
Summer Student
Program


MANITOBA GEOSCIENCE
ORGANIZATIONAL CHART 1998
MINISTER
Hon. David Newman
(204) 945-6429
OIL & GAS
CONSERVATION BOARD
MINING BOARD
DEPUTY MINISTER
Oliver Boulette
(204) 945-4172
A/DEPUTY MINISTER
Garry Barnes
(204) 945-0542
ADMIN. SERVICES DIVISION
EXECUTIVE DIRECTOR
Craig Halwachs
(204) 945-3675
13
0
COMPUTER
SERVICES
Andy Bibik
(204) 945-2172
3
0
FINANCIAL
SERVICES
Shelly Lizak
(204) 945-3686
5
0
PERSONNEL
SERVICES
JoAnne Reinsch
(204) 945-4437
3
0
18
MARKETING BRANCH
DIRECTOR
Jim Crone
(204) 945-1874
0
BUSINESS
DEVELOPMENT
OFFICERS
(204) 945-6585
2
2
MANITOBA EXPLORATION
ASSISTANCE PROGRAM
Carol Isfeld
(204) 945-8662
2
0
CLIENT
SERVICES
Monique Lavergne
(204) 945-6551
7
1
MEDIA RELATIONS AND
CONVENTION COORDINATION
Shirley Henry
(204) 945-2691
2
0
ACCOUNTS
Lil Homeniul
(204) 945-6868
1
0
29
PETROLEUM & ENERGY BRANCH
DIRECTOR
Bob Dubreuil
(204) 945-6573
1
GEOLOGY
AND ADMINISTRATION
Carol Martiniuk
(204) 945-6570
5
2
ENGINEERING
AND INSPECTION
John Fox
(204) 945-6574
10
2
COMPUTER SYSTEMS/
SPECIAL PROJECTS
Keith Lowdon
(204) 748-1627
3
0
ENERGY EFFICIENCY/
ALTERNATIVE ENERGIES
Grant McVicar
(204) 945-3674
9
1
31
MINES BRANCH
DIRECTOR
Art Ball
(204) 945-6505
1
MINING
RECORDING
Sheena Shetty
(204) 945-6528
17
1
MINING
ENGINEERING
Barry Hadfield
(204) 945-6517
10
3
EXPLORATION
INFORMATION
Bruno Esposito
(204) 945-6535
2
1
46.5
GEOLOGICAL SERVICES BRANCH
A/DIRECTOR
Christine Kaszycki
(204) 945-6549
1
PRECAMBRIAN
SECTION
Eric Syme
(204) 945-6556
11.5
11.5
FLIN FLON OFFICE
Thomas Heine
(204) 687-1633
3
2
THOMPSON OFFICE
Peter Theyer
(204) 677-6886
7
5
SEDIMENTARY AND
INDUSTRIAL MINERALS
Vacant
10
6
ADMINISTRATION
Diana Kircz
(204) 945-6558
3
0
GEOSCIENCE DATA
MANAGEMENT
Paul Lenton
(204) 945-6553
9
4

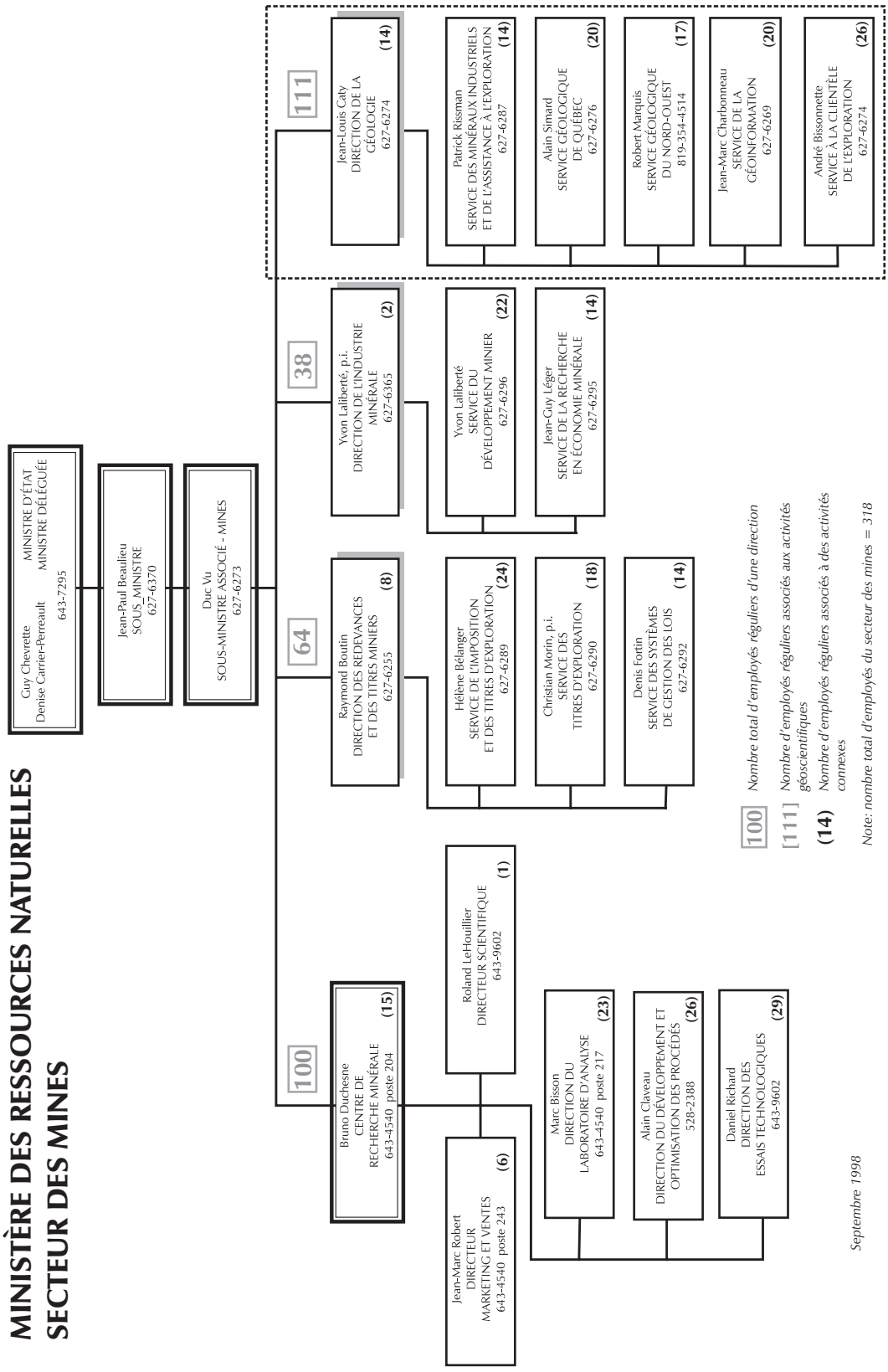
Ontario Mines and Minerals Division Organization Chart

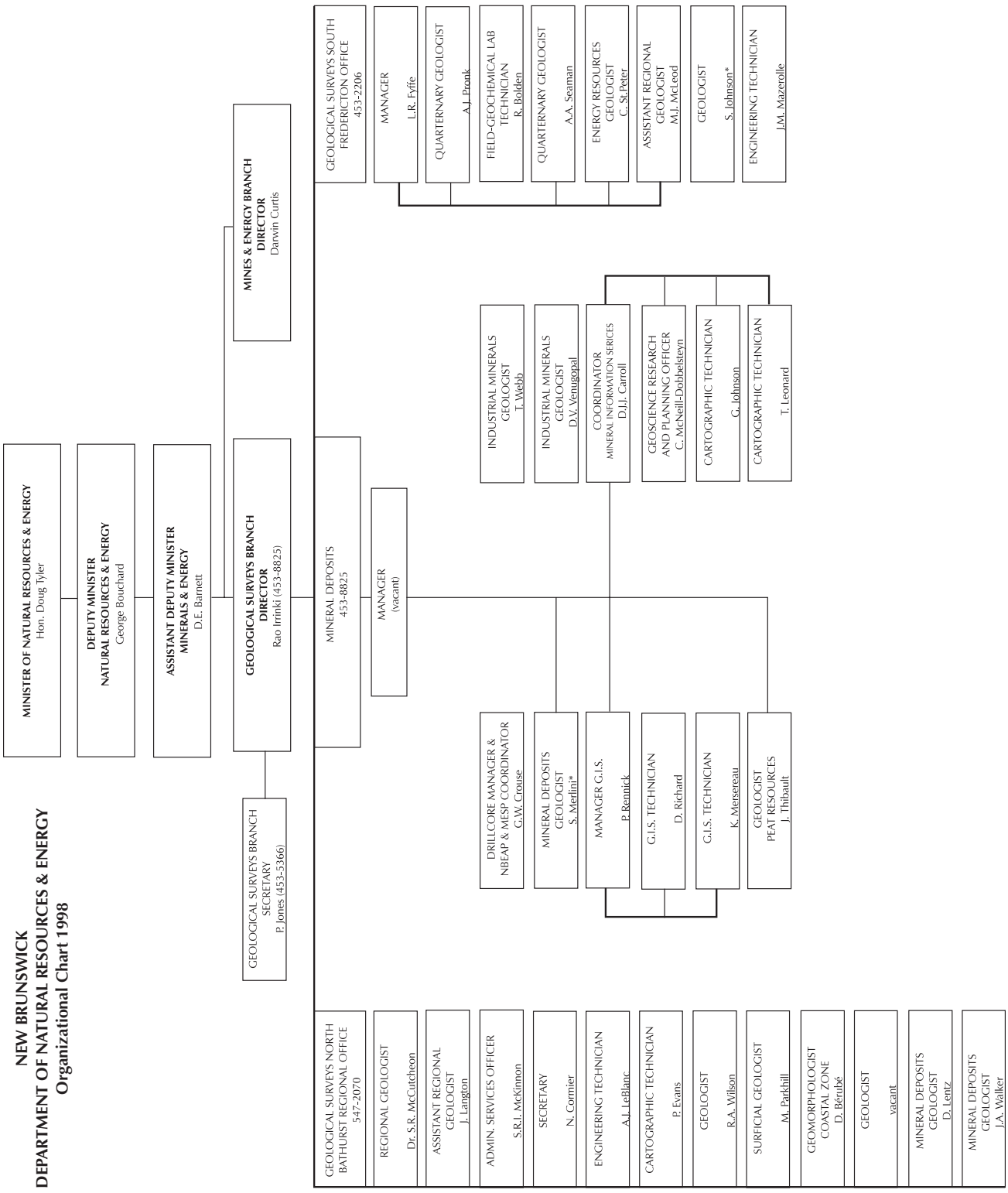


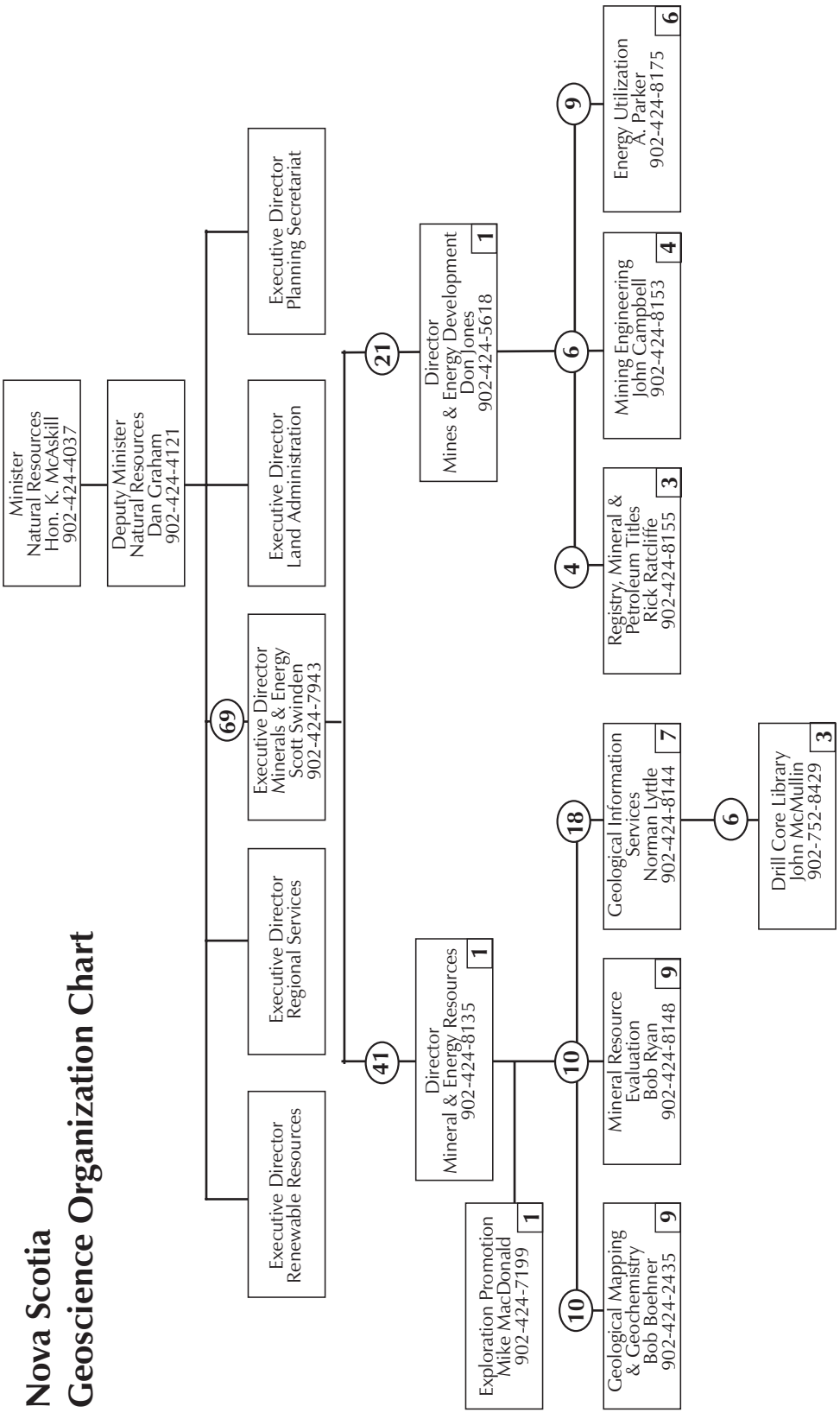
LEGEND

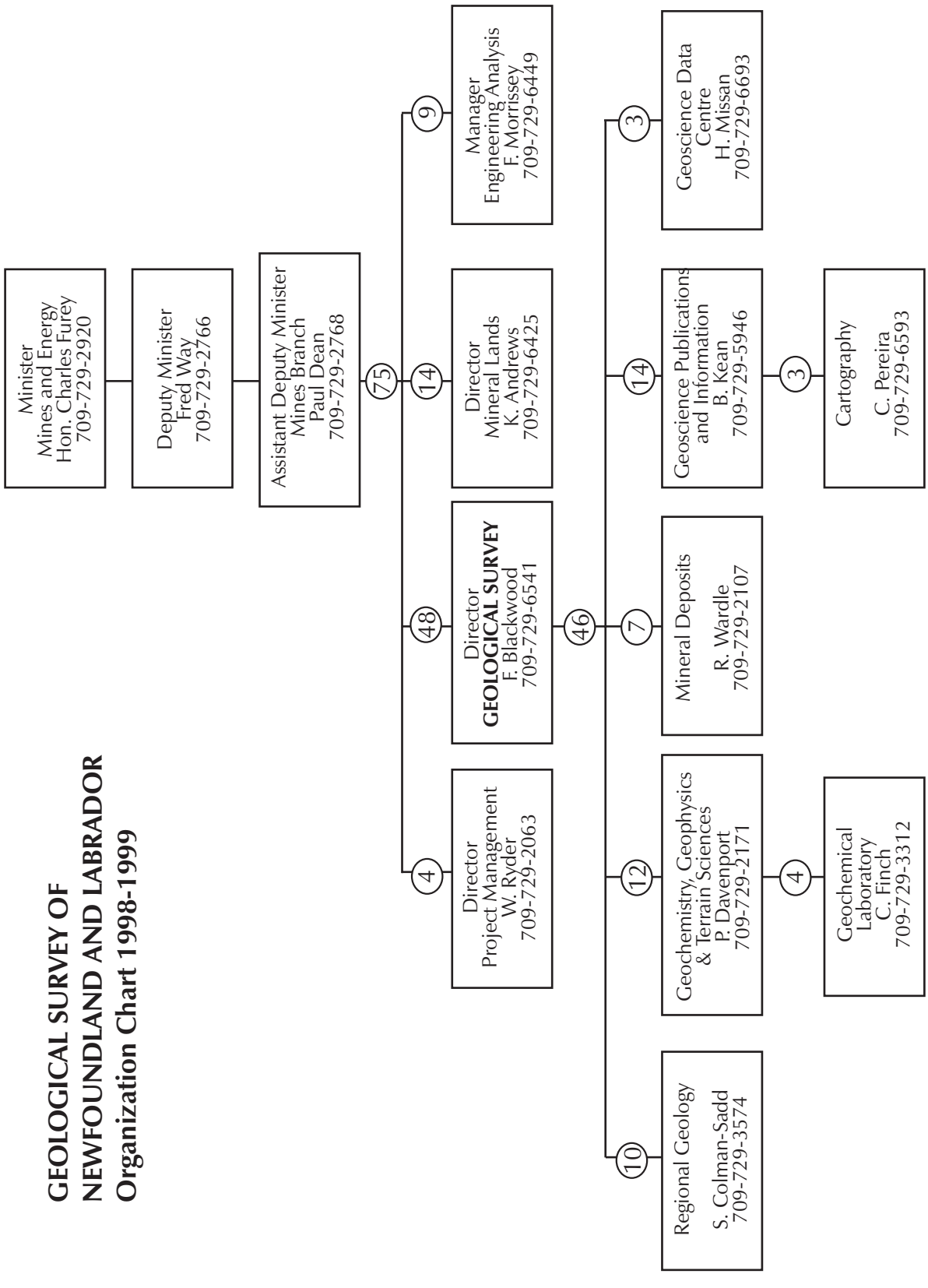
30 *Number of staff directly associated with Geoscience Activities*

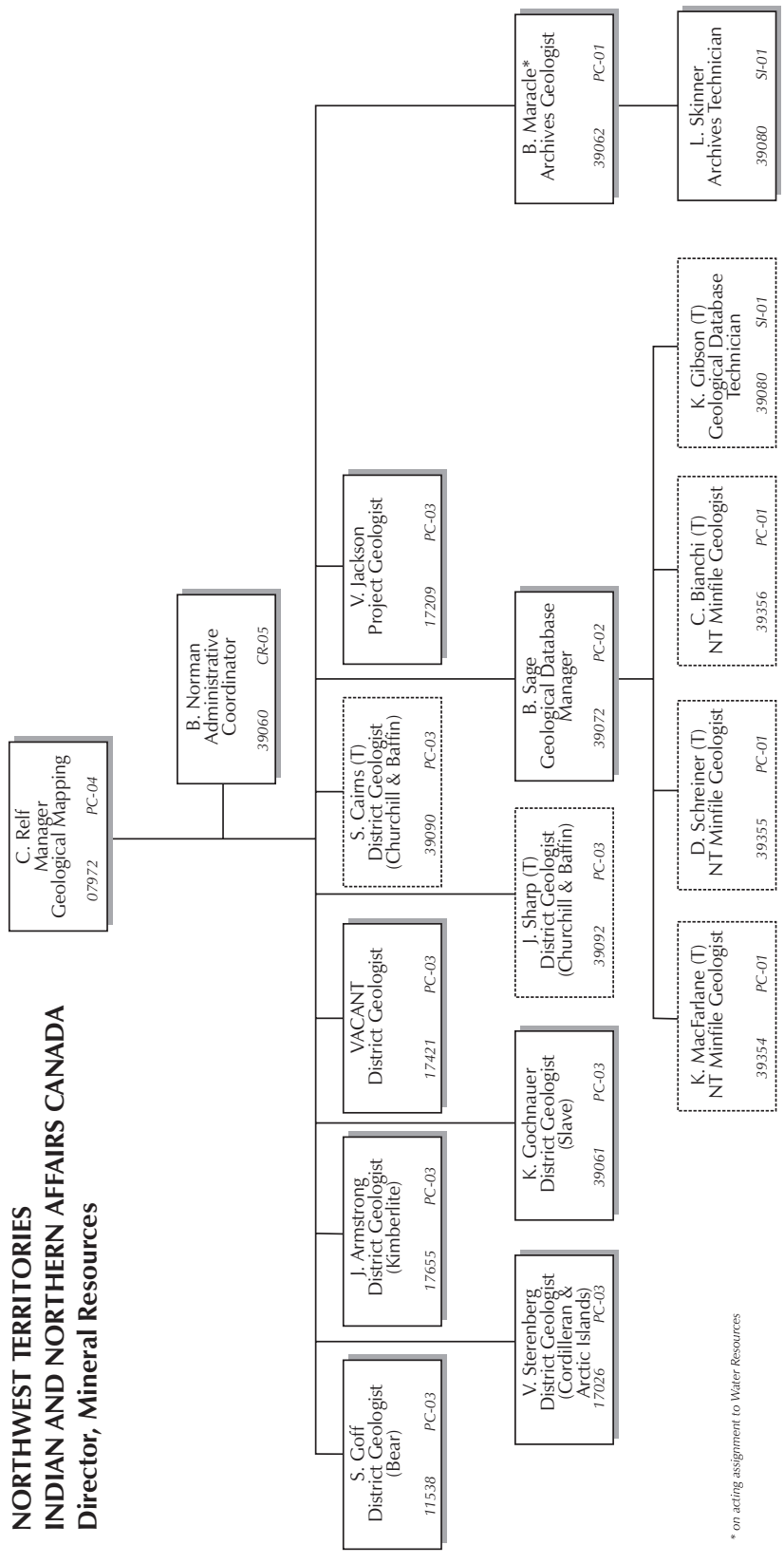
31.5 *Total Staff*

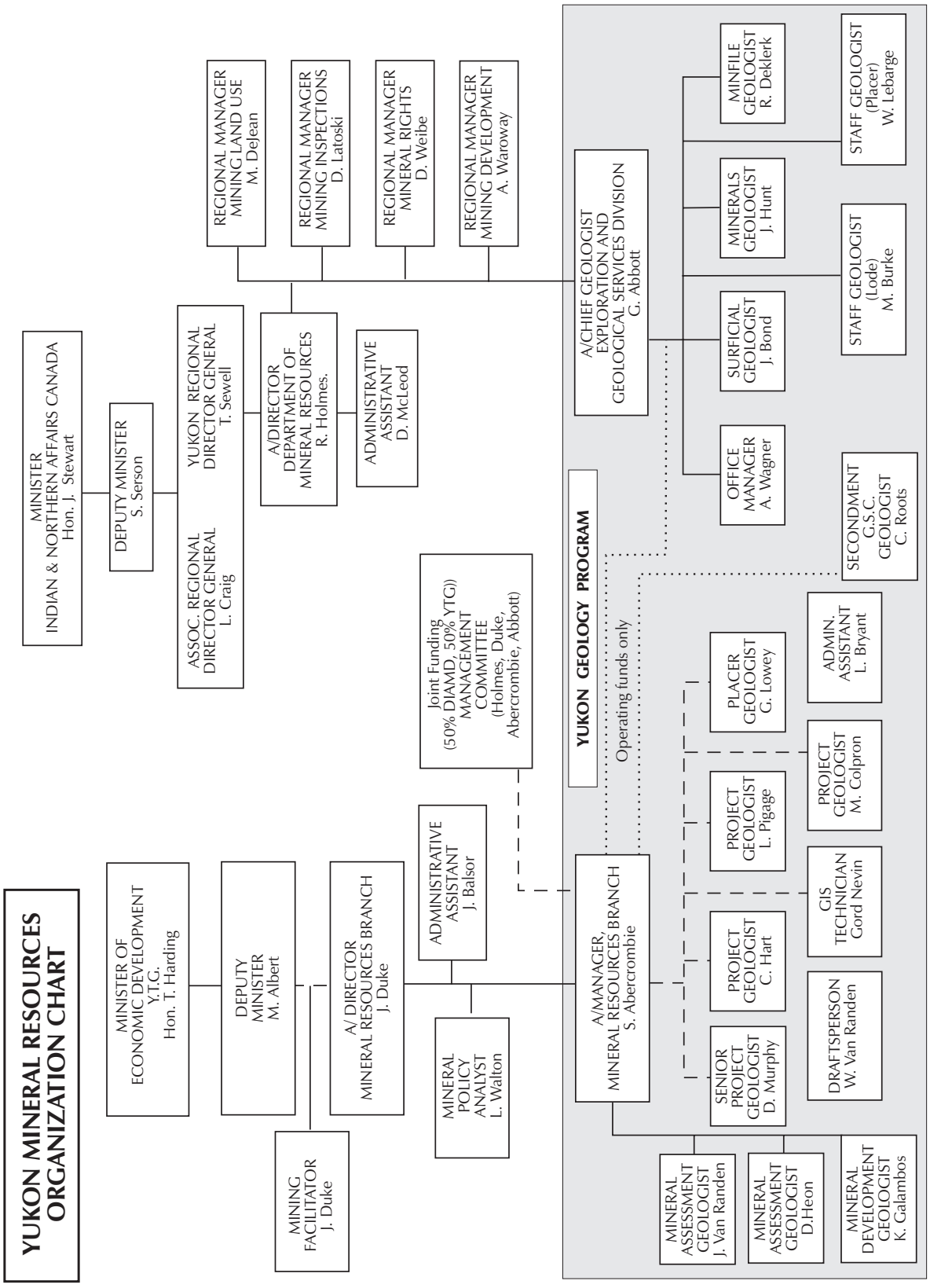

MINISTÈRE DES RESSOURCES NATURELLES
SECTEUR DES MINES
Guy Chevrette
Denise Carrier-Perreault
MINISTRE D'ÉTAT
MINISTRE DÉLÉGUÉE
643-7295
Jean-Paul Beaulieu
SOUS_MINISTRE
627-6370
Duc Vu
SOUS-MINISTRE ASSOCIÉ - MINES
627-6273
100
64
38
111
Bruno Duchesne
CENTRE DE
RECHERCHE MINÉRALE
643-4540 poste 204
(15)
Roland LeHouillier
DIRECTEUR SCIENTIFIQUE
643-9602
(1)
Jean-Marc Robert
DIRECTEUR
MARKETING ET VENTES
643-4540 poste 243
(6)
Marc Bisson
DIRECTION DU
LABORATOIRE D'ANALYSE
643-4540 poste 217
(23)
Alain Claveau
DIRECTION DU DÉVELOPPEMENT ET
OPTIMISATION DES PROCÉDÉS
528-2388
(26)
Daniel Richard
DIRECTION DES
ESSAIS TECHNOLOGIQUES
643-9602
(29)
Raymond Boutin
DIRECTION DES REDEVANCES
ET DES TITRES MINIERS
627-6235
(8)
Hélène Bélanger
SERVICE DE L'IMPOSITION
ET DES TITRES D'EXPLORATION
627-6289
(24)
Christian Morin, p.i.
SERVICE DES
TITRES D'EXPLORATION
627-6290
(18)
Denis Fortin
SERVICE DES SYSTÈMES
DE GESTION DES LOIS
627-6292
(14)
Yvon Laliberté, p.i.
DIRECTION DE L'INDUSTRIE
MINÉRALE
627-6365
(2)
Yvon Laliberté
SERVICE DU
DÉVELOPPEMENT MINIER
627-6296
(22)
Jean-Guy Léger
SERVICE DE LA RECHERCHE
EN ÉCONOMIE MINÉRALE
627-6295
(14)
Jean-Louis Caty
DIRECTION DE LA
GÉOLOGIE
627-6274
(14)
Patrick Rissman
SERVICE DES MINÉRAUX INDUSTRIELS
ET DE L'ASSISTANCE À L'EXPLORATION
627-6287
(14)
Alain Simard
SERVICE GÉOLOGIQUE
DE QUÉBEC
627-6276
(20)
Robert Marquis
SERVICE GÉOLOGIQUE
DU NORD-OUEST
819-354-4514
(17)
Jean-Marc Charbonneau
SERVICE DE LA
GÉOINFORMATION
627-6269
(20)
André Bissonnette
SERVICE À LA CLIENTÈLE
DE L'EXPLORATION
627-6274
(26)
100 Nombre total d'employés réguliers d'une direction
[111] Nombre d'employés réguliers associés aux activités géoscientifiques
(14) Nombre d'employés réguliers associés à des activités connexes
Note: nombre total d'employés du secteur des mines = 318
Septembre 1998


NEW BRUNSWICK
DEPARTMENT OF NATURAL RESOURCES & ENERGY
Organizational Chart 1998
MINISTER OF NATURAL RESOURCES & ENERGY
Hon. Doug Tyler
DEPUTY MINISTER
NATURAL RESOURCES & ENERGY
George Bouchard
ASSISTANT DEPUTY MINISTER
MINERALS & ENERGY
D.E. Barnett
GEOLOGICAL SURVEYS BRANCH
DIRECTOR
Rao Irrinki (453-8825)
MINES & ENERGY BRANCH
DIRECTOR
Darwin Curtis
GEOLOGICAL SURVEYS BRANCH
SECRETARY
P. Jones (453-5366)
MINERAL DEPOSITS
453-8825
MANAGER
(vacant)
GEOLOGICAL SURVEYS SOUTH
FREDERICTON OFFICE
453-2206
MANAGER
L.R. Fyffe
QUARTERNARY GEOLOGIST
A.J. Pronk
FIELD-GEOCHEMICAL LAB
TECHNICIAN
R. Bolden
QUARTERNARY GEOLOGIST
A.A. Seaman
ENERGY RESOURCES
GEOLOGIST
C. St.Peter
ASSISTANT REGIONAL
GEOLOGIST
M.J. McLeod
GEOLOGIST
S. Johnson*
ENGINEERING TECHNICIAN
J.M. Mazerolle
INDUSTRIAL MINERALS
GEOLOGIST
T. Webb
INDUSTRIAL MINERALS
GEOLOGIST
D.V. Venugopal
COORDINATOR
MINERAL INFORMATION SERICES
D.J.J. Carroll
GEOSCIENCE RESEARCH
AND PLANNING OFFICER
C. McNeill-Dobbelsteyn
CARTOGRAPHIC TECHNICIAN
G. Johnson
CARTOGRAPHIC TECHNICIAN
T. Leonard
DRILLCORE MANAGER &
NBEAP & MESP COORDINATOR
G.W. Crouse
MINERAL DEPOSITS
GEOLOGIST
S. Merlini*
MANAGER G.I.S.
P. Rennick
G.I.S. TECHNICIAN
D. Richard
G.I.S. TECHNICIAN
K. Mersereau
GEOLOGIST
PEAT RESOURCES
J. Thibault
GEOLOGICAL SURVEYS NORTH
BATHURST REGIONAL OFFICE
547-2070
REGIONAL GEOLOGIST
Dr. S.R. McCutcheon
ASSISTANT REGIONAL
GEOLOGIST
J. Langton
ADMIN. SERVICES OFFICER
S.R.I. McKinnon
SECRETARY
N. Cormier
ENGINEERING TECHNICIAN
A.J. LeBlanc
CARTOGRAPHIC TECHNICIAN
P. Evans
GEOLOGIST
R.A. Wilson
SURFICIAL GEOLOGIST
M. Parkhill
GEOMORPHOLOGIST
COASTAL ZONE
D. Bérubé
GEOLOGIST
vacant
MINERAL DEPOSITS
GEOLOGIST
D. Lentz
MINERAL DEPOSITS
GEOLOGIST
J.A. Walker


Nova Scotia
Geoscience Organization Chart
Minister
Natural Resources
Hon. K. McAskill
902-424-4037
Deputy Minister
Natural Resources
Dan Graham
902-424-4121
69
Executive Director
Renewable Resources
Executive Director
Regional Services
Executive Director
Minerals & Energy
Scott Swinden
902-424-7943
Executive Director
Land Administration
Executive Director
Planning Secretariat
41
Director
Mineral & Energy Resources
902-424-8135
1
Exploration Promotion
Mike MacDonald
902-424-7199
1
10
Geological Mapping
& Geochemistry
Bob Boehner
902-424-2435
9
10
Mineral Resource
Evaluation
Bob Ryan
902-424-8148
9
18
Geological Information
Services
Norman Lyttle
902-424-8144
7
6
Drill Core Library
John McMullin
902-752-8429
3
21
Director
Mines & Energy Development
Don Jones
902-424-5618
1
4
Registry, Mineral &
Petroleum Titles
Rick Ratcliffe
902-424-8155
3
6
Mining Engineering
John Campbell
902-424-8153
4
9
Energy Utilization
A. Parker
902-424-8175
6


GEOLOGICAL SURVEY OF
NEWFOUNDLAND AND LABRADOR
Organization Chart 1998-1999
Minister
Mines and Energy
Hon. Charles Furey
709-729-2920
Deputy Minister
Fred Way
709-729-2766
Assistant Deputy Minister
Mines Branch
Paul Dean
709-729-2768
75
4
Director
Project Management
W. Ryder
709-729-2063
48
Director
GEOLOGICAL SURVEY
F. Blackwood
709-729-6541
14
Director
Mineral Lands
K. Andrews
709-729-6425
9
Manager
Engineering Analysis
F. Morrissey
709-729-6449
46
10
Regional Geology
S. Colman-Sadd
709-729-3574
12
Geochemistry, Geophysics
& Terrain Sciences
P. Davenport
709-729-2171
4
Geochemical
Laboratory
C. Finch
709-729-3312
7
Mineral Deposits
R. Wardle
709-729-2107
14
Geoscience Publications
and Information
B. Kean
709-729-5946
3
Cartography
C. Pereira
709-729-6593
3
Geoscience Data
Centre
H. Missan
709-729-6693


NORTHWEST TERRITORIES
INDIAN AND NORTHERN AFFAIRS CANADA
Director, Mineral Resources
C. Relf
Manager
Geological Mapping
07972 PC-04
B. Norman
Administrative
Coordinator
39060 CR-05
S. Goff
District Geologist
(Bear)
11538 PC-03
J. Armstrong
District Geologist
(Kimberlite)
17655 PC-03
V. Sterenberg
District Geologist
(Cordilleran &
Arctic Islands)
17026 PC-03
VACANT
District Geologist
17421 PC-03
K. Gochnauer
District Geologist
(Slave)
39061 PC-03
S. Cairns (T)
District Geologist
(Churchill & Baffin)
39090 PC-03
J. Sharp (T)
District Geologist
(Churchill & Baffin)
39092 PC-03
V. Jackson
Project Geologist
17209 PC-03
B. Sage
Geological Database
Manager
39072 PC-02
B. Maracle*
Archives Geologist
39062 PC-01
L. Skinner
Archives Technician
39080 SI-01
K. MacFarlane (T)
NT Minfile Geologist
39354 PC-01
D. Schreiner (T)
NT Minfile Geologist
39355 PC-01
C. Bianchi (T)
NT Minfile Geologist
39356 PC-01
K. Gibson (T)
Geological Database
Technician
39080 SI-01
* on acting assignment to Water Resources


YUKON MINERAL RESOURCES ORGANIZATION CHART
MINISTER INDIAN & NORTHERN AFFAIRS CANADA Hon. J. Stewart
DEPUTY MINISTER S. Serson
ASSOC. REGIONAL DIRECTOR GENERAL L. Craig
YUKON REGIONAL DIRECTOR GENERAL T. Sewell
A/DIRECTOR DEPARTMENT OF MINERAL RESOURCES R. Holmes.
ADMINISTRATIVE ASSISTANT D. McLeod
REGIONAL MANAGER MINING LAND USE M. Dejean
REGIONAL MANAGER MINING INSPECTIONS D. Latoski
REGIONAL MANAGER MINERAL RIGHTS D. Weibe
REGIONAL MANAGER MINING DEVELOPMENT A. Waroway
MINISTER OF ECONOMIC DEVELOPMENT Y.T.G. Hon. T. Harding
DEPUTY MINISTER M. Albert
A/ DIRECTOR MINERAL RESOURCES BRANCH J. Duke
MINING FACILITATOR J. Duke
ADMINISTRATIVE ASSISTANT J. Balsor
MINERAL POLICY ANALYST L. Walton
Joint Funding (50% DIAMD, 50% YTG)) MANAGEMENT COMMITTEE (Holmes, Duke, Abercrombie, Abbott)
YUKON GEOLOGY PROGRAM
Operating funds only
A/MANAGER, MINERAL RESOURCES BRANCH S. Abercrombie
A/CHIEF GEOLOGIST EXPLORATION AND GEOLOGICAL SERVICES DIVISION G. Abbott
OFFICE MANAGER A. Wagner
SECONDMENT G.S.C. GEOLOGIST C. Roots
SURFICIAL GEOLOGIST J. Bond
MINERALS GEOLOGIST J. Hunt
MINFILE GEOLOGIST R. Deklerk
STAFF GEOLOGIST (Lode) M. Burke
STAFF GEOLOGIST (Placer) W. Lebarge
PLACER GEOLOGIST G. Lowey
ADMIN. ASSISTANT L. Bryant
PROJECT GEOLOGIST L. Pigage
PROJECT GEOLOGIST M. Colpron
PROJECT GEOLOGIST C. Hart
GIS TECHNICIAN Gord Nevin
SENIOR PROJECT GEOLOGIST D. Murphy
DRAFTSPERSON W. Van Randen
MINERAL ASSESSMENT GEOLOGIST J. Van Randen
MINERAL ASSESSMENT GEOLOGIST D.Heon
MINERAL DEVELOPMENT GEOLOGIST K. Galambos

PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES
1997 – 1998 FINAL and 1998 – 1999 PRELIMINARY

Provincial/Territorial Geological Survey Expenditures
1997-1998

Province/Territory	Survey Expenditures**	% of Total	1997 Provincial Mineral Production*	Survey Expenditures as percentage of Provincial Mineral Production	Area Prov/Terr km^2	Survey Expenditures $/km^2$	Population 1996	Survey Expenditures per Capita
NEWFOUNDLAND	3,252,239	6.0%	1,008,273,000	0.32%	405,000	$8.03	552,000	$5.89
NOVA SCOTIA	2,481,310	4.6%	378,005,000	0.66%	55,000	$45.11	909,000	$2.73
PRINCE EDWARD ISLAND			3,410,000		6,000		135,000	
NEW BRUNSWICK	2,770,100	5.1%	853,071,000	0.32%	73,000	$37.95	738,000	$3.75
QUEBEC	15,401,400	28.5%	3,395,910,000	0.45%	1,541,000	$9.99	7,138,000	$2.16
ONTARIO	11,794,100	21.8%	5,573,825,000	0.21%	1,069,000	$11.03	10,754,000	$1.10
MANITOBA	3,689,400	6.8%	1,020,573,000	0.36%	650,000	$5.68	1,114,000	$3.31
SASKATCHEWAN	2,525,158	4.7%	2,214,208,000	0.11%	652,000	$3.87	990,000	$2.55
ALBERTA	2,692,294	5.0%	26,671,286,000 +	0.01%	661,000	$4.07	2,697,000	$1.00
BRITISH COLUMBIA	4,345,265	8.0%	3,046,937,000	0.14%	948,000	$4.58	3,725,000	$1.17
NORTHWEST TERRITORIES	2,871,000	5.3%	548,768,000	0.52%	3,380,000	$0.85	64,000	$44.86
YUKON	2,247,100	4.2%	225,302,000	1.00%	483,000	$4.65	31,000	$72.49
Canadian Total:	**$54,069,366**	**100%**	**$44,939,568,000**	**0.120%**				

** Source: Natural Resources Canada: Mineral Industry Review 1997 Revised estimates*

*** Does not include expenditures on Industry Grant Programs (e.g.. Prospectors Assistance) see Table 2 for details on grants*

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

Expenditures column includes a total of A-base funds and other funds available to the geological surveys.

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

+ Alberta figures also include natural gas, natural gas by-products and crude oil.

Provincial/Territorial Industry Grant Programs
1997-1998 Final

Province/Territory	Prospectors Assistance	Mineral Exploration Assistance	Total
BRITISH COLUMBIA	$500,000	$0	$500,000
ALBERTA			
SASKATCHEWAN	$45,000	$0	$45,000
MANITOBA	$122,224	$3,000,000	$3,122,224
ONTARIO	$2,000,000	$0	$2,000,000
QUEBEC	$1,743,100	$3,800,000	$5,543,100
NEW BRUNSWICK	$50,000	$400,000	$450,000
NOVA SCOTIA	$45,000	$0	
NEWFOUNDLAND	$151,420	$0	$151,420
YUKON	$238,000	$268,000 *	$506,000
NORTHWEST TERRITORIES	$75,000	$0	$75,000
Totals:	**$4,969,744**	**$7,468,000**	**$12,392,744**

** Yukon Target Evaulations*

Provincial Geological Survey Expenditures
1998-1999 Preliminary Estimates

Province/Territory	Survey Expenditures	% of Total	1998-1999 Industry Grant Programs	Totals
BRITISH COLUMBIA	$4,131,600	7.74%	$500,000	$4,631,600
ALBERTA	$2,358,125	4.42%	$0	$2,358,125
SASKATCHEWAN	$2,550,000	4.78%	$0	$2,550,000
MANITOBA	$3,776,200	7.08%	$3,125,000	$6,901,200
ONTARIO	$11,560,000	21.67%	$2,050,000	$13,610,000
QUEBEC	$15,067,180	28.25%	$5,898,520	$20,965,700
NEW BRUNSWICK	$2,664,100	5.00%	$400,000	$3,064,100
NOVA SCOTIA	$2,541,600	4.76%	$155,000	$2,696,600
NEWFOUNDLAND	$3,364,200	6.31%	$175,100	$3,539,300
YUKON	$2,724,040	5.11%	$506,000	$3,230,040
NORTHWEST TERRITORIES	$2,605,000	4.88%	$180,000	$2,785,000
Canadian Total:	**$53,342,045**	**100.00%**	**$12,989,620**	**$66,331,665**

Province: British Columbia 1997-1998

Mineral Activities	Funding Agency	# of Projects	Positions		Salaries	Operational	Total $
			Permanent	Casual			
Bedrock geological surveys	GSB	9	12.00	2.57	$1,020,978	$255,487	$1,276,465
Geochemical surveys	GSB	1	2.00		$135,062	$211,032	$346,094
Surficial geology surveys	GSB	3	5.50	2.22	$490,623	$155,775	$646,398
Mineral deposit studies	GSB	5	5.30	0.52	$397,606	$89,105	$486,711
Mineral inventory compilations	GSB		3.38		$192,918	$7,500	$200,418
Industrial mineral studies	GSB	2	2.80	0.19	$203,327	$64,371	$267,698
Mineral resource assessments	GSB/CRII	1	0.50		$36,363	$0	$36,363
Vancouver regional office	GSB		1.00	0.34	$85,077	$20,402	$105,479
District geologists	Mines Br.		5.00	0.00	$382,473	$63,914	$446,387
Sub Total		**21**	**32.48**	**5.84**	**$2,561,954**	**$803,672**	**$3,365,626**
Energy Activities							
Coal		3	1.30		$103,374	$22,091	$125,465
Sub Total		**3**	**1.30**	**0.00**	**$103,374**	**$22,091**	**$125,465**
Other Activities							
Terrain Map Library	FRBC		2.00		*$124,000*	$0	*$124,000*
Environmental (Hazards)	JEPP/UBC				$0	*$20,000*	*$20,000*
Assaying Costs	GSB		0.50		$36,307	$134,344	$170,651
Chief's office/administration	GSB		5.90	0.44	$307,958	$196,238	$504,196
Sub Total		**0**	**8.40**	**0.44**	**$344,266**	**$330,582**	**$674,848**
Miscellaneous							
Publications	GSB		0.85		$73,324	$1,000	$74,324
Information/assessment files	GSB		1.63		$67,502	$7,500	$75,002
Research grants	GSB		--		$0	$30,000	$30,000
Sub Total		**0**	**2.48**	**0.00**	**$140,826**	**$38,500**	**$179,326**
Total Mineral Survey Activities		**24**	**44.65**	**6.28**	**$3,150,420**	**$1,194,845**	**$4,345,265**

(GSB Base Budget)

Funding Agency Abbreviations:

**GSB - Geological Survey Branch; CRII - Corporate Resource Inventory Initiative; Mines Br. - Mines Branch, FRBC - Forest Renewal BC; JEPP/UBC - Joint Emergency Preparedness Planning and University of BC*

Province: ALBERTA 1997-1998

	Agency	Funding	Projects	Person Years Perm.	Person Years Casual	Salaries ($) Perm.	Salaries ($) Casual	Operating Expenditures	Total ($)
Mineral Activities									
Geochemical Surveys	EUB	EUB	1	2.08		$ 125,054.31	$ -	$ 63,930.59	$ 188,984.90
Bedrock Geology	EUB	EUB	2	1.51		$ 94,913.35	$ -	$ 55,403.60	$ 150,316.95
Mineral Investigations (Field)	EUB	EUB	3	0.95		$ 59,959.66	$ -	$ 91,397.55	$ 151,357.21
Mineral Deposit Analysis and/or Inventory	EUB	EUB	1	0.01		$ 424.80	$ -	$ 1,126.87	$ 1,551.67
Industrial Minerals	EUB	EUB	2	1.86		$ 112,061.19	$ -	$ 60,031.93	$ 172,093.12
Core Repositories	EUB	EUB	1	0.46		$ 24,862.15	$ -	$ 6,037.81	$ 30,899.96
Energy Activities									
Oil, Gas, and Coal	EUB	EUB	4	2.44		$ 139,408.28	$ -	$ 148,138.15	$ 287,546.43
Other Activities									
Environmental/Land Use	EUB	EUB	2	0.76		$ 39,528.25	$ -	$ 36,759.65	$ 76,287.90
Hydrogeology	EUB	EUB	2	2.54		$ 159,996.92	$ -	$ 118,219.15	$ 278,216.07
Geoscience Information System	EUB	EUB	3	2.5		$ 129,308.85	$ -	$ 184,769.75	$ 314,078.60
Chief's Office/Administration	EUB	EUB	4	7.46		$ 413,456.78	$ -	$ 137,999.43	$ 551,456.21
Laboratories	EUB	EUB	1	0.28		$ 14,499.65	$ -	$ 20,176.53	$ 34,676.18
Miscellaneous									
Library	EUB	EUB	1	0.49		$ 18,665.94	$ -	$ 41,538.86	$ 60,204.80
Publication/Data Sales	EUB	EUB	3	2.4		$ 121,214.55	$ -	$ 63,766.57	$ 184,981.12
Other	EUB	EUB	4	0.84		$ 45,728.62	$ -	$ 163,914.36	$ 209,642.98
Totals				**26.58**	**0**	**$ 1,499,083.30**	**$ -**	**$ 1,193,210.80**	**$ 2,692,294.10**

Province: SASKATCHEWAN 1997-1998

	# Projects	Positions #py's Permanent	Positions #py's Non-permanent	Salaries Permanent	Salaries Non-permanent	Operational $	Total $
Mineral Activities							
Bedrock Geology Survey	7	5	3	$339,983.00	$ 132,000.00	$194,746.00	$ 666,729.00
Mineral Investigations	1	1	0	$ 64,821.00	$ -	$ 8,673.00	$ 73,494.00
Mineral Deposit Invertory	1	1	0.3	$ 51,927.00	$ 8,000.00	$ -	$ 59,927.00
Industrial Mineral Studies	2	2	0.3	$106,201.00	$ 8,000.00	$12,345.00	$ 126,546.00
District Geologists	n/a	2	0	$124,093.00	$ -	$ -	$ 124,093.00
Core Depositories	1	0	0.3	$ -	$ 8,000.00	$10,513.00	$ 18,513.00
Mineral Resource Assessment	1	1	0	$ 47,389.00	$ -	$ 2,239.40	$ 49,628.40
Energy Activities							
Oil/gas	n/a	7	3	$ 230,884.00	$ 58,716.00	$ 8,600.00	$ 298,200.00
Core Depositories	1	5	3	$ 130,260.00	$ 76,640.00	$ 25,800.00	$ 232,700.00
Subsurface analysis	3	5	1	$ 267,690.00	$ 24,210.00	$ 16,200.00	$ 308,100.00
Other Activities							
Chief's Office/Administration	n/a	1.6	1	$ 87,716.00	$ 21,887.00	$ 81,726.00	$ 191,329.00
Miscellaneous							
Publications	n/a	2.5	0.6	$ 147,827.00	$ 23,064.00	$ 70,978.00	$ 241,869.00
Information/Assessment Files	n/a	0	0.7	$ -	$ 26,920.00	-	$ 26,920.00
Other - GIS/Computerization	n/a	1	1	$ 56,274.00	$ 32,095.00	$ 18,741.00	$ 107,110.00
Grand Total	**17**	**34.1**	**14.2**	**$ 1,598,791.00**	**$ 387,437.00**	**$ 431,820.40**	**$ 2,525,158.40**

Province: MANITOBA 1997-1998

	Survey Research Agency	Funding Agency	No. of Projects or Facilities	Permanent SMY	Casual/ Term SMY	SALARIES Permanent $	SALARIES Casual $	Operating Expenditures $	TOTAL
Mineral Activities									
Bedrock Geology Surveys	MGS	MAN	26	12:00	2:34	$785,100	$50,700	$159,700	$995,500
Geochemical Surveys	MGS	MAN	1	2:00	0:26	$143,400	$9,500	$213,400	$366,300
Surficial Geology Surveys	MGS	MAN	3	1:00	0:39	$56,600	$17,000	$2,500	$76,100
Geophysical Surveys	MGS	MAN	2	1:00	-	$63,800		$2,600	$66,400
Mineral Investigations (Field)	MGS	MAN	5	2:00	0:46	$137,800	$16,600	$50,900	$205,300
Mineral Deposit Analysis/Inventory	MGS	MAN	1	1:00	-	$57,200		$0	$57,200
Industrial Minerals	MGS	MAN	2	1:00	0:13	$60,100	$4,300	$4,300	$68,700
District Geologists	MGS	MAN	4	4:26	-	$205,300		$35,300	$240,600
Core Repositories	MGS	MAN	6	1:00	-	$40,900	$0	$11,000	$51,900
Other Activities									
Environment/Land Use	MGS	MAN	1	-	-			$700	$700
Hydrology	MGS	MAN	-	-	-				
Laboratories	MGS	MAN	3	4:00	-	$137,600	$0	$18,300	$155,900
Miscellaneous Activities	MGS	MAN	3	9:00	-	$408,400		$68,300	$476,700
Chiefs Office/Administration	MGS	MAN	9	6:26	-	$300,100	$0	$628,000	$928,100
TOTALS Reported in Table 1	**-**	**-**	**66**	**45:00**	**5:02**	**$2,396,300**	**$98,100**	**$1,195,000**	**$3,689,400**
Industry Grant Programs									
Prospector Assistance									$122,224
Mineral Exploration Assistance (MEAP)									$3,000,000
Grand Total	**-**	**-**	**66**	**45:00**	**5:02**	**$2,396,300**	**$98,100**	**$1,195,000**	**$6,811,624**

Province: ONTARIO 1997-1998

	Funding Agency	No. of Projects or Facilities	Staff Permanent (person/yrs)	Staff Contract (person/yrs)	Salaries	Operating Expenditures[1] (incl. Benefits)	Totals
Mineral Activities							
Bedrock Geology Surveys	MNDM	13	19.5	7.5	$1,421,300	$925,900	$2,347,200
Geochemical Surveys	MNDM	4	5.5	2.5	$406,000	$297,300	$703,300
Surficial Geology Surveys	MNDM	4	6.0	3.0	$448,000	$32,500	$480,500
Mineral Investigations (field)	MNDM	2	3.0	1.5	$224,600	$149,100	$373,700
Mineral Deposit Analysis and/or Inventory	MNDM	1	0.5		$31,600	$26,600	$58,200
Industrial Minerals	MNDM	4	4.0	1.5	$285,000	$215,000	$500,000
District Geoogists	MNDM	11	35.0		$1,785,200	$765,000	$2,550,200
Core Repositories	MNDM		2.0		$95,000	$56,000	$151,000
Geophysical Surveys	MNDM	6	1.0		$63,100	$98,300	$161,400
Other Activities							
Geoscience Assessment	MNDM		1.0		$58,500	$32,300	$90,800
Environment/Land Use	MNDM		1.0		$71,000	$39,900	$110,900
Laboratories	MNDM		11.0	13.0	$1,050,300	$762,000	$1,812,300
Miscellaneous Details							$0
Library	MNDM		1.0		$35,300	$41,400	$76,700
Publications	MNDM		10.0		$478,900	$337,000	$815,900
Data Services	MNDM		7.5		$437,000	$832,500	$1,269,500
Totals			**108.0**	**29.0**	**$6,890,800**	**$4,610,800**	**$11,501,600**
Industry Grant Programs							
Prospector's Assistance*	MNDM/OPAP					2,000,000	2,000,000

**Program administered by Mines Group*

MNDM - Ministry of Northern Development & Mines

OPAP - Ontario Prospector's Assistance Program

[1] Salary benefits increased 7% in 97/98 over 96/97

Province: QUÉBEC 1997-1998

	Financement	Nb de Projets	Employés			Salaires			Dépenses d'opération	Total
			Permanents	Occasionnels	Contrat	Permanents	Occasionnels	Contrat		
			(équivalent à temps complet)				$		$	$
Activités géominières										
* Cartographie géologique	MRN	13	18.5	19.4	9.8	$899,800	$643,100	$529,000	$2,263,600	$4,335,500
*Levés/études géochimiques	MRN/Co	2	1.8			$102,700			$3,332,000	$3,434,700
*Levés/études géophysiques	MRN	13	1.0		0.8	$58,700		$17,000	$56,000	$131,700
*Levés/études géologie de surface	MRN	2	1.0	0.3		$58,700	$7,600		$57,200	$123,500
* Recherche en métallogénie (terrain)	MRN	9	4.5	1.8	2.0	$251,200	$32,800	$107,000	$249,000	$640,000
* Cîtologie	MRN	3	1.1	1.0		$56,700	$45,000		$13,000	$114,700
* Étude de potentiel minéral	MRN	2	0.8			$50,300			$305,000	$355,300
* Minéraux industriels	MRN	6	4	0.3		$234,000	$7,600		$47,400	$289,000
* Géologues résidents	MRN		32.9	3.1		$1,080,800	$80,000		$206,300	$1,367,100
Autres activités										
* Administration/Bureau du géologue en chef	MRN		20.1			$796,500			$572,400	$1,368,900
Divers										
* Publications	MRN		9.1	3.9		$405,700	$150,000		$178,000	$733,700
* Information	MRN		8.7	3.5		$404,800	$100,000		$393,100	$897,900
* Autres (SIGÉOM-GIS)	MRN	14	7.5	2.7	0.5	$352,500	$124,100	$20,000	$1,112,800	$1,609,400
Total		**64**	**111**	**36**	**13.1**	**$4,752,400**	**$1,190,200**	**$673,000**	**$8,785,800**	**$15,401,400**

MRN = Ministère des Ressources naturelles
Co = Compagnies d'exploration

Province: NEW BRUNSWICK 1997-1998

	No. of Projects	Staff			Salaries	Operating	Total
		Perm.	Casual	Contract			
Geological Surveys Branch							
Bedrock Geology	5	5	0.8		$295,380	$131,200	$426,580
Surficial Geology and Till Geochemistry	6	5	0.4		240,260	147,800	$388,060
Mineral Deposits	4	3.5	0.7		181,410	62,150	$243,560
GIS and Digital Technology	4	3.5	0		134,850	50,150	$185,000
Regional Geologists	2	7			297,400	79,200	$376,600
Drill Core	3	1			53,300	33,900	$87,200
Editorial (Communications Branch)	1	1			48,000	5,900	$53,900
Director's Office	1	1			66,600	7,800	$74,400
Geophysics (Airborne)	1					440,000	$440,000
Industrial Minerals	3	3			157,000	25,400	$182,400
Publications, Education	5	5			186,500	51,700	$238,200
Oil, Gas, Oil Shale	1	1	0.2		61,500	12,700	$74,200
Total	**36**	**36**	**2.1**		**$1,722,200**	**$1,047,900**	**$2,770,100**

1 Includes $100,000 funding from N.B. Regional Development Corporation

2 Includes $20,000 funding from N.B. Department of Natural Resources and Energy Development Fund

3 N.B. Regional Development Corporation funding

Province: NOVA SCOTIA 1997-1998

	Survey Research Agency	Funding Agency	No. projects or facilities	Employees		Operating Expenditures	Salaries	Total
				Permanent	Casual*			
Mineral Activities								
Bedrock Geology Surveys	MERD	NSDNR	6	4.7	1.25	$33,300	$251,612	$284,912
Geochemical Surveys	MERD	NSDNR	1	2.6	0	$10,200	$104,457	$114,657
Surficial Surveys	MERD	NSDNR	2	1.7	0.5	$12,500	$91,261	$103,761
Geophysical Surveys	MERD	NSDNR	0	0	0	$0	$0	$0
Mineral Investigations (Field)	MERD	NSDNR	3	3.5	0.5	$43,500	$181,686	$225,186
Mineral Deposit Analysis/Inventory	MERD	NSDNR	2	2.5	0.5	$28,000	$127,308	$155,308
Industrial Minerals	MERD/MEDD	NSDNR	2	2.5	0.25	$23,000	$122,826	$145,826
District Geologists	RSD	NSDNR	3	0	0	$0	$0	$0
Core Repositories	MERD	NSDNR	1	6	0.55	$40,400	$264,982	$305,382
Energy Activities								
Coal/Peat	MERD	NSDNR	2	2.5	0.25	$22,000	$162,043	$184,043
Oil and Gas	PD	NSDNR	0	0	0	$0	$0	$0
Core Repositories	PD	NSDNR	0	0	0	$0	$0	$0
Subsurfact Analysis	PD	NSDNR	0	0	0	$0	$0	$0
Other Activities								
Environmental/Land Use	MERD	NSDNR	2	2.4	0.25	$7,000	$138,882	$145,882
Hydrology	DOE		0	0	0	$0	$0	$0
Laboratories			0	0	0	$0	$0	$0
Misc. Activities	MERD	NSDNR	0	0	0	$0	$0	$0
Chief Geol's Office/Admin.	MERD	NSDNR	0	4	1	$65,000	$167,470	$232,470
Miscellaneous Details								
Library	PS	NSDNR	0	0	0	$0	$0	$0
Publications	MERD	NSDNR	0	3.4	0	$47,800	$157,300	$205,100
Public Awareness/Prospectors Training	MERD	NSDNR	0	1.4	0.25	$7,000	$92,737	$99,737
Information/Assessment Files	MERD	NSDNR	0	1.4	0	$7,000	$82,100	$89,100
Research Grants			0	0	0	$0	$0	$0
Information Technology	MERD	NSDNR	0	2.4	0.75	$18,200	$171,746	$189,946
Totals				**41**	**6.05**	**$364,900**	**$2,116,410**	**$2,481,310**

Budget figures for MERD only;
MERD - Mineral and Energy Resources Division
MEDD - Mines and Energy Development Division
RSD - Regional Services Branch
PDA - Petroleum Directorate
PS - Planning Secretariat
DOE -Department of Envrironment

Province: NEWFOUNDLAND and LABRADOR 1997-1998

	Survey Research Agency	Funding Agency	Number of Projects / Facilities	Permanent SMY	Casual SMY	Permanent $	Salaries Contract [1]	Casual $	Operating Expenditures	Totals
Mineral Activities										
Bedrock geology surveys	GSNL	NDME	13	11	4	$500,272	-	$54,200	$348,678	$903,150
Geochemical Surveys	GSNL	NDME	4	3	1	$163,923	-	$8,596	$19,937	$192,456
Surficial geology Surveys	GSNL	NDME	3	3	1	$148,220	-	$16,733	$63,885	$228,838
Geophysical Surveys	GSNL	NDME	1	1	-	$48,304	-	-	$1,206	$49,510
Mineral Investigations (field)	GSNL	NDME	4	3	1	$170,327	-	$16,994	$118,577	$305,898
Mineral deposit analysis and/or inventory	GSNL	NDME	1	3	-	$119,811	-	-	$356	$120,167
Industrial minerals	GSNL	NDME	2	2	-	$107,742	-	-	$27,398	$135,140
District geologists	-	-	-	-	-	-	-	-	-	-
Core repositories	MLD	NDME	1	2	1	$91,026	-	$11,325	$33,490	$135,841
Energy Activities										
Coal/Peat	-	-	-	-	-	-	-	-	-	-
Oil & Gas	EB	NDME	4	20	-	$809,900	$181,000	-	$305,300	$1,296,200
Core Repositories	-	-	-	-	-	-	-	-	-	-
Subsurface Analysis	-	-	-	-	-	-	-	-	-	-
Other Activities										
Environment/Land Use	MLD	NDME	1	2	-	$96,572	-	-	$16,338	$112,910
Hydrology	-	-	-	-	-	-	-	-	-	-
Laboratories	GSNL	NDME	1	5	-	$189,306	-	-	$49,727	$239,033
Miscellaneous Activities	-	-	-	-	-	-	-	-	-	-
Director's Office/ Admin.	GSNL	NDME	2	7	1	$216,248	$15,921	$6,878	$161,090	$400,137
Miscellaneous										
Library	GSNL	NDME	1	3	-	$44,461 *	-	-	$5,646	$50,107
Publications/Cartography	GSNL	NDME	3	8	-	$225,120	$29,827	-	$52,527	$307,474
Information/Assessment files	GSNL	NDME	2	3	-	$136,990	-	-	$34,192	$171,182
Research Grants	-	-	-	-	-	-	-	-	-	-
Information Technology	GSNL	NDME	1	-	-	-	-	-	$149,147	$149,147
Totals			**44**	**76**	**9**	**$3,068,222**	**$226,748**	**$114,726**	**$1,387,494**	**$4,797,190**
Total Geological Survey Activities Reported in Table 1										**$3,252,239**

GSNL - Geological Survey of Newfoundland and Labrador
MLD - Mineral Lands Division
MB - Mines Branch
EB - Energy Branch
NDME - Newfoundland Department of Mines and Energy
1 - includes long-term temporary staff
** - includes $ 21,349 (Opening Doors Program)*

Territory: Northwest Territory 1997-1998

	Funded by	Projects	PY's	Salary	O&M	Totals
Mineral Activities						
Bedrock Mapping	INAC	1	1	$70,000	$121,000	$191,000
	GNWT	2	2	$120,000	$220,000	$340,000
District Geologists	INAC	-	4.4	$320,000	$94,000	$414,000
Other Activities						
Mineral Showings Database	INAC	1	2	$114,000	$445,000	$559,000
Chief Geologist/Admin	INAC	-	2	$128,000	$230,000	$358,000
Miscellaneous						
Library/Publications	INAC	1	1	$38,000	$13,000	$51,000
Archives/Assessment Files	INAC	1	1	$57,000	$44,000	$101,000
Research Grants/Contributions	INAC	7	-		$555,000	$555,000
Mineral Development Area Projects	GNWT	2	2	$130,000	$120,000	$250,000
Staffing	INAC				$52,000	$52,000
Totals:				**$977,000**	**$1,894,000**	**$2,871,000**

Territory: YUKON 1997-1998

	Agency	Funding	Projects	Staffing		Expenditure
				Permanent	Casual	
Mineral Activities						
Bedrock Geological Surveys	YTG	INA/YTG	2	1.25	0.5	$129,200
	GSC	INA/YTG/GSC	1	1	0.25	$94,200
Mineral Deposit Studies	INA	INA/YTG	1	1	0.25	$136,400
	YTG	INA/YTG	1	1	0.5	$133,400
Geological Compilation	GSC	INA/YTG	1	0	0	$40,000
Surficial Geology	YTG	INA/YTG	1	0	0.25	$83,400
	INA	INA	1	1	1	$220,200
	GSC	INA/YTG/GSC	1	0	0	$65,000
Geophysical Surveys	GSC	INA/YTG	1	0	0	$130,000
Mineral Resource Assessments	YTG	YTG	2	1	0	$100,000
	YTG	INA/YTG	1	1	0	$145,000
Mineral Deposit Inventory	INA	INA	1	0.75	0.25	$67,400
	YTG	INA/YTG	1	0	0	$40,000
District Geologists	INA	INA	1	1	0	$68,000
Core Repositories	INA	INA	1	0.25	0.25	$17,500
Energy Activities						
Oil & Gas Resource Assessments	YTG/NEB	YTG	1	0	0	$50,000
Other Activities						
Chief Geologist / Administration	YTG	INA/YTG	1	1	0	$212,700
	YTG	YTG	1	1	0	$87,300
	INA	INA	1	1.5	0	$206,600
Library	INA	INA	1	0	0	$15,000
Cartography/Publications	INA	INA	1	0.5	0.25	$10,000
	YTG	INA/YTG	1	1	0	$124,000
Assessment Files	INA	INA	1	0.25	0	$5,000
Economic Analysis	YTG	YTG	1	1	0	$66,800
Totals:				**16**	**4**	**$2,247,100**

GEOLOGICAL PROGRAM HIGHLIGHTS

OVERVIEW

The 1998 program was targeted at meeting government objectives in areas of economic development, environmental management, and land use planning. Early in the 98/99 fiscal year $750 000 was allocated to the branch for the field program targeted at stimulating and assisting mineral exploration. The base budget in 98/99 was $4.3 million. This was supplemented by $605 000 for partnership projects with other government departments.

In February 1998 a separate Ministry of Energy and Mines was recreated in a government reorganization. The GSB is one of 6 Branches in the Energy and Minerals Division. In April 1998 the Government announced new mining initiatives to spur exploration and development. These include:

- A 20% refundable tax credit for mineral exploration
- The Mining Rights Amendment Act which recognises the right to mine and assures access to mineral tenures and the right to compensation when tenures are expropriated for parks.
- The Mineral Exploration Code which applies environmental standards designed specifically for exploration.
- Creation of a mining-advocate position. Responsibilities include creating within government a positive climate for mining in British Columbia and addressing issues directly at a high level to ensure an efficient process for administration of exploration and mining.

One new mine opened in 1998, the Kemess South porphyry gold-copper mine in the remote Toodoggone area. Exploration expenditures in 1998 were depressed because of low commodity prices, problems in equity markets and other factors. Focus continued to be on gold-enriched porphyries, VMS deposits and gold deposits.

PROGRAM HIGHLIGHTS FOR 1998

Economic Development Program

The Branch's economic development field surveys concentrated on under-explored frontier regions and on areas with established mining infrastructure, such as the Gibraltar Mine area. Highlights include:

- Completion of fieldwork for the 5-year Nechako Plateau NATMAP project, which is a collaborative effort with the Geological Survey of Canada and various universities. The focus of GSB work is on the Babine porphyry belt with its important mineral potential and the Sitlika belt for its volcanogenic massive sulphide potential.
- Release of survey results for the Regional geochemical survey of the Mesilinka River Map Sheet (94C) in east central British Columbia
- Year 3 of the multidisciplinary Eagle Bay Project which is utilising surficial geology and till geochemistry to look for buried mineral deposits in the Adams Plateau area.
- Continuation of the Devono-Mississippian VMS project which is mapping potential extensions of strata that host the Kudz Ze Kayah and Wolverine deposits into northern British Columbia.
- The McConnell Range regional mapping project which extended existing coverage of the Toodoggone volcanic belt in the general area of the Kemess deposit.
- Examination of a number of mineral deposits and deposit types such as remapping the regional geology around the Gibraltar copper mine to provide new exploration ideas, field investigations of sediment hosted gold deposits, and examinations of a number of gemstone prospects.
- Initiation of a new NATMAP project in the Foreland Belt in the northeast Rocky Mountains. This area has significant oil and gas potential and the westernmost past of the area, being studied by the GSB, also has lead-zinc mineralization. The GSB carried out bedrock mapping and collaborative mineral deposit studies with the GSC.

Resource Management Program

Significant improvements were made to the Branch's Internet site in 1998. Using MapGuide (TM) viewer (downloadable from our site) clients can now view, plot and perform sophisticated analysis on most of the Geological Survey Branch's georeferenced spatial information sets. Data such as geology, mineral occurrences, geochemistry, geophysics and mineral tenure are available for dis-

play and also provide a window into the associated supporting databases through a series of online reports. Some information such as geology and regional geochemistry are available for free download by map sheet or user defined areas.

The Branch received $135 000 from the Corporate Resource Inventory Initiative to maintain the Mineral Potential database of the province and to complete more detailed mineral potential analysis of the current planning area. Data compilation and analysis of the Cassiar-Iskut-Stikine area was completed in 1998 and the results were provided to the Planning Table. Work on the Lilloeet planning area is ongoing.

The Terrain Stability project, funded by Forest Renewal BC, continued in 1998. The Branch audits digital terrain data submitted by forest companies in compliance with the new Forest Practices Code and makes this data available over the Internet. Also, existing paper maps are being digitised and added to the database. In 1998 over 400 maps were digitised.

Aggregate potential maps were prepared for the Nanaimo Regional District at their request.

Publications

The Branch continued to produce print-on-demand publications and moved toward Internet publishing for maps and reports. Selected geoscience publications can be found at:

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

Prospector Assistance

The Government continued to issue grants to encourage prospectors to conduct grassroots exploration in the Province. Fifty-two prospectors received grants worth more than $420 000 in 1998.

INDUSTRIAL ACTIVITY

Oil Sands

In spite of the drop in oil prices, billions of dollars worth of oil sands projects are going ahead.

Diamond Exploration

Diamond exploration continues to evolve in Alberta as a result of Ashton Mining of Canada Inc., Pure Gold Minerals, and Alberta Energy Company's discovery of 23 kimberlites, 16 of which are diamondiferous, in the Buffalo Head Hills area of north-central Alberta. Kennecott and Montello announced a new kimberlite discovery East of the Buffalo Head Hills in October 1998.

Industrial Minerals

United Industrial Services Ltd. near Peace River are constructing a new plant for processing of silica from the Peace River Formation. Limestone, primarily for cement and lime, is the most valuable industrial minerals commodity being produced in Alberta. Sand and gravel ranks a close second with 1997 and 1998 being exceptional years for the industry. Sulphur, salt, calcium chloride (brine), clay, stone and ammolite all continue to be produced.

AGS

AGS delivers its mission and responsibilities through a team-based structure which currently is comprised of two units: Energy and Mineral Resources, and Client Services. The former is responsible for geological studies and the latter for GIS, information dissemination and related client service and program support.

Areas of expertise within the AGS are: surficial geologic mapping, stratigraphic studies, oil sands, coal, basin analysis, hydrogeology, geothermics, industrial minerals, structural geology, remote sensing, geologic database management and geographic information systems.

PRESENT ACTIVITIES - Northeast Alberta

Heavy Oil, Oil Sands

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. These studies are in support of the oil sands developments that utilize SAGD Steam Assisted Gravity Drainage) technology, and include: oil sands depositional environments and their relation to reservoir characteristics; Quaternary and hydrostratigraphic mapping; bedrock geology; and aggregate studies.

Using a high quality seismic line, a number of lateral accretion sets and multiple channel fills have been identified. Gas, water and bitumen isopach maps are also being created.

A unified facies classification has been developed to describe the facies variation of the oil sands on a regional scale.

In addition, AGS provided support to Alberta Energy and Utilities Board hearings in the Cold Lake Area.

Birch Mountains Area

Quaternary geology studies are determining the metallic mineral and diamond potential in this area and are currently focussed on mapping the bedrock topography, drift thickness, and major Quaternary stratigraphic units. Stratigraphic information from more than 5000 boreholes in an area covered by 2.5 NTS map sheets (73D, 73E, 84A, 84H) is being compiled. A number of buried channels have been identified, containing significant buried fluvial deposits.

Studies related to diamond and metallic minerals exploration are under way in Northeast and central Alberta. They include Quaternary stratigraphy, diamond indicator mineral sampling, and other methods as appropriate. Soil geochemistry and biogeochemistry profiles show significant anomalies over the Mountain Lake diatreme, indi-

cating that these methods can be used as exploration tools.

PRESENT ACTIVITIES - West Central and Northern Alberta

The Kakwa-Wapiti region has active coal, petroleum and diamond exploration. The metallic mineral potential of this area is not well known. Seismic information was used to identify a number of faults and detachment zones and a cross section was prepared. Esker complexes containing coarse gravel and coarse outwash deposits were identified.

In the Peerless Lake area of Northern Alberta, subsurface data from more than 600 water wells and 1000 oil wells were acquired, and field samples were collected for diamond indicator minerals and geochemistry, to determine drift thickness, quaternary stratigraphy, glacial history, and ice-flow and mineral-dispersal patterns. Glacial flow was found to have been strong and southwesterly, and pre-glacial gravels were discovered in the Buffalo Head Hills area.

ONGOING ACTIVITIES

Assessment reports

Metallic and industrial mineral exploration activity was up five-fold in 1998 from the previous year with diamond exploration leading the way. Gold, precious metals, limestone, magnetite and alumina were also very active. Up to October 1998, 17 reports were submitted with expenditures of $17,138,011 on 2,079,267 ha. of permitted lands. Most of these expenditures were related to diamond exploration activity. In 1997, 14 reports were submitted for a total claim of $2,750,110 on 547,576 ha. Twenty-seven assessment reports submitted in 1996/97 were taken off the confidential list and made public.

Information Services

A complete catalogue of AGS data holdings (both digital and hard copy) is being developed. Reports and data releases are being implemented on the AGS world wide web site. The AGS is participating in the Geoscience Knowledge Network (GSKN) that is being coordinated by the National Geological Surveys Committee. It will provide access to AGS information, publications and data via the AGS web site and the GSC GSKN common interface.

Web Site Activity

AGS restructured its web site and re-implemented it on new server software in May, 1998. The site was visited between 600 and 1400 times a week in September 1998 compared to between 1000 and 1400 times a week a year ago and between 150 and 450 times two years ago.

The most popular documents this year are the publications indices, followed by the new Atlas of the Western Canada Sedimentary Basin. The new publications list and Geo-Notes are also very popular.

A detailed list of AGS Programs, activities and contacts is located on the AGS website:

http:// www.ags.gov.ab.ca

Funding for the Saskatchewan Geological Survey remained unchanged in 1998-1999 at $2.5 million inclusive of professional and support staff salaries, summer student hiring, and operational expenditures. Although many projects were a continuation of those undertaken in 1997-98, new initiatives were begun in the northern part of the Precambrian Shield and industrial minerals. Additional enhancements to the province's geoscience program were achieved through cooperative ventures with the Geological Survey of Canada, Saskatchewan universities and the mineral exploration industry.

PRECAMBRIAN GEOLOGY

Once again three Saskatchewan Geological Survey and one Geological Survey of Canada mapping parties were active on the La Ronge – Lynn Lake Bridge Project. This was the third year of this major five year project that will: 1) see completion of 1:20000 map coverage of the PaleoProterozoic La Ronge Domain to the Saskatchewan – Manitoba border; 2) will examine the relationships of major crustal units accreted to the Rae-Hearne Craton in a north-south transect on Reindeer Lake; and 3) evaluate mineral potential. Two crews were involved in a new reconnaissance mapping project to the north of Lake Athabasca that will study the tectonic history and mineral potential of this generally poorly mapped area. Another field project focused on the stratigraphic context of sandstone-hosted Zn-Pb mineralization in the Wollaston Domain. As well, two other mapping parties continued work on a structural and stratigraphic transect of the domain initiated last year. This project has potential implications for uranium exploration in the Athabasca Basin and is a cooperative venture with the uranium industry and the Universities of Regina and Saskatchewan. Another new project examined the structural context of gold mineralization in the vicinity of the Byers Fault Zone of the Central Metavolcanic Belt in the La Ronge Domain. Also, the Precambrian portion of approximately eighty southern Saskatchewan drill cores was described in the first step of a multi-year project to catalog information on the sub-Phanerozoic Precambrian. Again this year, projects were augmented by undergraduate and postgraduate thesis projects at the Saskatchewan universities.

INDUSTRIAL MINERALS

Investigation of sodium sulphate deposits in southern Saskatchewan was initiated. Some of these deposits appear to be actively forming and a better understanding of deposit genesis should lead to enhancement of their value as resources. Collection of brine chemistry data from oil well samples continued. Brines could provide the feedstock for a diversified chemical industry in Saskatchewan. All available diamond-indicator mineral analyses have been compiled into a single database that will be published as a digital file.

PETROLEUM GEOLOGY

Three subsurface projects continued, one on Cretaceous post-Mannville Group rocks, another on Early Paleozoic strata, and the third on production of annotated digital 1:2 000 000 scale structure and isopach maps of the province's main Phanerozoic stratigraphic units. Staff contributed significantly to the new Geological Map of Saskatchewan and also were involved in several joint projects with the Geological Survey of Canada (both Calgary and Ottawa offices), and the Geology Departments of the Universities of Alberta, Regina and Saskatchewan.

Acquisition of several continuous cores through predominantly Cretaceous strata, recovered during kimberlite exploration drilling in the east-central and central parts of the Province, provides researchers with a valuable new data source.

The high demand being placed on the Petroleum Geology Branch for core and sample examinations, for processing and providing well information and processing of industry submitted drill cuttings and well log data has been somewhat reduced by the implementation of several amendments to the Oil and Gas Conservation Regulations. Of particular note is the requirement that industry now submit samples of drill cuttings already washed and labeled.

Core storage space has been increased by construction of a warehouse extension to the Subsurface Laboratory, potentially giving several more years of storage space. Internal reconstruction of the heated storage area has also expanded space for drill cuttings.

COMPUTERIZATION

Digital product and processing capability continues to develop not only in the Saskatchewan Geological Survey but also throughout the Saskatchewan Department of Energy and Mines. GIS software is being used to aid in map production and geological interpretation. All current Precambrian geology maps included with the Summary of Investigations are produced using AutoCAD and FieldLog on digital bases provided by SaskGeomatics. The 1: 1 000 000 scale Surficial Geology Map of Saskatchewan is available in hard copy and digital (DXF) format. The revised 1:1 000 000-scale Geology Map of Saskatchewan is nearing completion and both the hard copy and digital versions including various related data bases will be available on CD-ROM in GIS format this year. It is planned to release new versions of the CD-ROM as new data become available. Mineral claim maps are in the process of being converted to digital format and assessment work area maps are available digitally.

The Internet site for the department,

http:// www.gov.sk.ca/enermine

has been significantly expanded and upgraded and will continue to see the addition of information items.

MINERAL RESOURCE ASSESSMENTS

Regional mineral resource assessments, of known and potential mineral resources, are being done in response to Saskatchewan's Representative Areas Network program to preserve ecological diversity and regional integrated land use planning processes. Appraisals have been completed for the Pasquia-Porcupine, Suggi Lowland, Cumberland Delta, and southern Amisk-Atik areas in east-central Saskatchewan, the Primrose Lake Air Weapons Range in west-central Saskatchewan, the Prince Albert region in central Saskatchewan, and the Cypress Hills and Wood Mountain areas in southwest Saskatchewan. Current work is focussed on evaluating Shield terrain in the northern Amisk-Atik area, and the northeast and northwest corners of the province. Developed by the Ontario Geological Survey, the mineral assessment methodology is qualitative and integrates geoscience and mineral and petroleum exploration and development data with assessment criteria derived from descriptive mineral deposit models. Participation of the mineral and petroleum industries is a crucial component of the process.

EXPLORATION AND DEVELOPMENT

Mineral exploration expenditures are estimated at $39 million in 1998, a decrease of $4 million over actual expenditures of $43 million in 1997. This reflects a leveling off of uranium exploration activity at $27 million dollars and a decrease for gold and base metals. These figures exclude uranium, base metal and gold test mining, and underground exploration costs of $272 million in 1997 and estimated expenditures of $320 million in 1998.

A major development in the uranium sector was the acquisition of Uranerz Exploration and Mining Ltd., by Cameco Corporation. Construction work continued on the McArthur River project ($360 million) and began on the Cigar Lake project ($410 million) following regulatory approval. Cigar Lake and McArthur River comprise two of the highest grade uranium ore bodies in the world. Mineable reserves at Cigar Lake are estimated at more than 350 million pounds at an average grade of 14% U3O8; mineable reserves at McArthur River are estimated at 189 million pounds at an average grade of 18.7 % U3O8. Commercial production is expected to begin at McArthur River in late 1999 and at Cigar Lake in 2001. Ore from McArthur River will be milled at Key Lake; Cigar Lake will be milled at McLean Lake. Cogema Resources Inc. completed first phase construction of the $250 million McLean Lake project and is working towards licensing of the JEB Tailings Management Facility. At Rabbit Lake underground mining of the Eagle Point orebody continued and previously mined ore from the Collins Bay A and B zones was milled. Cogema announced plans to suspend mining operations at Cluff Lake in the year 2000 due to economic conditions.

Exploration expenditures for gold are expected to remain low at about $3 million. The Seabee gold mine of Claude Resources is expected to produce about 60,000 ounces in 1998 at a cash cost of below U.S. $185 per ounce. The Contact Lake gold mine closed in mid-1998 due to lower than expected grades.

Expenditures on base metal exploration are expected to decrease to about $6 million from $9 million in 1997. Hudson Bay Mining and Smelting announced the decision to proceed with the final phase of development of the Konuto Lake Cu-Zn orebody near Creighton, at a capital cost of $27.5 million. Production is expected to begin in June 1999. Foran Mining optioned the McIlvenna Bay deposit, near Hanson Lake, and is currently evaluating the feasibility of mining it.

Diamond exploration expenditures are projected to be about $3 million dollars.

Petroleum exploration and development have decreased with the numbers of both horizontal and vertical wells drilled down by 46% and 49% respectively relative to 1997. This level of activity is still high, however, compared to other years because 1997 was a record year for our petroleum industry in all aspects. These work levels are attributed to the ongoing application of horizontal drilling techniques and the stimulus of Deep Rights Reversion Regulations which came into effect in April 1998. Companies producing from upper level strata are now obliged to explore deeper levels or forfeit their rights to the deeper strata to the government for potential resale. Encouraging discoveries and production from several deep formations, especially the Ordovician Red River, add impetus to petroleum activity.

In 1998, geological programming in Manitoba, along with other government initiatives, continued to focus on stimulating socio-economic development by fostering a positive business climate for investment in mining and exploration within the province. The Manitoba Department of Energy and Mines has developed a mining strategy that summarizes a series objectives designed to help the Department fulfill its vision of making Manitoba the best place in Canada to invest in the minerals industry. This year, specific outcomes include:

- ✦ The introduction of more favourable taxation policies;
- ✦ Renewal of the Mineral Exploration Assistance Program (MEAP) for an additional three years;
- ✦ Continuation of the Prospector's Assistance Program;
- ✦ Implementation of a new Specialty Minerals Incentives Program, to help foster development in the industrial minerals sector;
- ✦ Progress toward the development of a partnership protocol between aboriginal groups and the minerals industry; and
- ✦ Active participation and industry consultation in the review of candidate sites for the Endangered Spaces Program.

A key objective of the mining strategy is the provision of current and relevant geoscience information that supports the minerals industry, fosters sustainable development and results in wise land management. To meet this objective, increased funding levels for the Geological Services Branch (GSB) were sustained in 1998/99 at $3.78 million.

GEOSCIENCE PROGRAM

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

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

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

Flin Flon/Snow Lake

Current and planned projects in the Flin Flon Belt are aimed at building on the new concepts and interpretations resulting from the NATMAP Shield Margin Project. The final NATMAP 1:100 000-scale compilation maps were released in hardcopy on November 12, 1998. The fully integrated digital maps and data sets will be released on CD-ROM in early 1999.

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

- ✦ New 1:20 000 scale mapping in the most productive portions of the Flin Flon belt. The importance of arc extension and rifting in localizing VMS deposits has been documented in the Flin Flon and Snow Lake areas and similar environments have been identified in the Aimee-Naosap lakes area through a com-

bination of stratigraphic mapping and geochemistry. New 1:20 000 scale mapping in the Snow Lake and Squall Lake areas has provided the stratigraphic and structural framework for assessing the geological setting of gold mineralization in this area.

- A variety of more detailed studies focused on known areas of mineralization to identify new methods of assessing mineral potential. These include: 1) rhyolite geochemistry, to define the origin and geochemistry of barren and ore-related rhyolites associated with VMS deposits; 2) detailed mapping (1:10 000 to <1:5 000) at Snow Lake and Flin Flon that focuses on bringing new concepts in stratigraphy, structure and geochemistry to define the genesis of specific mineral deposits.

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

Lynn Lake/Leaf Rapids

Long term objectives for the Lynn Lake/Leaf Rapids region focuses on upgrading existing databases and maps to modern standards. To this end, all of the Lynn Lake Project 1:50 000, 3-colour maps (Gilbert et al., 1980) and adjoining Barrington Lake maps (Gilbert, 1993) are in the process of being digitized and rendered in colour. These maps will form the base for new regional geochemical, geochronological and thematic mapping projects. The maps will be updated and interrogated in light of the new data, with the possibility of some follow-up mapping to solve specific problems.

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

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

Thompson Nickel Belt

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

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

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

- Regional mapping at 1:50 000 and 1:20 000 scales, including: 1) 1:20 000 scale mapping in the Setting Lake area, to define lithological, structural and regional tectonic relationships along the western boundary of the TNB; and 2) 1:50 000 scale structural mapping and geochronological investigations in the Natawahunan Lake area, to resolve the tectonic and metamorphic history of the region as it relates to the tectonic evolution of the Churchill-Superior boundary zone.

- Thematic studies focused on the petrogenetic and metallogenic significance of mafic-ultramafic dikes and volcanic sequences in the TNB, including: 1) detailed stratigraphic studies of the mafic and ultramafic flows on Ospwagan Lake, to place constraints on the temporal and genetic evolution of "Ospwagan Group volcanic se-

quences" as related to Ni-sulphide mineralization in the TNB; and 2) detailed study of mafic intrusions to characterize the relative timing and age of mafic intrusions in the Thompson area.

Southeast Manitoba

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

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

Northern Superior Province

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

The regional multi-media geochemical sampling program continued this year in the Knife Lake, Webber Lake, Goose Lake and Aswapiswanan Lake areas. Geochemical and mineralogical analysis of these samples will continue to build a multi-element, multi-media geochemical database to assist in the identification of potential exploration targets. Results of the 1997 field program were released in September 1998. Release of the 1996 results in May 1997 has already resulted in the announcement of a discovery of significant mineralization in the Carrot River area. Compilation of geophysical data for the Superior Province continued this year. The second and final report of this series is scheduled for release in January 1999.

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

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

Southern and Central Manitoba

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

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

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

GSB is also involved in several large collaborative initiatives in the southern part of the province. The Winnipeg region NATMAP project, now its 2nd year of a 4 year program, is focused on 3-D mapping emphasizing engineering and environmental geology and surficial mapping.

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

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

GEOSCIENCE INFORMATION SERVICES

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

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

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

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

ACKNOWLEDGMENT

Dr. W. D. McRitchie, Director of the Geological Services Branch since late 1974, retired on October 1, 1997. For over twenty years, Dave provided enthusiastic and insightful leadership, that promoted key geoscience initiatives and maintained a healthy geological survey. The Geological Services Branch will continue to reap the benefits of his commitment to collaborative initiatives both with industry and other government agencies, many of which will provide the framework for geological programming in the province for years to come.

INTRODUCTION

The Precambrian Geoscience Section (PGS) delivers geoscience activities of the Ontario Geological Survey (OGS), the Sedimentary Geoscience Section (SGS) and the Resident Geologist Program (RGP). Cartographic and editorial services and delivery of hardcopy products to clients are the responsibilities of the Information Services Section. Archiving and distribution to clients of digital data are the responsibilities of the Data Services Section. Primarily the PGS and the SGS deliver the mapping function. The RGP focuses on front-line client services. The Geoscience Laboratory (GL) provides geochemical analysis to the OGS. The Mining Lands Section and the Mines Group administer the Mining Act, including legislation governing assessment information. As of August 31, 1998, there were 174 917 active claim units in Ontario, down from 183 299 in 1996. The Mines Group provides industrial mineral and building stone expertise. The geoscience program is focused on the support of the minerals industry.

The Ministry's Internet homepage is:

Http://www.gov.on.ca/MNDM/MINES/mmdhpage.htm

GEOSCIENCE ACTIVITIES – HIGHLIGHTS

Economic Activity

Listed according to commodity are advanced exploration projects:

Gold

1060 Zone Project, Kinross Gold Corp. (Abitibi Subprovince);

Aquarius Project, Echo Bay Mines Ltd. (Abitibi Subprovince)(project on hold pending improved gold prices);

Armistice Mine, Armistice Resources Ltd. (Abitibi Sup-province);

Bannockburn Project, Madoc Mining Ltd. (Grenville Province);

Fuller Zone Project, Vedron Gold Inc. (Abitibi Subprovince);

Glimmer Mine Project, Exall Resources Limited and Glimmer Resources Inc. (Abitibi Subprovince);

Hammond Reef Property, Pentland Firth Ventures Ltd. (Wabigoon Subprovince);

Madsen Mine Project, Madsen Gold Corp. (Uchi Subprovince);

Matachewan Property, Ontario Division, Royal Oak Mines Inc. (Abitibi Subprovince);

Stock, Taylor and Hislop Mines, St. Andrew Goldfields Ltd. (Abitibi Subprovince);

Thunder Lake West, Teck Exploration Ltd. (Wabigoon Subprovince);

North Williams Project, Extender Minerals of Canada Ltd. (Abitibi Subprovince);

Victoria Creek Project, Sudbury Contact Mines Ltd. (Abitibi Subprovince).

Nickel - Copper

Montcalm Project, Outokumpu Mines Ltd. (Abitibi Subprovince);

Victor Project, Inco Limited (Sudbury Igneous Complex);

Cobalt - (Nickel) – (Copper)

Werner Lake Cobalt Project, Canmine Resources Ltd. and Red Engine Resources (Winnipeg River Subprovince).

New or Expanded Operations

No new mines opened between September 1997 and August 1998.

GEOSCIENCE PROGRAM HIGHLIGHTS

Precambrian Geoscience Section

Precambrian bedrock mapping focused on the granite-greenstone terranes in the Abitibi, Sachigo, Wabigoon, and Wawa subprovinces, examination of rare metal pegmatite mineralization, and characterization of kimberlite intrusions. The Precambrian Geoscience Section (PGS) has entered into approximately 20 jointly-delivered projects involving university, industry, and other government geological surveys, including: a) western Superior NATMAP project; b) Abitibi stratigraphic mapping;

c) Abitibi gold deposit studies; d) airborne geophysical survey of Shining Tree area; and e) rare metal-petalite-bearing pegmatite studies.

The western Superior NATMAP project is designed to examine relationships between old oceanic and younger arc assemblages in the Superior Province with a view to the metallogenic and large-scale tectonic implications of these relationships. The Western Superior Lithoprobe transect provides an opportunity to image three-dimensional relationships beneath granite-greenstone, plutonic, and metasedimentary subprovinces. The Lithoprobe project includes geoscience projects by universities and the Geological Survey of Canada.

Sedimentary Geoscience Section

In 1998, Quaternary mapping and sampling projects were undertaken, in part, to gain an understanding of the distribution of kimberlite and base/precious metal indicator minerals. The results of the previous year's work in the Kapuskasing area has spurred land acquisition and upgraded the mineral potential of the region. A project sampling glacial and modern sediments was also conducted along the Vermilion River north of Sudbury. The project was designed to model the transport of mineral indicator grains through a drainage basin and assess what type of dispersal pattern is reflected in stream sediments by small greenstone belts occurring up-ice from the drainage basin.

A geochemical lake sediment survey was completed over the Garden Lake greenstone belt, north of Thunder Bay to assist in evaluating the mineral potential of the region and provide exploration targets. A project centered on determining how selective leach anomalies are produced continued in the thickly drift covered areas of the Abitibi greenstone belt. This work has led to the development of an electrochemical model that is being refined and tested in the field. The successful testing of the model could have significant implications to exploration in areas of thick overburden.

Fieldwork associated with aggregate resource inventory studies were completed in the area east of Sudbury and started for Renfrew County; the latter project is a two-year undertaking. Updating of existing aggregate inventories was completed for several counties and regional municipalities in the Greater Toronto and surrounding area.

Resident Geologist Program

During the latter part of 1997 and throughout 1998, Resident Geologist Program (RGP) staff were extensively involved in the "Lands for Life" process. This Government of Ontario land-use planning initiative involves Crown lands within three large regions. Program managers and staff spent thousands of hours conducting hundreds of mineral resource assessments and providing other geoscience/mineral sector information to three regional round tables. The three regional round tables, comprised of representatives from various stakeholder groups, were charged to make recommendations to Government in creating a blueprint for the future stewardship and management of public lands, and were asked to review and make recommendations on candidate sites nominated for protection and conservation considerations. MRAs played a key role in helping to maximize the area available for exploration and development. The round table recommendations are to be released during the autumn of 1998. RGP staff also performed their normal duties serving mineral sector clients and the public. Program staff responded to >16 000 client office visits, >22 000 client telephone inquires and conducted 276 field investigations.

A new and improved Mineral Deposits Inventory (MDI) database software was implemented. RGP staff are the stewards of the database. RGP also plans to release information via the Internet, including periodic updates of exploration activity and quarterly updates on recommendations for exploration within Ontario.

Information Services Section

Information Services Section (ISS) is responsible for marketing the geoscience, tax and infrastructure advantages of Ontario for investment attraction purposes. Marketing plans for 1998 include 10 trade shows, of which 4 are international and 6 are national. ISS is also responsible for the Geoscience Library services and the cartographic and hardcopy publication functions, through the Publication Services Section. Between September 1997 and August 1998, 39 maps, 25 reports, 10 digital information products and 9 digital data sets were released.

Data Services Section

Data Services Section (DSS) is improving the relevance of topic and quantity of content and ease of navigation of the Mines and Minerals Internet site (see URL, above) to provide information on: a) OGS programs and activities; b) Mining Lands and Mines regulation programs; c) hardcopy publica-

tions and digital data products; and d) exploration opportunities. The Mines and Minerals Division offers Mining Claims Information via the Internet:

Http://www.mndm.gov.on.ca/claims/clm_intr.cfm

Soon, mining claim maps will be delivered via the Internet.

The AeroMagnetic-ElectroMagnetic (AMEM) geophysical project has reprocessed and released 30 of 32 OGS-sponsored, high resolution airborne geophysical surveys to a common set of standards and format. The surveys are available on CD media. Each CD includes a program for simple data selection and viewing and exporting data to industry-standard data formats, which are suitable for use with more advanced analysis tools. DSS completed digitizing the OGS publications. The database is available through the comprehensive digital data access environment, ERLIS. The new database contains 2000 geological reports and 6500 maps, both in scanned raster images and some vector files. Client feedback and organization efficiency measures fostered the initiation of the Earth Resources and Mineral Exploration web site (ERMES) project. ERMES will deliver all ERLIS information via the Internet.

Geoscience Laboratories

The Geoscience Laboratories (GL) provides high quality data to the OGS. As capacity permits, service is delivered to university and commercial clientele. In August, a request for proposals (RFP) was issued seeking a new laboratory operator. The RFP requires the new operator to commit to a Science Park concept and provide access to Laurentian University students, faculty and researchers. A decision is expected early in the 1999 calendar year.

The GL established a service level commitment with the OGS. The agreement includes quality levels and turn-around commitments. The GL reorganized its staffing and processes to facilitate a more business-like approach to its operation. The laboratory is in the final stages of application for ISO 9002 accreditation.

An access agreement with Laurentian University ensures the support of a variety of research and education programs. There is collaboration with the Mineral Exploration Research Centre at Laurentian and with other academic and research organizations.

Customer Satisfaction Surveys

Clients recorded the level of satisfaction of 91% for the quality of services provided by the Resident Geologist Program. The Precambrian Geoscience Section and the Sedimentary Geoscience Section combined recorded an overall client satisfaction rating of 88% based on 7 factors.

Budget

The 1997-98 base budget for the geoscience activities of the Mines and Minerals Division (see budget table) was approximately $11.7 million, essentially the same as 1996-97.

OGS ADVISORY BOARD

The OGS Advisory Board was struck in November 1997 to advise the Minister on OGS issues of strategic importance. The Advisory Board established two subcommittees. A technical subcommittee will work in consultation with the OGS to: a) classify Ontario into areas requiring priority mapping; b) establish a 3 to 5 year strategic plan; and c) review the annual OGS work plan. A "Mines Ontario" subcommittee was also struck (see below).

ALTERNATIVE SERVICE DELIVERY

The Mines and Minerals Division is exploring alternative service delivery structures. Included in this analysis are the two core businesses of the Division: a) administration of the Mining Act; and b) provision of the OGS geoscience function. External client consultations have taken place. The Ministers Mining Act Advisory Committee and the OGS Advisory Board have each struck subcommittees to review the alternative service delivery models and funding mechanisms.

GÉOLOGIE QUÉBEC

Le ministère des Ressources naturelles (MRN) 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, GÉOLOGIE QUÉBEC est l'unité administrative du MRN responsable de l'acquisition, du traitement et de la diffusion des 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.

Sur une base annuelle, son personnel réalise plus de 60 projets allant du levé géologique de territoires nouveaux à la production de cartes d'évaluation du potentiel minéral, en passant par diverses compilations et l'opération du SIGÉOM (Système d'information géominière du Québec). Toutes ces informations sont rendues disponibles à la clientèle de l'exploration minérale sous forme numérique ou sous format papier.

En 1998-1999, GÉOLOGIE QUÉBEC dispose d'un effectif de 144 personnes (dont 111 permanents) réparti à Charlesbourg et dans six bureaux régionaux (Montréal, Sainte-Anne-des-Monts, Sept-Îles, Rouyn-Noranda, Val-d'Or et Chibougamau).

Le Service à la Clientèle de L'exploration

le service à la clientèle de l'exploration (SCE) regroupe l'ensemble des services au comptoir offerts dans les six (6) bureaux régionaux (Montréal, Sept-Îles, Sainte-Anne-des-Monts, Rouyn-Noranda, Chibougamau, Val-d'Or). Le SCE offre, en collaboration avec le Secteur des Forêts, des points d'accès à l'information géoscientifique à Sherbrooke et à Hull, en plus des services offerts au bureau de Québec. Chaque bureau régional est sous la responsabilité d'un géologue résident, et fournit les services suivants:

- la communication de renseignements généraux sur l'industrie minière, sur les programmes d'aide financière et sur la Loi sur les mines;
- la consultation, la reproduction ou la vente de documents géoscientifiques;
- l'assistance technique aux utilisateurs du SIGÉOM;
- la vente et la mise à jour des cartes de titres miniers et le traitement partiel des dossiers relatifs aux titres miniers.

Le Service de la Géoinformation

Le service de la géoinformation (SG) révise et prépare pour publication les nouveaux documents (format papier et numérique) géoscientifiques faisant état des résultats de travaux géologiques, géochimiques et géophysiques. Le SG compile et numérise les produits de compilation géoscientifique dans le SIGÉOM.

Les informations disponibles dans le SIGÉOM au début de septembre 1998 étaient :

- la localisation des périmètres des travaux d'exploration décrits dans 90% des rapports privés d'exploration minière;
- les indices minéralisés (64% des cartes du Québec);
- la compilation des données de la quasi totalité des forages au diamant de la province;
- 60 cartes géologiques résultant des levés de 1995 à 1997;
- 340 cartes de compilation géologique;
- les résultats d'analyses de sédiments meubles (sur presque tout le Québec) ;
- les produits géophysique (champ magnétique, gradient magnétique vertical, anomalies électromagnétiques).

De plus, la compilation des blocs erratiques dans le SIGÉOM est en cours, en vue de sa diffusion ultérieure et un nouveau module est en développement sur les minéraux industriels.

Géologie Québec signale à sa clientèle sur son site Internet1 les nouveaux documents géoscientifiques et les nouveaux rapports privés d'exploration disponibles. Un accès Internet1 à la base de données bibliographique EXAMINE (quelque 60 000 références du fonds documentaire sur les ressources minérales du Québec) est aussi prévu pour novembre 1998.

Le Service Géologique de Québec

Le Service géologique de Québec (SGQ) dessert un vaste territoire qui comprend les Appalaches, les Basses-Terres du Saint-Laurent, la majeure partie du Grenville et l'ensemble du territoire du Nouveau-Québec situé au nord du 55^{e} parallèle. Une équipe constituée d'une vingtaine de géologues (à Charlesbourg, Montréal, Sept-Îles et Sainte-Anne-des-Monts) réalise les levés et les études géologiques.

En 1998-1999, le SGQ dispose d'un budget de 4,5 M$ pour réaliser 14 projets. Encore une fois cette année, l'accent est mis sur la cartographie géologique. Ainsi, la plus grande partie des ressources sera consacrée à la réalisation de 8 projets qui généreront 9 nouvelles cartes géologiques : 2 feuilles au 1:20 000, 4 feuilles au 1:50 000 et 3 feuilles au 1:250 000.

Au niveau des faits saillants, mentionnons les débuts, dans le cadre du Programme d'exploration minière du Grand-Nord, de la cartographie géologique du territoire situé au nord du 55^{ième} parallèle (4 feuilles 1:250 000). Ailleurs, les principaux travaux ont été réalisé dans la Province de Grenville i.e. sur la Côte-Nord, dans la région de Mont-Laurier et dans celle du Lac Saint-Jean.

Le Service Géologique du Nord-Ouest

Le Service géologique du Nord-Ouest (SGNO) dessert l'Abitibi, le secteur de la Baie James et une partie du Grand-Nord québécois. Son effectif est réparti dans trois bureaux régionaux (Rouyn-Noranda, Val-d'Or et Chibougamau). Le personnel de direction est regroupé au bureau de Val-d'Or. En 1998-1999, le SGNO dispose d'un budget de 3,96M$ pour réaliser 5 projets de cartographie d'envergure et 9 études thématiques ainsi que des travaux de compilation géologique et gîtologique.

L'initiation du programme de cartographie du Grand Nord a permis de démarrer deux projets de cartographie 1:250 000 et la poursuite du programme d'exploration du Moyen Nord a permis de réaliser deux projets de cartographie au 1:50 000. Un autre projet d'inventaire au 1:50 000 dans la sous-province d'Abitibi complète la cartographie géologique. Les études thématiques en cours impliquent des travaux de métallogénie, de géochimie et de volcanologie, en collaboration avec plusieurs universités et centres de recherche. Les datations géochronologiques se poursuivent en Abitibi et dans les terrains du Nord.

En ce qui concerne l'évaluation du potentiel minéral, un nouveau module intégré au SIGÉOM a été testé avec succès pour les gisements de type porphyrique de la région de Chibougamau. Les travaux actuels visent à étendre les capacités d'évaluation du potentiel minéral dans le SIGÉOM à d'autres modèles et d'autres régions.

Le Service des Minéraux Industriels et de L'assistance à L'exploration

le service des minéraux industriels et de l'assistance à l'exploration (SMIAE) regroupe le personnel oeuvrant dans les champs d'activité suivants: les minéraux industriels, la géochimie, la géophysique et les programmes d'assistance financière à l'exploration minière.

Le groupe des minéraux industriels, de la géochimie et de la géophysique effectuent diverses études dans leur domaine respectif.

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

- Le Programme d'assistance à l'exploration minière qui dispose de crédits de 9 M$ sur trois ans (depuis 1997) pour les prospecteurs, pour les compagnies et les Fonds régionaux d'exploration.
- Le Programme d'exploration minière du Moyen-Nord pour les compagnies.
- Les Fonds d'exploration autochtones qui disposent de 3M$ sur trois ans (depuis 1997).
- Le Programme des forages profonds dans la sous-province de l'Abitibi met à la disposition des sociétés d'exploration un budget de 5,5 M$ sur trois ans (début le 17-09-98).

Adresse Internet:

Http://www.mrn.gouv.qc.ca/4/42/423/119/repentet.asp

INTRODUCTION

The Geological Surveys Branch (NBGSB) is the main agency delivering geoscience programs in New Brunswick and is the oldest organization of its type in Canada, dating from the appointment of Abraham Gesner as Provincial Geologist in 1838. The Branch is responsible for building and maintaining a comprehensive geoscience database for the province and using it to promote mineral exploration and development, as well as to advise government and the public regarding land use. The Branch has a staff of 35 and 2 regional offices, one in Bathurst and the other in Sussex. The regional offices provide direct contact with the mineral industry based in northern and southern New Brunswick, respectively. The major activities of the branch are geological mapping (bedrock and regolith), mineral deposit inventory and studies, geophysical and geochemical surveys, management of prospecting and exploration assistance programs and distribution and maintenance of geoscience information. The CARIS-based Geoscience Information System has been used to digitize all the data collected since 1988. In addition to carrying out mapping, the branch has undertaken three major programs, which are EXTECH II, Restigouche and NATMAP.

GEOSCIENCE PROGRAMS

EXTECH II (Northern N.B.): Exploration Technology II (EXTECH) is a joint Geological Survey of Canada and New Brunswick Geological Surveys Branch program, addressing problems of declining base metal reserves by developing integrated and multi-disciplinary approaches to exploration and by improving the geoscience knowledge base in the Bathurst Mining Camp. The program was initiated in 1994 with a total funding of $6.6 million over 5 years and completion is planned for March 31, 1999. During the last four years, fieldwork was carried out in order to collect data on bedrock geology, surficial geology, mineral deposits, geochemistry and geophysics. Most of the data was published as maps and reports by New Brunswick's Geological Surveys Branch and the Geological Survey of Canada. Most of the collected data has been maintained in digital format, which will be used for two- and three-dimensional modeling in an attempt to find mineral deposits. It is planned to publish several papers in a special volume of "Economic Geology Monograph" and New Brunswick's Current Research volume. A comprehensive summary of the project is available on the web site:

http://extech2.gsc.nrcan.ca

In 1998, bedrock geology maps at 1:20 000 and 1:50 000 were being finalized and edge-matched in order to produce a seamless 1:250 000 geology map of the Bathurst Camp. Mineral deposit studies included field checking and updating of mineral occurrences in Bathurst Camp and detailed work on Flat Landing Brook and Captain deposits. Surficial geology involved mapping of 21 P/5, field checking of problem areas and completion of 1:50 000 maps for the Bathurst Camp. The results of geochemistry and biogeochemical surveys on the Restigouche – Murray Brook area will soon be released to the public. The geophysical work includes ground follow-up to 1996 airborne multiparameter geophysical survey and publishing of a "Geophysical Atlas" of case history studies of 20 massive sulphide deposits in the Bathurst Camp. A CD ROM containing EXTECH II database for the Bathurst Camp is being produced and will be available by March 31, 199**9.**

Restigouche Project (Northwestern N.B.): The Restigouche project involves geological, geophysical and geochemical surveys on the Restigouche geological zone extending from Campbellton to Grand Falls. It comprises three phases. Phase I comprising an airborne survey, similar to the Bathurst Mining Camp, and a stream-sediment survey was carried out over a test block with a budget of $540,000. The results of Phase I were released to the public in July, 1998. Phase II, involving evaluation of Phase I results, is being carried out with a funding of $50,000 and will be completed by December 31, 1998. Phase III, consisting of geological, geophysical and geochemical surveys for the entire belt will be carried out in 1999-2001, with a budget of $2.2 million, if the Regional Development Corporation approves the funding.

NATMAP (Southern N.B.): New Brunswick has participated in the five-year (1993-98) National Mapping Program (NATMAP), which began in 1994 under the leadership of the GSC geologists. The program entailed mapping the Carboniferous Maritimes Basin, which underlies parts of Nova Scotia, New Brunswick, Prince Edward Island,

Newfoundland and Quebec. The Geological Surveys Branch participants were responsible for mapping part of the Moncton, Sackville and Cumberland subbasins. The project and previous geological mapping helped to attract oil and gas and bituminous shale exploration to New Brunswick.

Southern N.B.: Bedrock mapping was carried out to refine the interpretation in problem areas (21 G). Several mineral occurrences (21 G, 21 H, and 21 B) are being investigated in the field. Work is in progress on the St. Stephen nickel deposit. Surficial geology mapping was carried out on 21 J/3W and Caledonia project.

Geology and development potential of gypsum, anhydrite, silica, clay/shale, titanium and graphite deposits will be investigated in 1998-99. An inventory of industrial mineral occurrences is also targeted for 1998. Mineral aggregate resource maps of the greater Fredericton and Moncton areas were released to the public.

The GIS section provided support for geological surveys and for the management of mineral claims. As part of the Integrated Mineral Resource Management System (IMRMS), geochemistry, geophysics and mineral claims databases have been developed using CARIS and INGRIS.

An active Internet website has been developed and contains Industry Highlights, Mining and Development, Exploration, Publications and Information, Industry News, Calendar, Annual Review of Activities, and other current events. The website location is:

http:// www.gov.nb.ca/dnre/minerals

EXPLORATION

The final exploration expenditure for 1996 is $13.5 million, while the preliminary figure for 1997 is $11.4 million. The forecast for 1998 exploration expenditures is $7.7 million. The decline in exploration is a concern to the province even though it is attributed to low metal prices and poor world economy. Base metals are the focus of exploration in northern New Brunswick. The emphasis of exploration in southern New Brunswick continued to be gold, limestone and PGE minerals. Active oil and gas and oil shale explorations are being carried out in southern New Brunswick.

MINING AND DEVELOPMENT

Mining continues at Brunswick No. 12, Heath Steele, NB Coal and Potash Corporation of Saskatchewan mines. In addition, several limestone and aggregate quarries, and peat operations are in full production.

Breakwater Resources Inc.'s Caribou mine, which resumed production in June 1997 after a long shutdown, was forced to cease production again in August, 1998 because of low metal prices and below-target mill recoveries. The shutdown also caused the cessation of production from the company's Restigouche open pit. Breakwater is currently evaluating alternative operating scenarios and will conduct metallurgical research with a view to reopening the mines when metal prices improve.

EXPLORATION AND DEVELOPMENT ASSISTANCE PROGRAMS

Mineral Exploration Stimulation Program (MESP): In order to provide stimulus to the exploration industry, the Province of New Brunswick continued its support of this prospector incentive program by approving 35 grants totaling $50 000 in 1998. The grants helped a number of prospectors to option their properties to exploration companies who rely on the prospectors to find areas of interest.

New Brunswick Exploration Assistance Program (NBEAP): NBEAP is a federal/provincial assistance program aimed at assisting the junior sector in New Brunswick. The program was initiated in 1994 with an annual budget of $400 000, and later expanded to three years (1994-1997) with a total budget of $1.2 million. The program provides assistance of 50% of project costs to a maximum of $40 000 per company. To 1997, grants were provided to 58 properties from 91 proposals received. As a result of this investment, junior mining companies have expended more than $6.7 million. In 1998-99, the province funded 12 projects for a total of $350,000.

Valued-Added/Mineral Processing (VAMP): One of the major issues of the Provincial Mineral Policy released in 1993 was the desire to add value to mineral production in New Brunswick. In 1996, the province introduced this new program aimed at value-added products. The program provides direct assistance for projects that could lead to increased metal/mineral recoveries, as well as value-added products. Reasonable expenditures directly attributable to the projects, except for the ac-

quisition of capital equipment, are considered eligible under VAMP. A total of $100 000 was allocated for this program in 1998

ANNUAL REVIEW OF ACTIVITIES

The 23rd Annual Review of Activities of the New Brunswick Minerals and Energy Division was held at the Sheraton Inn, Fredericton, Monday, November 2, 1998 to Wednesday, November 4, 1998. The program includes a VMS Deposits seminar, field trip to recently found gold mineral occurrence, Technical Sessions, Poster sessions, Core Shack and Industry Trade Show.

The Mineral and Energy Resources Division is the geoscientific arm of the Department of Natural Resources. It is responsible for providing a comprehensive, integrated geoscience knowledge base for the province in support of mineral exploration and development, integrated resource management, sustainable economic development in non-mineral sectors, environmental protection, land-use planning, and scientific research. Divisional programs are delivered through three sections, Geological Mapping and Geochemistry, Mineral Resource Evaluation, and Geoscience Information Services.

1997-1998 represented a period of considerable change within the Minerals and Energy Branch resulting from ongoing implementation of restructuring within the Division as well as the agreement with the Geological Survey of Canada on cooperative geoscience program planning. The release of the Westray Public Inquiry report and implementation of the resulting recommendations resulted in an independent review (with related recommendations) of the Minerals and Energy Branch organization and responsibilities by Dr. C. G. Miller of the Industry Govenrment Relations Group. Miller made a number of recommendations for change in the Branch including suggestions for legislative changes to address the recommendations of the Westray Inquiry, structural changes to accomodate changes in mandate, and a program plan to focus project planning and facilitate cross-branch working relationships.

Mineral promotion initiatives focus on increasing the exploration for, and development of, Nova Scotia's mineral resources through sound promotional activities. Highlights included the Twenty-first Annual Review of Activities in November 1997 and attendance at the British Columbia and Yukon Chamber of Mines Cordilleran Roundup Convention, Vancouver; and the Prospectors and Developers Association of Canada, in Toronto; as well as contacts with representatives of numerous local, national and international mining companies to discuss mineral-related opportunities. Properties Available for Option in Nova Scotia, containing submissions from prospectors and companies, was prepared and circulated at several of the trade shows.

GEOLOGICAL MAPPING AND GEOCHEMISTRY SECTION

Geological mapping of the Central Meguma Project area continued in NTS (National Topographic System) map areas 11D/13 and 11E/04 in 1997-98, with emphasis on the Lucasville-Lake Major area on 11D/13. Significant advances have been made in documentation of the stratigraphy and structure of the Meguma Group, which hosts significant gold, lead, zinc and antimony deposits with local barite and fluorite occurrences. A series of 1:10 000 geological maps from NTS 11D/13 and 11E/04 were published and a related series of 1:50 000-scale Enhanced Aeromagnetic Digital Data Maps from most of the Meguma Terrane were also released. A preliminary map of the Guysborough and Strait of Canso area (parts of 11E/08, 11F/05, 06, 10, 11, 12 and 15) was under preparation as part of previous work with Dr. Sandra Barr at Acadia University. Mapping and related coal resource geoscience work continued in the Debert-Kemptown area as well as study of the roof strata geology and three-dimensional models in the Phalen Coal Mine. The Musquodoboit Batholith project geology maps and report are in preparation and results from the Tangier Grand Lake area in eastern area were published. This work will be incorporated into the new Eastern Shore Meguma Zone project. The south-central Cape Breton Highlands geological map and report on NTS map area 11K/07 was published. Project planning was initiated for new geological mapping and compilation in the Southwest Nova and the Eastern Shore projects.

The Hants-Colchester Lowlands surficial geology project maps in the Shubenacadie and Musquodoboit area (NTS 11E/03) and Lawrencetown area (NTS 21A/14) were published. This project work in co-operation with the Geological Survey of Canada directly stimulated the current extensive private sector kaolin exploration activity in Cretaceous basins, especially within the Musquodoboit Valley where post-Cretaceous age faulting has been recently documented in seismic surveys. A report on Late Quaternary glaciation and sea-level change along the Atlantic coast of Nova Scotia was published. New work was undertaken on the industrial mineral application of surficial deposits as well as bedrock material including: slates, barite, zeolites, clay, sand and dimension stone.

MINERAL RESOURCE EVALUATION SECTION

The Mineral Inventory Program continued field verification of mineral occurrences in selected areas for the Mineral Occurrence Database including: several mineral occurrences in Cape Breton Island discovered during mineral exploration since the mid-late 1980s and in the eastern shore region between Halifax and Sheet Harbour. The work was closely coordinated with the Geoscience Information Section to ensure integration of the most up-to-date mineral occurrence information, available on the Public Access GIS system.

Coal Basins Program continued in most of the major coal-bearing basins including geological mapping and evaluation of energy and non-traditional resources in targeted areas with significant mineral and energy resource potential. Work included research into basin evolution and its influence on energy resources, features in active coal mines that may prove a hindrance to underground and open-pit mining (e.g. cooperative investigations of roof rock and structural geology in the Sydney Basin and Stellarton Basin coal operations), and community-based economic development of world-class fossil sites (e.g. Joggins and Brule). The Debert-Kemptown Coal Basin mapping continued with 1:10 000 scale maps completed from the Kemptown area to Folly River. A 1:20 000 scale map of the Stellarton Basin has been compiled and published in cooperation with the Geological Survey of Canada. Initial mapping and resource evaluation for the Antigonish-Guysborough area was in the planning stage.

Base metal deposit studies were highlighted by continued work on metallogeny in southeast Cape Breton including a new look at nature and origin of the Stirling Deposit, on pegmatites and their relationship to mineralization at East Kemptville, Cu-Pb-Zn-Ag at Dunbrack and Ba-F in the Kinsac Pluton. A special highlight was the completion of a special issue of the journal Economic Geology on the Gays River and Walton projects in collaboration with Geological Survey of Canada.

Precious metals studies focussed on the Cochrane Hill and Moose River gold deposits, evaluating bulk gold potential in the Meguma Group, and Eastern Shore gold deposit compilation as part of the new Eastern Shore Project. Investigations were undertaken of the West Gore Au-Sb deposit and Touquoy Zone at the Moose River gold deposit as well as other deposits along the Eastern Shore. A review paper on morphology of the Meguma Gold Deposits was prepared for Ore Geology Reviews as part of a special issue on mesothermal gold.

Aggregate resource studies focussed on identifying sources of sand for cranberry production in cooperation with Nova Scotia Department of Agriculture and Marketing, and continued work on dimension stone potential and aggregate resource database and maps for Digby and Yarmouth Counties in the Annapolis Valley region.

GEOSCIENCE INFORMATION SERVICES SECTION

The **Digital Information Services** Group has developed an ARC/INFO® based corporate Geographic Information System (GIS) for Branch staff and clients that provides access to provincial and detailed digital datasets on geology, geochemistry, geophysics and land use (for purchase information, see the branch web site). A related public access GIS with colour plotter is now available for client use in the library. The new 1:500 000 scale provincial geological map is in production and a compilation of current 1:50 000 scale map data has started. The Branch Internet website at http://www.gov.ns.ca/natr/meb contains information on branch activities and staff, a What's New page, a Topics page, all issues of the Nova Scotia Minerals Update newsletter, Publications Release Notices, and the Publications and Digital Data For Sale lists. NovaScan, the provincial bibliographic, geoscience database continues to be updated.

Mineral Resource Land-use Information and Policy activities focused on providing services, advice and technical assistance to the department's Integrated Resource Management process, and reviews of other initiatives: e.g. the action plan for the mineral policy; Draft Wilderness Act; Sustainable Development Strategy for the Department of Fisheries and Oceans; Nova Scotia's State of the Environment Report; Draft Municipal Government Act; Watershed Management Strategy for Nova Scotia. Project specific information, presentations and consultations with government and public clients included: rural development, acid drainage potential and historical land use along proposed gas pipelines and other developments; development project specific geochemical data, geohazard potential, water quality, natural features, reclamation, highways, and mineral resource information. Special thematic maps were prepared for public release and development continued on a digital Mineral Resource Land Use (MRLU) atlas and the aquaculture licence review database.

Helping various audiences understand and appreciate the importance of minerals and mining is the key objective of the **Minerals Outreach Program.** A variety of projects focused on this objective including: prospecting courses, teachers' workshops, class presentations, articles and newsletters, public interpretive walks and partnerships with museums. Highlights were the Special Audience Communication Strategy, EdGeo Workshop and Nova Scotia Mining Week.

The exploration community in Nova Scotia has a new **Prospector Assistance Program** funded by the Canada-Nova Scotia Cooperation Agreement on Economic Diversification ($600,000 over four years). This agreement provides the means to support and encourage the growth of prospecting through prospector training and technical assistance, and marketing assistance to participate in trade shows.

Geoscience editing and publishing continued activities to ensure that current geoscience information is readily available to enhance public awareness and to promote our mineral resources including five papers submitted to earth science journals, one published (colour) map, four issues of the Nova Scotia Minerals Update, nine open file reports, thirty-five open file maps, two published reports (including the Minerals and Energy Branch Report of Activities), and five information circulars.

The **Drill Core Library**, based in Stellarton, houses an extensive collection of drill core and a variety of other geological samples, including well cuttings, rock slabs, geochemical samples, till samples and some large samples of industrial minerals. These materials are catalogued and maintained for the use of government, educational and industry researchers, who may re-examine, re-analyse or conduct new projects with the available samples. Approximately 5,700 m of additional drill core was received, bringing the cumulative total to approximately 645 400 m (about the length of the Province). Work continued on the development and upgrading of the branch's drilling databases and public access: the Drillholes Database contains 21 000 records for more than 18 000 holes drilled during the last 100 years and the Drillcore Database contains information on more than 7000 cores in the Core Library collection.

Mineral exploration in Nova Scotia demonstrated a significant increase in activity over the previous year, with expenditures for 1997 estimated at $8.9 million, compared with $5.7 million in 1996 and $2.8 million in 1995. The total number of general claims staked during 1997 decreased by 34.4% over the previous year's total of 33 380 claims to approximately 21 880. A total of 22 690 claims for all commodities were in effect at the end of 1997, represented by 890 exploration, coal, tailings, and special licences. The amount of exploration drilling increased over the previous year with a preliminary total 21 800 m compared with 15 600 m in 1996. Exploration was carried out for gold, base metals, industrial minerals, and coal in a variety of geological environments throughout the province and was highlighted by the continuation of increased interest in the exploration and development of industrial minerals such as limestone, gypsum, kaolin and silica sand. The early Paleozoic Meguma Group continued to be a focus for gold exploration in Nova Scotia and exploration for coal was undertaken in the Carboniferous rocks of the northern mainland.

INTRODUCTION

The Geological Survey of Newfoundland and Labrador's (GSNL) program for 1998-1999 consisted of approximately 25 projects having a total budget of $3.3-million. The budget was funded entirely from the provincial treasury and represents the second year of three-year stable funding committed under a government-wide Program Review process.

Exploration activity in the province during 1998 is expected to come in at approximately $46-million. Some $35-million of that is projected for Labrador with approximately $20-million being expended by Voisey's Bay Nickel and $14-million by the Teck/Donner joint venture. Approximately $11-million is projected for the Island. Some 4000 claims were staked in Labrador and 7000 in Newfoundland during 1998. These are part of the 100 000 claims in good standing at the end of the year.

PROGRAM HIGHLIGHTS

Bedrock Geology Surveys

Donald James and Charles Gower carried out regional, 1:100 000-scale mapping in the Grenville Province of eastern Labrador. This work will replace existing GSC reconnaissance maps from the 1960s. The region is dominated by a southern zone of orthogneiss, foliated granitoids and foliated banded mafic rocks that are bounded to the north by monzonite and anorthosite of the Paleoproterozoic Mealy Mountains Intrusive Suite. Post-tectonic, minor Grenvillian granitic plutons intrude the southern zone. Oxide and sulphide disseminations occur in the banded mafic rocks.

Stratigraphic analysis of western Newfoundland's Cambro-Ordovician shelf sequences was continued by Ian Knight in the Port au Port Peninsula – Stephenville area. The area is structurally complex due to much thrusting and backthrusting, which has resulted in several repetitions of the section. The Middle Cambrian March Point Formation, for example, was originally thought to be 90 m thick but could be as little as 30 m thick.

Knight's logging of stratigraphic sections was supported by Doug Boyce's biostratigraphic analysis. A new fossil discovery in the Hawke Bay Formation by Ian Knight was identified by Boyce as the Middle Cambrian trilobite *Glossopleura*. Boyce also found some 20 other previously unknown fossiliferous sites, including several in the Aguathuna Formation. His work in the Aguathuna Formation was partly supported by a grant from the National Geographic Society (Boyce was named a co-investigator) for a project entitled "Lower Ordovician Gastropods of Newfoundland".

The Siluro-Devonian Hodges Hill Intrusive Suite of central Newfoundland was the subject of a 1:50 000-scale mapping project by Lawson Dickson. The suite intrudes Ordovician and Silurian volcanic and sedimentary rocks post-tectonically, and consists of two main phases: an earlier layered gabbroic phase and a younger granitic phase. The granitic phase has potential for dimension stone and contains two test quarries.

Mapping of hydrothermal alteration zones of the Avalon Zone continued last summer with the focus being on the Burin Peninsula, and in particular on the Hickey's Pond and Stewart showings. Sean O'Brien and Cyril O'Driscoll of the GSNL worked in concert with Benoît Dubé of the GSC. (This continues to be a very successful and rewarding collaboration between the two Surveys.) The two showings exhibit advanced pre-deformation argillic alteration indicative of high-sulphidation epithermal alteration. Also, the Neoproterozoic host volcanic rocks are exactly coeval with the host rocks to the Hope Brook gold deposit.

Geochemical Surveys

John McConnell conducted a follow-up lake-sediment and lake-water geochemical survey in four areas of central Labrador. The areas were chosen based on regional nickel and copper anomalies resulting from the earlier regional geochemical surveys of the GSC. Some 5700 km^2 were covered last summer with a sample density of one every 6 km^2. Results will be released in spring 1999.

Surficial Geology Surveys

Dave Liverman carried out surficial geology mapping at 1:50 000 scale in the southern St. George's Bay area of western Newfoundland. The area includes a large coastal plain that stretches back to the foothills of the Long Range and Anguille

mountains. The coastal plain consists of a thick Quaternary cover of marine sediments, gravels and tills. A previous interpretation of a climate-driven re-advance is apparently no longer valid based on stratigraphic analysis and dating of shells. It seems that the entire Quaternary section represents a normal deglaciation.

Jerry Ricketts on the Avalon Peninsula near St. John's carried out a surficial-aggregate study. For the most populous region of the province, adequate aggregate supply is an important consideration. Sand and gravel deposits are rare so glacial tills were also mapped and sampled for silt/clay analysis.

Mineral Investigations

A study of Ni-Cu sulphide occurrences in north-central Labrador, outside the Voisey's Bay area, was continued by Andrew Kerr. The study includes detailing the characteristics of the various showings as well as an analysis of core from the many that have been drilled. Mineralization in the Nain area is not directly related to the anorthosites but to younger minor mafic intrusions. In the South Voisey's Bay area, there are many parallels with Voisey's Bay itself. Sulphide showings in the Harp Lake Complex are unlike those in the Nain area in that they are syngenetic disseminations in the anorthosites.

A project by Dave Evans to examine and catalogue the gold showings of the Baie Verte Peninsula was completed this year with some 110 showings being included in the study. Most of the gold showings occur east of the Baie Verte Line in the ophiolitic basement rocks and Ordovician cover sequences of the Baie Verte Belt. Also, most of the showings are epigenetic, being either quartz-vein-hosted or altered-wall-rock-hosted mineralization.

Ambrose Howe, who sampled Grenville Inlier quartzite for purity analysis and mapped talc deposits of the Baie Verte Peninsula, carried out industrial mineral studies. The talc occurs in altered ophiolitic rocks, and two areas, Deer Cove and Red Cliff Pond, were mapped and sampled this year. Standard testing, including the brightness factor, will be conducted on large samples.

Geoscience Needs Workshop

A Geoscience Needs Workshop, jointly sponsored by the Geological Survey of Newfoundland and Labrador and the Geological Survey of Canada, was held on November 2nd and 3rd in St. John's. The Workshop was part of the Geoscience Needs Study called for in the Memorandum of Agreement signed by the two Surveys in the spring of 1998. The Needs Study must undertake extensive consultations with stakeholders, which is what the workshop was all about. Some 40 external participants representing the full spectrum (e.g., minerals, petroleum, land use, environment, regulatory, education) of the Surveys' client groups spent two days discussing and defining their long-term geoscience needs. GSNL and GSC staff were on hand as facilitators and advisors. Breakout groups on the first day focussed on strategic directions whereas on the second day the focus was on specific client needs. The full proceedings of the workshop are captured in the Workshop Report, which will be used by both Surveys to guide future program planning.

Prospectors Resource Room

The GSNL, in collaboration with the Newfoundland and Labrador Chamber of Mineral Resources, Newfoundland and Labrador Explorationists and Memorial University's Department of Earth Sciences, has inaugurated a Prospectors Resource Room in the Survey's Geoscience Publications and Information area. This room will be known as the Matty Mitchell Room, after the famous Newfoundland prospector who discovered the world-class Buchans orebodies. Prospectors will have full access to the room during regular working hours, and will be able to avail of reference reports, maps and samples, a microscope, a Internet-linked computer and other resources to assist their researching and prospecting efforts. A committee representing the sponsoring agencies will procure and administer the room's resources.

Open House 1998

The Mines Branch 22nd Annual Review of Activities took place on November 5, 1998. As usual, it was held in conjunction with the annual CIM Newfoundland Branch Meeting (its 45th) and attracted some 200 registrants. The "Open House" included reviews of GSNL and GSC field activities, mining and exploration activities, and the research capabilities at Memorial University. Technical presentations included talks on multisensor geophysical surveys, gold environments, organizing data in GIS, and the mineralizing environments of the Avalon Zone. Thirty-six posters were also on display by GSNL and GSC geoscientists.

INTRODUCTION

The federal Department of Indian Affairs and Northern Development (DIAND) and the Government of the Northwest Territories' Department of Resources, Wildlife and Economic Development (RWED) jointly delivery a geoscience program in the NWT, and provide services similar to provincial geological surveys elsewhere in the country. In 1998-99, the two agencies had a combined operating budget of about $3.1M.

In March, 1998, the Trilateral Geoscience Memorandum of Understanding between the Geological Survey of Canada, DIAND and RWED was signed at the Prospectors and Developers Convention in Toronto. The agreement provides a framework for improved collaboration and cooperation between the three agencies in their geoscience program delivery, and has a provision for the establishment of a joint geoscience office.

DIAND NWT GEOLOGY DIVISION

The NWT Geology Division supported several field-based geoscience studies in 1998, some of which are being carried out by university researchers through contracts. In the eastern Cordillera, a project was initiated to examine gold showings associated with Cretaceous granites. In the Slave Province, mapping was completed on two graduate thesis studies, work continued on a digital compilation of the Yellowknife greenstone belt, and a new bedrock mapping project in the southwestern Slave Province was initiated. The latter project will support a Ph.D. study on metamorphic petrology/geochronology. The Division also started a petrographic/mineral chemistry study of selected kimberlites in the Slave Province, and an evaluation of mineral showings in the southeastern part of the province.

In the Keewatin (Kivalliq District of Nunavut), bedrock mapping continued in the Angikuni and Noomut Lakes areas, and a new bedrock mapping/mineral evaluation project was undertaken at Linklater Lake. Concurrent with the Angikuni mapping project, an isotope geochemical study of rocks of the Proterozoic Baker Lake Group was funded. In addition, till sampling was carried out over several linear magnetic anomalies near the community of Arviat, to evaluate the potential for iron formation-hosted gold.

Progress continued on data entry into NORMIN.DB, the Region's digital mineral showings database. Approximately 30% of the NWT's mineral showings and associated references have now been entered. The database can be viewed and queried on-line, although digital extracts must be provided to clients by Division staff. Work is underway on the database to allow clients to extract data directly.

Finally, Division staff monitored mineral exploration activity, carried out field visits to exploration sites, and reviewed representation work submitted by companies for compliance with the Canada Mining Regulations. At the time of publication, the Division had released 15 Open File publications, and was looking into making digital data available to clients through the world wide web.

RWED MINERALS OIL AND GAS DIVISION

Minerals, Oil and Gas Division of RWED (MOG) completed two Mineral Development Area projects in 1998. The first was a jointly-funded (RWED-GSC-Qikiqtaaluk Inuit Corp.) initiative to create a digital geoscience knowledge base and mineral potential assessment of northern Baffin Island and Melville Peninsula. A 1:500 000 compilation of geological, geophysical and remotely-sensed data was produced at the GSC, and has been presented to stakeholders at geoscience and mining fora. The second initiative was a digital compilation of geoscience, environmental, infrastructure, socioeconomic and other data on the Coronation Gulf area. The data are available online in a GIS format, and provide useful baseline information for explorationists, developers, businesses and land use planners.

The Division hired a Community Minerals Advisor to coordinate and oversee geoscience education initiatives such as the Prospector Training program, Project Rocks and Community Mobilization, and to serve as liaison between communities and representatives from the exploration industry. In addition, RWED staff worked with partners in the NWT's Protected Areas Strategy to draft a document defining the Territories' strategy for protection and conservation of representative ecozones.

MOG participated in creating the document, and have the lead on coordinating and carrying out mineral resource assessments.

JOINT INITIATIVES

DIAND and RWED collaborated on several geoscience projects in 1998, including the Western Churchill NATMAP project, and the recently announced EXTECH III. Under the Churchill NATMAP, RWED completed bedrock mapping in the Yathkyed Lake area with partial funding and co-leadership by DIAND. The Yathkyed project supported field work for two thesis studies, and benefited from collaborative geochronological and geochemical studies by GSC personnel. In the western NWT, RWED funded a regional stream sediment sampling study along part of the Canol Trail. Field work for this study was carried out by DIAND.

In preparation for the creation of the new territory of Nunavut, DIAND, RWED (in Yellowknife and Iqaluit) and GSC have initiated discussions about geoscience program delivery, and about a new regulatory regime for mining and exploration in Nunavut.

EXPLORATION/MINING ACTIVITY

The NWT led Canada in exploration expenditures in 1998. Bulk sampling was carried out on several kimberlites in the Slave Province, including Koala North (BHP), A-11 north (Diavik), four pipes at Kennady Lake (Monopros), and a dike at Snap Lake (Winspear). Major gold exploration projects included the Meadowbank (Cumberland Resources), Meliadine West (WMC International) and Meliadine East (Cumberland Resources/Comaplex Minerals) in the Churchill Province, and the George Lake (Kit Resources) and Damoti (Quest International) in the Slave Province. Exploration was also carried out on other deposits, most notably the Sunrise massive sulphide deposit in the Slave Province, and the NICO and Sue-Dianne polymetallic deposits in the Bear Province. Projected exploration expenditures in the NWT for 1998 are estimated at $156M., and the Geology Division will review close to 200 assessment reports this year.

1998 marked a significant shift in the focus of NWT mining, with the closure of two gold mines and the opening of Canada's first diamond mine. Colomac Mine (Royal Oak Mines) shut down operations at the end of 1997, and Echo Bay's Lupin Mine suspended production for a year. Both cited low gold prices and high production costs as the reason. In addition, a labour dispute at Con Gold Mine (Miramar) in Yellowknife halted production in the spring. Nevertheless, with Ekati diamond mine in production and Diavik's comprehensive review underway, NWT will continue to make a contribution to Canada's mineral production.

GEOSCIENCE FORUM 1998

Preparations are underway for the 26th annual Yellowknife Geoscience Forum, organized jointly by the NWT Chamber of Mines, DIAND Geology and RWED. The Forum features oral and poster presentations on current government geoscience initiatives and exploration activities across the north, as well as sessions focussed on the regulatory regime in the north. New additions to the Forum this year will be a session on oil and gas exploration, and a workshop on the proposed Yellowknife EXTECH project.

OVERVIEW

Now in its third year, the Yukon Geology Program is a de facto Yukon Geological Survey consisting of two integrated and jointly managed offices with different administrative structures. Federal funding is provided through the Exploration and Geological Services Division of DIAND, and Territorial and cost-shared (YTG/DIAND) funding comes through the Mineral Resources Branch of the Department of Economic Development. The Geological Survey of Canada also maintains an office with the Program.

The past year saw some stability and growth after the uncertainty and change of the previous year. Five managers in DIAND and YTG completed their first full year in new jobs. Budgets have remained constant for the third straight year. Five geological positions were filled and the Program is now operating at full strength for the first time in three years.

In the spring, a Technical Liaison Committee with representatives from industry organizations, major mining companies, and academia was struck to review and comment on the Program. The first year has been very successful and both the Program and management have received constructive, positive feedback.

Negotiations to devolve the responsibilities of the Northern Affairs Program to YTG are ongoing. Conclusion of negotiations on outstanding issues is expected before release of this publication. If they are successful, transfer could be completed as early as the end of 1999, a year later than originally planned.

PROGRAM HIGHLIGHTS FOR 1998

The Yukon Geology Program in 1998 supported three regional bedrock mapping projects, two mineral deposit studies, two placer deposit studies, a till geochemistry study, three staff geologists, one Minfile geologist, two resource assessment geologists, and in part, one GSC mapper. Several other projects were also funded through contributions to the Geological Survey of Canada and to university researchers.

Fieldwork

Industry liaison and support was provided through two staff geologists; one for hard rock and one for placer.

A new project was initiated to study the relationship between sedimentology, grain size distribution, and water quality in placer deposits. Data gathered from this study should assist with the review of placer regulations, water quality standards and stream classifications scheduled for 2001.

The metallogeny of volcanogenic massive sulphide deposits in Yukon is in its final year. The focus was the geological setting of the Wolf deposit in Devono-Mississipian volcanic rocks on the Pelly Cassiar Platform. The Wolf deposit is a new discovery which has re-ignited exploration interest in Ancient North America after so much recent attention was paid to VMS deposits of similar age in adjacent Yukon–Tanana terrane.

The metallogeny of precious metal deposits in Yukon project focussed on occurrences related to the Tombstone suite of Cretaceous intrusions. These include the Brewery Creek gold deposit and in Alaska, the Fort Knox and True North gold deposits, and attracted significant exploration interest this year. Interest in the Dawson Range may be spurred next year by the recent realization that several of the gold occurrences and deposits in it are the same age as the exciting new Pogo gold discovery on trend to the west in Alaska.

Recent massive sulphide discoveries in the Finlayson Lake District have helped to stimulate research interest in the Yukon-Tanana terrane and other pericratonic terranes in the northern Cordillera. The Yukon Geology Program is playing a significant role in the Ancient Pacific Margin NATMAP Proposal. This cooperative effort involves the Geological Survey of Canada, the British Columbia Geological Survey and the Universities of Alberta, British Columbia and Victoria. The project, if approved, will examine critical localities in British Columbia, Yukon and possibly Alaska. In the Yukon, the Geological Survey of Canada contribution will mapping of the Stewart River sheet, and the western half of Wolf Lake sheet, in conjunction with the adjoining northern half of Jennings River sheet in B.C.. The Yukon Geology Program contribution will include continued 1:50 000 scale map-

ping in the Finlayson Lake area, and in the Glenlyon area. In the Stewart River area, where most of Yukon's gold placers are located, surficial mapping by the GSC will be accompanied by placer deposit studies by the YGP.

The closure of the Faro mine at the beginning of the year was a major blow to the Yukon economy. Remaining reserves in the Anvil District are uneconomic at present, but significant exploration potential remains. The YGP has embarked on several projects to capture, synthesize, and enhance the geological database that operators have accumulated over the last 30 years. The projects include compilation and bedrock mapping at 1:25 000 scale, lithogeochemical studies, surficial mapping, and a till geochemistry case study.

The Yukon Geology Program supported the work of several scientists of the Geological Survey of Canada. A final report for Lansing map area is nearing completion. A digital geological map of the Yukon is expected to be released in March 1999 A glacial limits map of Yukon to mark the 100th anniversary of the Klondike Gold Rush in 1998 will be integrated with the digital bedrock compilation.

Yukon Minfile

Yukon MINFILE has been upgraded from Foxbase to Microsoft Access v.2 and a second phase is underway to convert to Access 97 with major revision and simplification of the database structure. Updated versions of both the digital version, and text summaries and maps on paper are released each spring.

H.S. Bostock Core Library

The H. S. Bostock Core library contains about 124 000 metres of diamond drill core from about 200 Yukon mineral occurrences. Confidentiality of material is determined on the same basis as mineral assessment reports. Confidential core can be viewed with a letter of release from the owner. Rocks saws and other rock preparation equipment are available to the public.

Mineral Resource Assessments

The Yukon Geology Program is responding to an increasing need for geological and metallogical information to assist resolution of land use issues and conflicts. Some of the pressures have come from native land claims negotiations, and localized land use conflicts such as one within the city limits of Whitehorse, but most important is the priority of the Yukon Government to implement a Protected Areas Strategy by the year 2000. The Yukon Protected Area Strategy will result in protection and withdrawal of land in all 23 ecoregions in the Yukon. The Geology Program plans to provide efficient and cost-effective input into the selection process by undertaking a Yukon-wide mineral potential study in the spring of 1999.

Yukon Mining Incentive Program

The Yukon Government provides grants for grass roots exploration and initial development of properties. This year a total of $378 000 was distributed to 27 prospectors.

Publications

All geological maps are now printed on-demand, and new publications are being produced from a digital format. We expect to eventually distribute digital files through our website at

http://www.yukonweb.com/government/geoscience.

Discovery Methods for Canadian Metal Mines that Opened in 1998

Discovery Methods for Canadian Metal Mines that Opened in 1998

New Mines in BRITISH COLUMBIA - 1998

Mine	Kemess	Blackdome
Discovery (New - N or Old - O)	N	O
Date of original discovery	**1983**	**1979**
(Reassessment)	-1990	-1985
NTS	094/02E	092/08W
Location	435 km, northwest of Prince George	64 km west of Clinton
Years of operation	1998 -	1986-1991
Methods of discovery (Reassessment)	geochemistry, geophysics, drilling	geology, geochemistry, drilling
Methods of later developments	geological modeling, drilling	drilling
Discovered (reassessed) reserves	200 400 000 tonnes grading 0.22% Cu and 0.63 g/t Au	177 046 tonnes grading 19.41 g/t Au and 54.85 g/t Ag
1998 production	limited production - May 19/98 commercial production - Oct 7/98	1986 - 1991: 305 615 tonnes milled yielding 223 592 oz Au and 760473 oz Ag 1998 commercial production - Oct 10
Mining type	open pit	underground
Milling rate	45 000 tpd	200 tpd
Commodities	Au, Cu	Au, Ag
Deposit classification	porphyry	vein-epithermal
Key reference	MI - 094E 094 CIM SV 46, pp.377-397	MI - 0920 050 & 053
Capital cost	$480M	$3M

Mines Ouvertes au QUÉBEC en 1997-1998

Mine	Troïlus	Gallen	Raglan
Découverte nouvelle (n) ou ancienne (a)	n	a	a
Date d'ouverture officielle	12/96	07/98	12/97
Date découverte originale	1997	1929	circa 1930
Méthode de découverte	Tracage de blocs, géophysique et forages	Prospection	Prospection et forages
NTS	32O/01	32D/07	35H/12
Localisation	130 km au N de Chibougamau	9 km au NE de Rouyn-Noranda	2000 km au N de Québec
Années d'opération	1997 (1an)	1953-59;81-85;1997 (13 ans)	10 mois
Réserves actuelles	45,5 Mt @ 1,23 g/t Au 1,35 g/t Ag et 0,12% Cu	1,82 Mt @ 0,23% Cu 4,78% Zn - 29 g/t Ag et 1,1 g/t Au	22 Mt @ 3,06% Ni et 0,87% Cu
Production en 1997	4350 Kg Au - 4879 Kg Ag et 5158 t Cu	29,5 t Cu - 1063 kg Ag - 60,2 kg Au et 3357 t Zn (en préproduction)	estimé annuel: 21000 t Ni, 5200 t Cu et 300 t Co
Emploi	254	25	Plus de 300
Type d'exploitation	Souterraine	Souterraine	Souterraine
Substances extraites	Au, Ag, Cu	Zn, Cu, Ag, Au	Ni, Cu, Co
Classification du dépôt	Porphyre dans volcanoclastiques mafiques	Lentilles de SMV bréchifiées	Lentilles de SM à la base de coulées ultramafiques

Survey of Hard Rock Drill Core Programs 1997 - 1998

SURVEY OF HARD ROCK DRILL CORE PROGRAM IN CANADA
Fiscal Year 1997-98

PROVINCE	B.C.**	ALBERTA	SASK.	MAN.	ONT.	QUEBEC	N.B.	N.S.	NFLD. & LAB.	P.E.I.***	YUKON	N.W.T.
No. of Facilities	0	1	1	4	6	4	3	3	6	1	1	1
Staff Person Days Worked 97-98	0	95	137	0	200	0	900	700	620	0	145	0
Capital Cost 97-98 ($ x 000)	NIL	5.0	NIL	NIL	NIL	NIL	NIL	0.0	NIL	0.5	20.0	0
Operating Cost 97-98	0.0	22.0	19.2	2.0	69.0	68.0	95.0	25.0	21.7	0	17.5	0.0
Core Collected and/or Delivery 1997-98	0	4 667	629	830	50 435	0****	36 100	5 676	18 362	0	NIL	0
Core Reduction*	NIL	NIL	NIL	NIL	NIL	0	NIL	NIL	NIL	NIL	NIL	NIL
Use of Facilities Person Days (pd) 97-98 Visits (v)	0	45	48	6 v	348 v	5	250-300 pd	226	456 md	5	100 v	15-20 v
Total Core in Storage (from all years in metres)	0	37 932	86 601	220 000	1 139 248	224 000	588 100	645 350	937 362	0	124 400	32 640
Total Exploration Drilling 97-98 (in metres)	407 561	30 000	237 869	537 844	580 000	556 500	60 000	17 800	141 320	0	85 489	62 288

*

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

*** *There is no hard rock drill core in storage.*

****Over last year*

APPENDIX

Alternative Funding Arrangements for Government Geological Surveys

ALTERNATIVE FUNDING ARRANGEMENTS FOR GOVERNMENT GEOLOGICAL SURVEYS

A Report to Mines Ministers

by

A Task Force Appointed by
The Intergovernmental Working Group on the Mineral Industry

55th. Annual Mines Ministers' Conference
Calgary, Alberta
July 1998

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ALTERNATIVE FUNDING ARRANGEMENTS FOR GOVERNMENT GEOLOGICAL SURVEYS

SUMMARY AND CONCLUSIONS

SUMMARY

Canada's national geoscience knowledge base is the foundation upon which the mineral industry plans and conducts its exploration activities, and is one of Canada's key advantages in attracting investment in the increasingly competitive global mineral exploration market. This national geoscience knowledge base resides in and is disseminated by Canada's government geological surveys.

If the mining industry in Canada is to continue to find and develop new deposits and make important contributions to the nation's economy and well-being, all efforts must be made to compete in the global exploration market - both to keep Canadian exploration companies in Canada and to attract exploration by companies from other nations. A key contribution to these efforts is to provide to explorationists a comprehensive, up-to-date, and easily accessible understanding of the geology and mineral resource potential of all parts of Canada.

Canada's geological surveys will be unable to provide the geoscience knowledge base required to help attract the mineral industry back to Canada unless ways can be found to reverse the current trends of declining budgets, cutbacks to and elimination of some program elements, and overall reductions in program levels

CONCLUSIONS
(Prepared by Industry Members of the Task Force)

In 1996, the Canadian mining industry contributed $21.3 billion to the GDP, almost $2 billion in direct taxation to federal and provincial treasuries and directly employed approximately 365,000 people. A variety of other industrial sectors directly depend on the minerals industry, contributing an additional $25 billion to the GDP and almost 300,000 jobs to the economy.

The industry members of the IGWG/Industry Task Force on Alternative Funding Arrangements for Government Geological Surveys have concluded that:

1. Mineral exploration is fundamental to the survival of the Canadian mining industry. Without continuous exploration to replace depleted reserves, there will be no mining in Canada in the future.

2. Historically, Canada's strong advantage has been its ability, at all levels of government, to provide a reliable, impartial geoscience knowledge base to attract investors to the Canadian mineral exploration industry.

3. The Canadian geoscience knowledge base has been adversely affected by total expenditure cuts of 66% over the period 1987-1998. The situation has gone beyond critical. Without an adequate geoscience knowledge base to stimulate mineral exploration, there will be no mining in Canada in the future.

4. Canadian mining companies raise more than 25% of the funds used around the world for mineral exploration, but are increasingly spending their money elsewhere. Less than a third of the $1.8 billion of the venture capital raised in Canada for exploration in 1996-97 was actually spent in Canada, and only 30% of the money raised by Canadian junior companies was spent in Canada.

5. No studies have been done to determine how much mapping, surveying or other data collection is appropriate. Preliminary assessment by this Task Force suggests that the levels of mapping deemed inadequate range from 30% to 97%, depending on map type. It is clear that current coverage is totally inadequate.

6. Because our understanding of geological processes changes with time, most geoscience data has a useful shelf life of only 20 and 30 years before it needs to be reviewed and perhaps totally re-done.

7. Fundamental to our review of alternative funding arrangements are certain principles and assumptions:
   a) Government geoscience must be provided by agencies that are both impartial and objective;
   b) Continuity of expertise is important;
   c) Government geoscience agencies must have sufficient funding stability to allow effective long-term program planning and delivery;
   d) Government geoscientists must operate in a structure that allows them to represent government to industry and industry to government, so as to influence policy formulation;
   e) Other geoscience programs, unrelated to the mining or energy industries, must also be maintained;
   f) Productivity should be maintained or improved;
   g) There should be no new levies or other costs to industry; and,
   h) No government should compete with the private sector.

8. Funding sources for government geoscience can be classified in three broad categories:
   a) Annual allocation by a government to its departments, *i.e.*, the "status quo";
   b) Funds generated by work for other government departments, through partnerships with industry or other governments and/or from sales of products and services, most likely used as an enhancement to (a) rather than a prime source of funding; and,
   c) Funds obtained from a Dedicated Revenue Stream related to industry contributions, *e.g.*, Peru, Portugal and Mines Ontario proposal.

9. The advantage of continuing to fund government geoscience from annual allocations from government is that most of the principles in Conclusion 7 are met. The principal disadvantages are that, in practice, current allocations are neither stable nor sufficient, long-term program planning is virtually impossible and continuity of expertise is not maintained.

10. The advantage of enhancing current budget allocations through partnerships or sales of products and services is that additional funds would be available. The principal disadvantages are:
    a) This source of funding might be erratic, which could be detrimental to strategic program planning,
    b) Funding derived from other government departments is normally directed at short term priorities but does not address strategic planning,
    c) Industry-government partnerships are often limited to the larger companies.

11. The advantages of a Dedicated Revenue Stream based on existing industry contributions are the ability to establish stable, adequate levels of funding, based on the existing significant contribution of industry, and to maintain continuity of expertise.

12. Several organizational models could be used to deliver government geoscience, based on specific jurisdictional needs and operating philosophies. Further study of these options by industry and government is required.

13. It is unlikely that one funding alternative or one organizational model is appropriate for every government.

14. The mining industry is opposed to additional levies to fund geological surveys over and above existing fees and taxes.

ALTERNATIVE FUNDING ARRANGEMENTS FOR GOVERNMENT GEOLOGICAL SURVEYS

RECOMMENDATIONS TO MINISTERS
(Prepared by Industry Members of the Task Force)

The industry members of the IGWG/Industry Task Force on Alternative Funding Arrangements for Government Geological Surveys recommend that:

1. The Task Force work with the National Geological Surveys Committee to determine appropriate levels of geoscience map coverage as a basis for determining future funding requirements of geological surveys.

2. A commitment be made by all governments to establish stable, adequate funding levels to generate geoscience programs that will stimulate investment in mineral exploration.

3. Funding for geoscience agencies be derived from:
   a) The annual appropriation to government departments,
   b) A dedicated revenue stream generated from existing taxes, fees and levies collected by governments from the mining industry, and
   c) Joint programs cooperatively funded by government and industry, as enhancements to funding from (a) and (b).

4. Organizational arrangements for geological surveys be further reviewed, with the clear understanding that this should not impact on the immediate need to address funding issues.

INTRODUCTION

Canada's national geoscience knowledge base is the foundation upon which the mineral industry plans and conducts its exploration activities, and is one of Canada's key advantages in attracting investment in the increasingly competitive global mineral exploration market. It has been developed over many years through a partnership among government, industry and universities. Government geological surveys provide objective geoscience information in the form of data, maps and reports, and maintain a resident pool of knowledge gained by an expert staff over many years of work. Industry contributes exploration data from its drilling, mapping, geophysical and laboratory activities. Universities train future geoscientists and carry out pure research. All of this information is made publicly available through the government survey organizations, which continually update and add to their databases.

The value and current state of this knowledge base were reviewed in a multi-stakeholder workshop entitled "*Canada's Geoscience Knowledge Base: Maintaining Our Competitive Advantage*" that was held at the 54th. Annual Mines Ministers' Conference in St. John's, Newfoundland, in July 1997. The workshop documented a long term decline in the funding levels of the government geological surveys. This decline has led to an erosion of the geoscience knowledge base and the competitive advantage that it provides. The principal recommendation from the workshop was that an industry-led Task Force be struck to examine funding options for federal, provincial and territorial geological surveys that would counteract the decline in their ability to maintain and expand the knowledge base.

A joint industry-government Task Force was established by the Intergovernmental Working Group on the Mineral Industry (IGWG) in response to this recommendation, and directed to report its findings to Ministers at their 1998 conference. Those findings are contained in this report. The role of the government representatives on the Task Force was to compile information about the mineral industry and geological surveys in Canada and abroad and to assist the industry representatives in the analysis of this information. The report's conclusions and recommendations to Ministers were developed by the industry representatives on the Task Force. Appendices A and B contain the terms of reference and the membership of the Task Force.

THE MINERAL INDUSTRY'S CONTRIBUTIONS TO CANADA

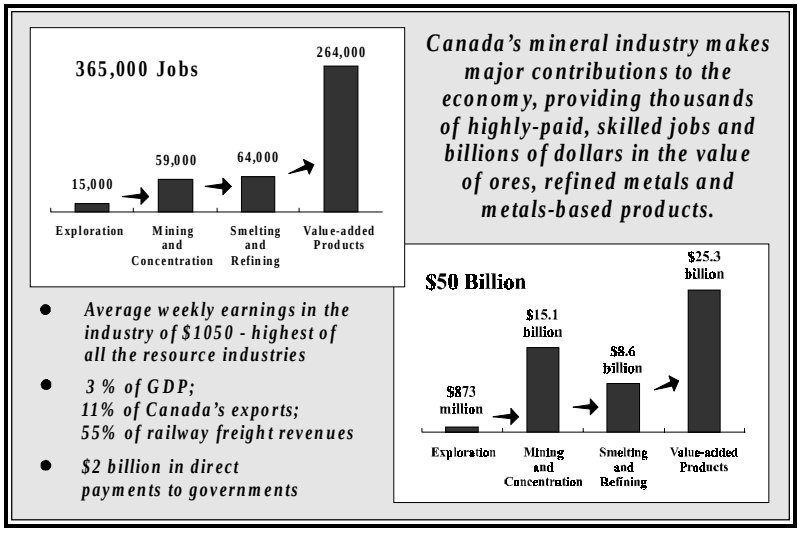
Canada's mineral industry is critically dependent upon continued exploration to discover new ore bodies in order to sustain its $50 billion direct and downstream contributions to provincial, territorial and national economies. Today's mineral exploration is a global industry, and Canada must make every effort to compete in this global market.

The mineral industry's activities begin with exploration to find ore deposits. Success in exploration leads to three other phases of activity - mining and concentration of ores and other commodities (primary production), refining and smelting of ores and concentrates, and, finally, the production of value-added products (*e.g.*, steel products, ceramics, cement). All four of these components of the sector are important to Canada's economy. For example, in 1996 some 15,000 Canadians were employed in exploring for new deposits. Operating mines and quarries, refining and smelting, and the production of value-added products employed an additional 350,000 Canadians - 59,000 in mining, 64,000 in smelting and refining, and 264,000 in the manufacture of mineral and metal products. The average weekly earnings of these employees were $1051, higher than the earnings in any other resource-based industry and higher than all but a few sectors of the economy. The efficiency of the mineral industry is also exemplary - in 1990, it required only slightly more than 4 employees to generate $1 million in production in the mineral industry, significantly less than the 9 employees required across the Canadian economy in general to generate the equivalent production.

In total, the mining and refining of ores directly contributed $21.3 billion (Cdn.) to the Canadian economy in 1996, which was more than 3 % of the Gross Domestic Product. The value of minerals produced in 1996 was $17.1 billion (excluding petroleum, natural gas and coal). This is approximately $500 of new wealth created for each Canadian. The four most important metals were gold ($2.80 billion), copper ($2.06 billion), nickel ($1.92 billion) and zinc ($1.63 billion). The value of coal production was approximately $1.9 billion, and that of potash was $1.28 billion. Minerals and mineral products are major contributors to the nation's balance of trade, comprising 11% of Canada's exports in 1996 and contributing $15.4 billion to the national trade surplus.

These direct contributions to the economy are dwarfed by those of industries that depend upon the mineral industry. Among these industrial sectors are the fabricated metals industry ($5.5 billion in sales, 160,000 jobs), the automotive parts sector ($13.3 billion, 89,000 jobs), the foundry industry ($2 billion, 15,000 jobs), ceramics ($1.5 billion) and the concrete industry ($3 billion). As well, Canadian railways derive significant revenues from the transportation of ores and metal products (55% of total freight revenues in 1995).

The mineral industry also makes important direct payments to all levels of governments in a variety of taxes, fees, levies and other payments. In 1996-97, these payments amounted to $34.9 million from exploration, $1.81 billion from production and $110 million from health and safety fees and levies (Appendix C).



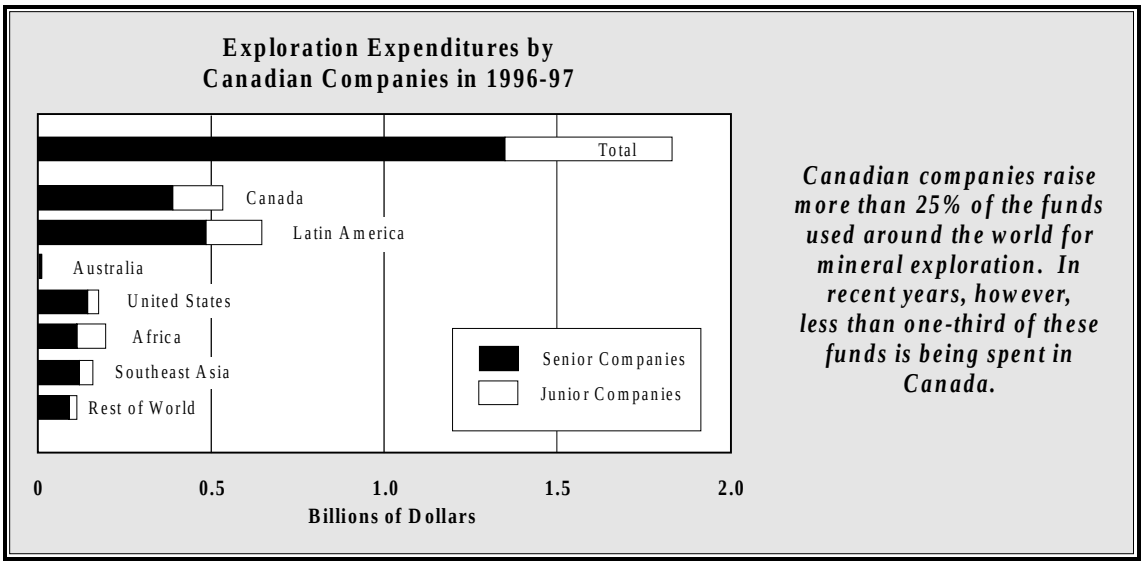
All of this activity can only be maintained and expanded if new ore deposits are discovered. *Without continuous exploration to replace depleted reserves, there will be no mining in Canada in the future.* The next section of the report examines the Canadian mineral exploration industry from domestic and global perspectives.

EXPLORATION TRENDS

Data compiled by the Minerals and Metals Sector of Natural Resources Canada in cooperation with provincial and territorial agencies show that some $873 million was spent on exploration for new mineral deposits in Canada in 1996-97. Of this total, $98 million was spent seeking additional deposits on properties either already in production or committed to production, and $775 million was spent in "grassroots" exploration - looking for deposits on relatively unknown ground. Junior companies and prospectors were responsible for $306 million in exploration, and senior companies spent $567 million (65% of the total).

Canada's equity market is the world's largest single supplier of capital for mineral exploration, and Canada has historically attracted more exploration than any other country. Over the past decade, however, Canadian companies have increasingly used this capital to explore elsewhere. Foreign companies have also reduced their activity in Canada.

Canadian companies raise over 25% of the funds used throughout the world for



mineral exploration - the largest amount from any single country. In recent years, however, more and more of those funds are being used to explore outside of Canada. In 1996-97, less than a third of the $1.8 billion raised in Canada for mineral exploration was spent in Canada. This focus on offshore exploration by Canadian companies is a relatively recent phenomenon. As recently as 1992, senior Canadian companies spent approximately 80% of their exploration budgets in Canada, and junior companies spent approximately 60% of their budgets in Canada.

These data also illustrate the global nature of the mineral exploration industry that has developed in the 1990s. This exploration is fundamental to the survival of the Canadian mining industry. All efforts must be made to compete in this global exploration market, both to keep the exploration efforts of Canadian companies in Canada and to attract exploration by companies from other nations.

Decisions by the private sector about where to explore for new resources are influenced by a number of factors, including the economics of mineral commodities, regulatory regimes, security of land tenure, physical infrastructure, and perception of mineral potential. Canada is attractive to the global explorationist from all of these perspectives, with its stable political regimes, well-developed infrastructure and experience in mining. Just as important is Canada's mineral potential. Although there is a long history of mineral deposit discovery, Canada's geology ensures that an excellent potential for discovery of additional deposits still exists, as demonstrated by the recent discoveries of base metals in the Yukon, diamonds in the Northwest Territories and nickel in Labrador. Indeed, exploration in Canada has literally "*just scratched the surface*" - many more deposits are yet to be discovered.

Given these positive attributes, it is important to clearly demonstrate that there are ore bodies waiting to be discovered in Canada. This can be accomplished by providing to explorationists a comprehensive, up-to-date, and easily accessible understanding of the geology and mineral resource potential of all parts of Canada. This national geoscience knowledge base resides in and is disseminated by Canada's government geological surveys.

Without an adequate geoscience knowledge base to stimulate mineral exploration, there will be no mining in Canada in the future.

CANADA'S GEOSCIENCE KNOWLEDGE BASE: A COMPETITIVE ADVANTAGE

Geoscience information comprises a range of earth science data and interpretations derived from geological, geophysical and geochemical surveys and research. In Canada, the principal use of this information is to promote and assist energy and mineral exploration and development by the private sector. There are, however, other, equally important uses of geoscience information by governments, where it is used to make land use decisions, protect the environment and human health, and assess risks due to geological hazards such as earthquakes, landslides, volcanic eruptions and floods.

Canada's government geological surveys play a key role in attracting mineral exploration by providing the up-to-date, comprehensive geoscience information and knowledge required by the mineral exploration industry. Degradation of this knowledge base, resulting from inadequate levels of support for the geological surveys, will inevitably damage the competitive advantage that it provides.

Government's Responsibility for the Geoscience Knowledge Base

Canada's government geological surveys have a well-recognized and important role in supporting private sector exploration activity. A principal role is to provide industry with a comprehensive geoscience knowledge base that includes both a wide range of different types of geoscience information, acquired by the surveys through their own programs and through contributions from industry and academia, and the insights developed by expert personnel over many years of work. This knowledge base is housed in the federal, provincial and territorial geological surveys and made publicly available as databases, reports, maps and other products and as expert advice.

Private sector mineral exploration is a complex, multi-stage process that proceeds from initial company decisions about which commodities to pursue, through target

Private Sector Action (with factors influencing decisions)	Government Geological Survey Contributions (knowledge, advice and people)
Commodity Selection - corporate goals - commodity markets	
Country/Area Selection - land access and tenure - mineral potential - investment climate - infrastructure	Provides a regional geologic framework (e.g., bedrock maps, regional geochemistry, metallogeny) that is essential to assessing the mineral potential of an area.
Exploration Model - theoretical and empirical knowledge of how specific ore deposits form	Provides mineral deposit models that are applicable to the target area.
Regional Reconnaissance - mineral inventory - regional geological mapping - airborne geophysical surveys - regional geochemical surveys - prospecting	Provides access to reports of previous industry exploration efforts, which are kept in survey files. Provides regional geological, geophysical and geochemical maps and data, and expert knowledge that increase the efficiency of the private sector exploration.
Property Acquisition - promising results from regional reconnaissance work	Public releases of new information in areas of current interest often lead to staking rushes.
Property Exploration - detailed geological mapping - detailed ground geophysical surveys - detailed geochemical surveys - definition of diamond drill targets	Provides camp-scale geological mapping and deposit models, and camp-scale, reconnaissance-type geophysical and geochemical data that assist in defining specific targets and interpreting new discoveries.
Deposit Discovery and Delineation - trenching, stripping and drilling - very detailed geological mapping - borehole geophysics - detailed sampling and analyses	Provides results of exploration technology research that leads to efficient application of exploration techniques. Provides expert knowledge to assist industry in analysis and interpretation of data.
Deposit Evaluation - advanced exploration - feasibility studies	
Permitting - positive results from feasibility, metallurgical and economic studies	Provides input to environmental reviews and other regulatory processes.
Mine Construction and Production	

Canada's geological surveys make important contributions throughout the mineral exploration process.

selection and extensive laboratory and field research that leads to discovery of deposits. Only a small proportion of these initial discoveries eventually prove to be economically viable. Government geological surveys make major, important contributions to industry's activities and decisions throughout the process.

The Current Status of Canada's Geoscience Knowledge Base

Because maps are still the primary way of displaying and interpreting geological data, one measure of the completeness and currency of the national geoscience knowledge base is a compilation of the coverage of the country for the most important types of geoscience maps used by the mineral industry. These critical map types are ones that show:

- the distribution and relationships among different bedrock components,
- the distribution and relationships among the different, unconsolidated, surficial materials that mask the bedrock geology,
- variations in geochemical parameters, as measured in media such as lake and stream waters or their bottom sediments and in glacial sediments (tills), and
- variations in geophysical parameters, such as the gravitational, magnetic and electromagnetic fields.

All of these maps are produced by government surveys at a variety of scales. Industry uses regional scale maps and data (*e.g.*, 1:250,000 to 1:1,000,000 and smaller) in the initial phases of an exploration program to select broad target areas. Increasingly more detailed information, presented on detailed maps (*e.g.*, 1:100,000, 1:50,000 and larger), is required as industry focuses its investigations on smaller and smaller areas. A compilation by the Task Force of current national coverage for these map types revealed large variations between different map types and in different regions of the country. This compilation must be interpreted with caution because of several critical variables, including:

- The extent of coverage at regional scales varies widely from one part of the country to another and from one map type to another. For example, approximately 80% of the country south of 60° N has been covered by regional scale aeromagnetic surveys, but coverage for areas north of 60° N is less than 45%. Similarly, regional scale coverage for geochemistry maps varies from approximately 50% to 100% in the provinces and the Yukon Territory, but is only about 10% in the Northwest Territories. Similar variations in regional coverage exist for the other map types.

- The problems of assessing coverage at detailed scales are considerably greater than those for regional scales, because of the much greater total number of maps and differences among the provinces and territories as to the actual scale of detailed mapping. Although 1:50,000 is a common scale in many of the provincial detailed mapping programs, significant mapping is carried out at greater detail (*i.e.*, scales ranging from 1:10,000 to 1:31,680) in areas of higher mineral potential. This database of detailed mapping is critical to industry, as it contains the level of information required for effective exploration once regional targets have been determined from regional scale information.

- Different types of mapping are required in different areas. For example, detailed bedrock maps may not be warranted in parts of the Prairies, where very large areas are underlain by only one or two rock units. At the same time, knowledge of the distribution of these rock units at depth is especially critical in the Prairies because of their high hydrocarbon potential. Similarly, there is little need to carry out detailed

Map Type	Scale	Approximate Number of Maps	Fully Adequate	Acceptable	Inadequate
Bedrock Geology	Regional	1,000 at 1:250,000	53%	12%	35%
	Detailed	14,150 at 1:50,000	Varies by province, ranging from 2% to 40% fully adequate.		
Surficial Geology	Regional	1,000 at 1:250,000	47%	22%	31%
	Detailed	14,150 at 1:50,000	17%	5%	78%
Geochemistry (Lake/stream waters and sediments)	Regional	670 at 1:250,000	33%	0%	67%
Geochemistry (Tills)	Regional	1,000 at 1:250,000	18%	13%	69%
Aeromagnetic Surveys	Regional	1,000 at 1:250,000	65%	0%	35%
	Detailed	14,150 at 1:50,000	Varies by province. Ontario, for example, has 25% coverage.		
Radiometric Surveys	Regional	1,000 at 1:250,000	20%	0%	80%

(See Appendix F for additional information)

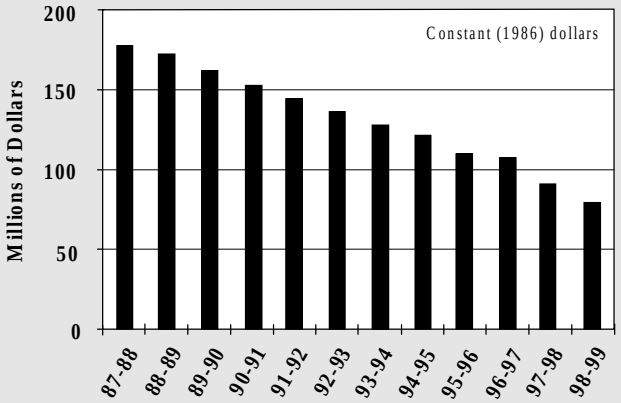
Industry uses a variety of geoscience maps, at both regional and detailed scales, at different stages in mineral exploration. Current coverage of the country varies widely from one type of map to another, and between different regions of the country. In general, however, coverage by any one map type is far from complete.

bedrock geological mapping in areas that are largely covered by unconsolidated glacial deposits: interpretations of the bedrock geology in these areas will be dependent on combinations of surficial, geochemical and geophysical mapping. Similar caveats apply to other map types.

Despite these caveats, the data compiled by the Task Force show that large areas of the country lack the geoscience information required to assess their mineral potential, or to establish baseline information for other land use decisions. Programming by the geological surveys to eliminate these gaps is being developed in consideration of the following factors:

- At least two scales of mapping are essential - one regional scale for the entire country and one detailed scale in prospective mineral belts. The actual scale of mapping will vary according to jurisdictional preferences.

- Most map types have a definable life, after which time advances in geological sciences mean that remapping of an area will result in tangible improvements over the pre-existing map and accompanying databases. This lifetime is widely accepted to be 20 to 30 years for bedrock and surficial geology maps. The usable life time of geophysical and geochemical surveys is longer, provided that appropriate methods of data acquisition are used in the initial surveys.



The combined budgets of Canada's federal, provincial and territorial geological surveys have decreased from $177.5 million in 1987 to $79.4 million in 1998. As a consequence, the national geoscience knowledge base is gradually eroding.

- Cuts to survey budgets over the past decade mean that each is now operating fewer projects annually, and that project teams are smaller than in the past. Thus, less area can be mapped annually. These reductions in number and size of field crews also have grave implications for the practical training for the next generation of Canadian field geologists, as there are substantially fewer summer employment opportunities.

- The limits on rates of mapping, the useful life of existing maps, and the needs for information mean that the surveys must operate programs that balance new mapping of relatively unknown areas with remapping of areas with known, high mineral potential. Current examples of this dilemma can be found in New Brunswick, Ontario, Manitoba and British Columbia, where new geoscience information is required both to maintain important mining camps (Bathurst, Timmins/Kirkland Lake, Flin Flon/Snow Lake, Sullivan) and to stimulate exploration in other parts of these provinces.

To cope with these conflicting demands, Canada's geological surveys have taken steps to ensure that their collective programs are planned and delivered in the most efficient manner. The Intergovernmental Geoscience Accord, signed by Ministers in 1996, has already proved effective in increasing federal-provincial/territorial collaboration in planning and delivering programs, eliminating overlaps and ensuring that projects of highest priority at both levels of government are identified and carried out in a timely manner.

ALTERNATIVE FUNDING ARRANGEMENTS FOR CANADIAN GEOLOGICAL SURVEYS

Canada's geological surveys will be unable to provide the geoscience knowledge base required to help attract the mineral industry back to Canada and for other, equally important, applications unless ways can be found to reverse the current trends of declining budgets, cutbacks to and elimination of some program elements, and overall reductions in program levels. This section reviews current and possible funding sources and organizational structures for the surveys, as a prelude to a review of how geological surveys operate in foreign jurisdictions, and a discussion of options that Ministers may wish to consider to counter this loss of capacity.

Canada's geological surveys have typically been operated as departmental line units, funded by appropriation from a central treasury. Alternative arrangements can be considered that invoke alternative funding mechanisms (both internal and external) or organizational models that provide different balances between funding and managerial independence and input to government policy.

Alternative funding arrangements for the geological surveys may be discussed from two perspectives:

- the *funding sources and mechanisms* available to the surveys, and
- the possible *organizational structures* for the surveys.

Funding Sources and Mechanisms

The geological surveys can obtain funds from *internal* (*i.e.*, the central treasury or other parts of their government) or *external* (*i.e.*, other Canadian or foreign governments, quasi-government agencies such as international development banks or the United Nations, and industry) sources.

Canada's geological surveys have historically been funded from internal sources, largely by an annual appropriation that has been augmented from time to time by additional funds for special programs such as the Mineral Development Agreements. The annual appropriation has varied with changes in government and departmental policies and priorities. The past decade has seen a steady decrease from year to year in the annual appropriation to the geological surveys. One proposal to halt further decreases is to base the survey's budget, entirely or in part, on government revenues from the mineral industry, dedicating a portion of those revenues to the survey's operations. Other proposals center on augmenting the appropriation by revenue generation through sales of products and services.

The geological surveys have explored a variety of cost recovery mechanisms.

Funding Source	Funding Mechanism	Description
Internal	Appropriation	a) Annual allocation by government to its departments. There is considerable discretion as to the distribution of appropriated funds within departments. Canada's geological surveys receive most or all of their funds as an appropriation. b) Funds voted from time to time for specific programs. The recently terminated MDAs are an example.
	Other Government Departments	Funds provided to the geological survey by other parts of its own government for specific programs or services.
	Dedicated Revenue Stream	Part or all of the geological survey's budget is obtained from a government revenue stream related to the industry. Examples include Peru and Portugal, where the survey budgets are linked to levies paid by the mineral industry. The revenue stream could be from an existing source, or from a new levy on the industry.
External	Partnerships	Funds received by the geological survey from industry or other governments who are interested in specific projects. Partners normally have confidential access to project results for a negotiated time period, but all project results eventually are made public. Examples of partnerships include the GSC's Industrial Partners Program and recent aeromagnetic and radiometric surveys that were jointly funded by the GSC, industry partners and provincial or territorial government agencies.
	Revenue Generation	Funds received by the geological survey for sales of its products and services. Sources include *product sales, contracting in* and *user fees.* Revenue from the sale of maps, reports, databases and other products could accrue to the survey rather than being deposited in the government's general revenue fund. The survey could enter into contracts with industry or government clients for specific projects on a *cost recovery* or *cost sharing* basis, or could establish a list of fees for services rendered, such as literature searches or property visits.

A number of alternative funding sources and mechanisms are available to Canada's geological surveys. Currently, all of the surveys receive the majority of their funding from internal sources. Lesser amounts are obtained from external sources. No Canadian survey is currently funded from a dedicated revenue stream.

Partnerships have proven effective for some programs, such as regional geophysical and geochemical surveys. Partnerships may not be effective, however, for all of the surveys' program elements and must be entered into carefully to preserve the objectivity of the surveys and to ensure that all data and results are publicly available as quickly as possible. The surveys have also explored the viability and potential of *sales of goods and services* to generate revenue. In the past, revenues from the sales of maps, reports and other products have typically been deposited in central treasuries, and did not accrue to the organization that generated them. Changes would be required to these policies for the surveys to benefit directly from sales of products. Critical to this mechanism for obtaining additional funds is the establishment of fair prices. Canadian governments have generally adopted the philosophy of *user pay* with respect to products and services, whereby the beneficiary of a particular program is expected to pay *user fees.* In the case

of geological surveys, user fees normally do not reflect the cost of primary data acquisition and interpretation, but are based on the cost of printing and distribution of maps, reports, databases and other information or the provision of specific services. The costs of data acquisition and interpretation are deemed to be a public good, and are paid from the survey's internal funding. A third area of revenue generation is *contracting in*, in which the survey enters into a contract with a client to deliver specific projects. Contracting in is particularly effective in cases where the client's needs match the survey's strategic program goals and objectives.

Organizational Models

During the present decade, governments in Canada and elsewhere have been searching for innovative ways to improve the delivery of programs and services. These approaches are referred to as *Alternative Service Delivery* and often involve adopting a new organizational model. There is a spectrum of organizational models ranging from the traditional government department or ministry to private enterprise.

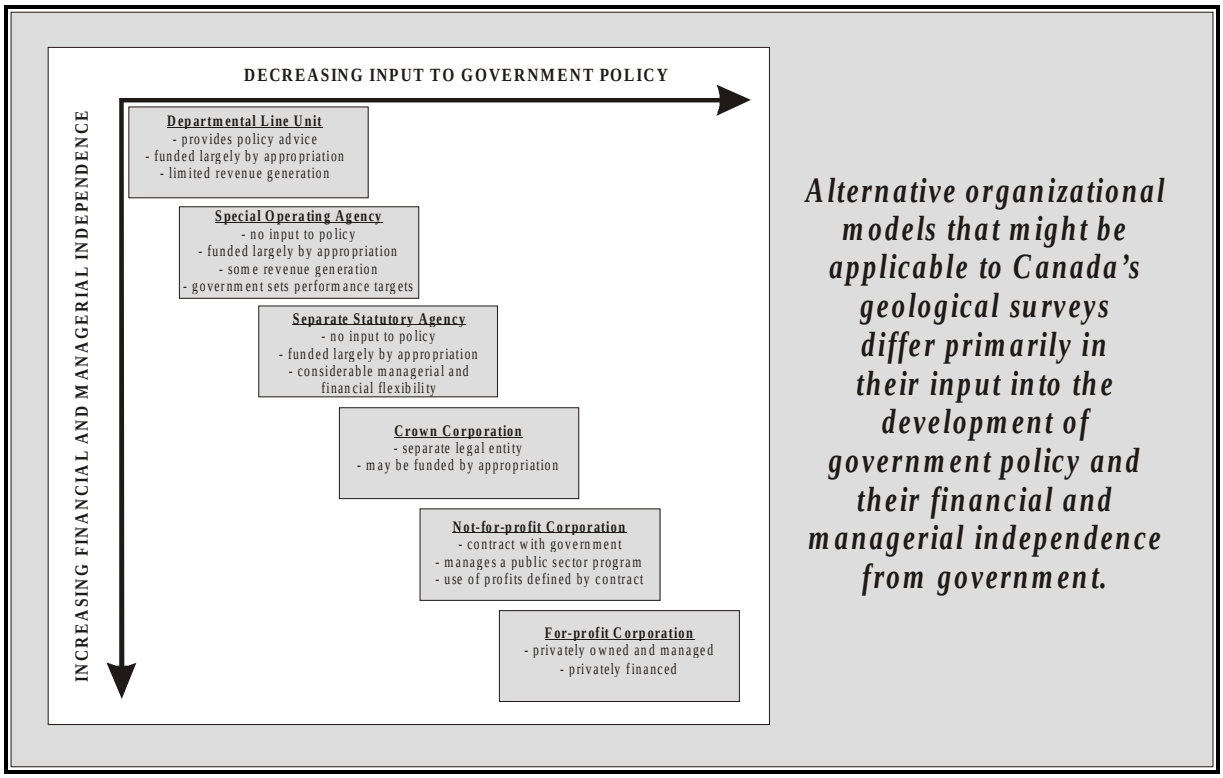
With the exceptions of those in Québec and Alberta, Canada's geological surveys[1] are *traditional units of government departments or ministries.* As such, they are accountable to a Minister and Deputy Minister, usually through an Assistant Deputy Minister, operate under a departmental statute, and receive most of their funding by appropriation.

Special Operating Agencies (SOAs) are organizations within existing departmental structures which deliver services, as distinct from providing policy advice to Ministers. They operate within the legislative framework of the department, but may be delegated additional authorities and flexibilities to promote a more businesslike approach. SOAs may be funded through any of the mechanisms available to their departments and, in many cases, there is an increased emphasis on cost recovery.

Separate Statutory Agencies operate under constituent legislation to manage the delivery of specific government services. They normally have a range of authorities which allow for more responsive and streamlined operation. They are accountable to a Minister through a Chief Executive Officer, equivalent to a Deputy Minister, and are similar to departments in most other respects, including their funding arrangements. Examples are the Canadian Space Agency and Statistics Canada.

Crown Corporations are government-owned enterprises, normally established by legislation and accountable to the legislature through a Minister. Their day-to-day operations are typically overseen by a board of directors. They define a broad spectrum of mandates and operating frameworks. At one end, they receive the bulk of their funding by appropriation, are subject to the same administrative requirements as departments, but have increased decision-making independence from government (*e.g.*, National Research Council). At the other end of the spectrum are crown corporations

[1] Ontario is currently considering a new organizational model (named Mines Ontario) for its Ministry of Northern Development and Mines, including the Ontario Geological Survey.



which operate in a commercial environment and are expected to earn a profit (*e.g.*, Canadian National Railway).

Complete separation from government can be achieved by privatization, as either a *not-for-profit* or a *commercial (for-profit) enterprise.* A not-for-profit enterprise would assume the responsibility for managing public sector functions under a contractual arrangement with the government and could be given the flexibility to generate additional funding from commercial activities. Commercial enterprises are privately owned, and financed and managed on a commercial basis.

These organizational models differ mainly in respect to their degree of managerial and financial independence, as well as the extent to which the organizations are expected to influence government policy. Although there may be an implicit assumption that the more an organization deviates from the traditional departmental model, the greater will be the reliance on external funding, this is not necessarily the case. These organizational alternatives do not in themselves offer solutions to the current funding situation of Canada's geological surveys. The choice among them will depend more on a government's expectations of its geological survey and, in particular, the importance that it attaches to the scientific perspective that the survey can provide to policy formulation.

Many of these different organizational and funding arrangements have been adopted by geological surveys around the world. Their experiences, which provide valuable lessons that should be considered before decisions are taken with regard to the future of Canadian surveys, are described in the next section.

WHAT OTHER COUNTRIES ARE DOING

All of the countries with which Canada is competing for exploration dollars maintain geological surveys. Providing geoscience information to stimulate and support mineral exploration is a principal activity of all of these geological surveys. There are, however, a number of different organizational and funding models in place among these surveys. The Task Force compiled information about foreign geological surveys as a prerequisite to developing options for Canadian surveys. The data, which are presented in detail in Appendix E, reveal the following generalizations:

All countries with an active minerals industry maintain geological surveys, most as line units of government departments. Departures from this organizational model occur in some countries where substantial parts of the survey budget are derived from sources other than appropriations, particularly other government departments and external contracts. A small number of countries tap a dedicated revenue stream generated by a levy on the mineral industry to fund their geological survey.

- The predominant organizational model for geological surveys throughout the world is that of line units of government departments. These surveys receive most of their funding as an appropriation.

- The furthest departures from this model are in Europe, where the very mature surveys of the United Kingdom, Germany and France and the younger surveys of the Scandinavian countries obtain substantive (up to 40%) parts of their funding from sources other than appropriation. Most of this external funding comes from other departments in the survey's own country, or from contractual work with foreign governments. Interestingly, the mineral industries in these countries are in an over-mature phase (*i.e.*, largely depleted reserves).

- There is only a limited potential for surveys to generate revenues from sales of their products. The markets for these products are limited, and prices must be carefully established so as not to eliminate sales to smaller, less affluent customers. This is particularly important in Canada, where much of the grass roots exploration work is carried out by individual prospectors and junior companies.

- There are a number of surveys that operate as agencies, with differing relationships to their governments. Included in this category are the surveys in New Zealand, South Africa and Denmark/Greenland. Most importantly, in all of these cases, the dominant (>90%) source of funding is the home government department.

In addition to compiling basic information about a large number of foreign geological surveys, the Task Force investigated the geological surveys of the United Kingdom, Peru

and Australia more thoroughly. These three countries provide examples of alternative funding arrangements that may be applicable to Canadian geological surveys. The United Kingdom is a country with a long-lived, highly respected geological survey and a mature minerals industry. Peru has a young, growing minerals industry and funds its national survey largely from a dedicated revenue stream. Australia closely resembles Canada in its government structure, its federal and state geological surveys, and its important minerals industry. Key features of the geological surveys in these three countries are described below.

United Kingdom

Founded in 1835, the British Geological Survey is the world's oldest geological survey. It has acquired a reputation as a world leader in many areas of geoscience over its long history, and has operated under a number of organizational structures within government. Since 1965, the BGS has been part of the Natural Environment Research Council (NERC). NERC is an "executive agency" that oversees research activities in its own laboratories and universities into five environmental and natural resource issues - biodiversity, environmental risks and hazards, global change, natural resource management and pollution and waste. In this current organizational structure, the BGS is accountable, through NERC, to the Minister of State for Science and Technology. In terms of the organizational structures defined in the previous section, it shares many of the characteristics of a *Crown Corporation* in Canada.

Today, the mission of the BGS is "to contribute to the economic competitiveness of the UK; the effectiveness of public services and policy, including international policy; and the quality of life, by providing the best, most relevant and up-to-date geoscience information and advice for the United Kingdom, both onshore and offshore, and internationally".

To fulfill this mission, the BGS operates a three-part scientific program:

- A *Core Program* of long-term strategic mapping, monitoring, database management and applied research. The Core Program is fully funded by appropriation from the national Science Budget.
- A *Partnership Program* of medium-term mapping and research, co-funded from the Science Budget and partners in the private and public sectors. Such co-funded projects address generic issues relevant to both the Core Program and the economic and environmental interests of the funding partners.

Country	Organizational Model	Funding Sources	Aspects of Interest to Restructuring of Canadian Geological Surveys
United Kingdom	Crown Corporation	42% - appropriation 19% - OGDs 39% - contract and partnership programs	Appropriation comes from national science budget that features regular reviews of long term programs. Much of the partnership and contract programs is done outside of the United Kingdom.
Peru	Special Operating Agency	3% - appropriation 94% - dedicated revenue stream 3% - product sales	Geological survey receives a fixed percentage (30%) of a levy on mining claims. The rest of the revenue from this levy is used to manage and regulate the Peruvian mining industry.
Australia	Line Units	Federal Survey 77% - appropriation 10% - OGDs 4% - product sales 6% - use of equipment 3% - private sector State/Territory Surveys 100% - appropriation	Many similarities to Canada: - both federal and state geological surveys - mineral resources owned by the states The federal survey's appropriation is from a national science budget, which features regular reviews of long term programs.

The United Kingdom, Peru and Australia are countries where some of the organizational models and funding mechanisms being considered for Canadian geological surveys have been used

- A *Contract Program* of research undertaken in direct response to commissions from customers in the private and public sectors and funded entirely by them. Contract projects build upon the expertise developed in the Core Program and return knowledge and skills to it.

This program structure was developed and implemented by the BGS in the mid-1980's to better enable the survey to obtain funding from both government and non-government sources to replace diminishing appropriations. By 1995-96, this mechanism had matured such that only 42% of the BGS budget was provided by appropriation from the Science Budget. Other government sources provided 19%, and 39% was derived from non-government sources.

In considering possible application of this model to Canadian geological surveys, it must be remembered that:

- While the United Kingdom's production of oil, natural gas and coal is great (some $42 billion (Cdn.) in 1996), its non-fuel mineral resource industry is very small ($4.5 billion (Cdn.) in 1996) in comparison with Canada's. Metalliferous minerals are only a minor part ($19.1 million in 1996) of the non-fuels production, which is dominated by aggregates and industrial minerals. This means that the requirements for geoscience information with direct application to mineral exploration are significantly different from those in Canada.

- BGS activities within the United Kingdom are largely limited to activities in the Core Program and much of the Partnership Program. A considerable proportion of the Contract Program, which contributes almost 40% of the total budget, is done outside

of the United Kingdom. While these projects provide valuable training and experience for BGS employees, they do not contribute new information to the national geoscience knowledge base.

Peru

Peru presents an example of a survey funded primarily by a dedicated revenue stream. The *Geological, Mining and Metallurgical Institute* of Peru (INGEMMET) was created in 1979 by the integration of the Mining, Scientific and Technologic Institute and the Geology and Mining Institute. Initially, INGEMMET carried out both geological mapping programs similar to those of Canadian surveys and mineral exploration and metallurgical and mining technology research. In 1992, INGEMMET's mandate was narrowed to the task of compiling, preparing and providing basic geological and mining information about Peru, in order to foster private investment in the mining sector. Mineral exploration was left entirely to private investors, and other research functions were transferred to Peruvian universities.

INGEMMET is a "decentralized public entity" within the Peruvian Ministry of Energy and Mines (MEM). It reports to the Vice Minister (Mining) of MEM, but has legal, financial and administrative autonomy, and defines its objectives to be "to promote scientific research in geology and to generate and spread basic geo-mining information." It is managed by a Directive Council which is headed by the Vice Minister (Mining) and is made up largely of representatives from mining companies. The Directive Council determines INGEMMET's program, including external contracts, and manages its budget. In terms of the organizational structures defined in the previous section, INGEMMET is best described as a *Special Operating Agency*.

For the purposes of this report, the most interesting aspect of INGEMMET is the way it is funded. INGEMMET receives 97% of its budget from the Peruvian government: the remaining 3% comes from sales of its products. Approximately 3% of the budget is derived by appropriation from general revenues. The overwhelming majority (94%) of the budget is derived from a dedicated revenue stream. Peru charges a "Mining Contribution" of $2 (US) per year per hectare of land held for mineral exploration. Thirty percent of this levy is dedicated to INGEMMET. The rest is also used to manage and regulate Peru's mineral exploration and mining industries - 15% goes to the Public Registry for Mining; 15%, to the Ministry of Energy and Mining and 40%, to the area in which each mining concession is located.

In considering application of this model to Canada, it must be remembered that:

- Peru's Mining Contribution is a long-standing levy on the industry, having been established in 1877. As well, it has always been dedicated to support of the mining industry, with an initial mandate to "cover the budget of the Civil and Mining Construction Special School, support the Office of Special Mining Engineers which shall render services in several mining communities, and promote the mining industry."

Australia

Australia offers perhaps the closest analogue to Canada among all of the world's geological surveys. Both countries have mineral industries that are major contributors to the national and state/provincial economies. Australia and Canada have vied to lead the world in mineral exploration expenditures for the past several years. They have similar government systems, and both operate federal and provincial/state geological surveys. Responsibility for minerals in both countries resides with the provinces/states.

The national geological research and survey agency in Australia is the Australian Geological Survey Organization (AGSO). The AGSO is a research agency of the national Department of Primary Industries and Energy, and was originally established in 1946 as the Bureau of Mineral Resources, Geology and Geophysics. Interestingly, state geological surveys comparable to Canada's provincial/territorial geological surveys, operated without a federal counterpart for many years before and after federation in 1901. The AGSO was established after the recognition of a need for a national organization to facilitate geological mapping of the continent and to advise the Commonwealth Government on earth resources issues.

The AGSO's mandate is to undertake geoscientific mapping and research to encourage sustainable development of Australia's mineral and energy resources; underpin sustainable management of Australia's land, groundwater and ocean resources; and mitigate the effect of natural hazards on Australia's infrastructure and communities. Geological surveys are also operated by the 6 Australian states and the Northern Territory. Their programs are focused on providing pre-competitive geoscience information to the minerals and petroleum sectors. A few also carry out programs in groundwater, urban geology and geohazards, and similar public interest programs, generally on a small scale.

All of these surveys are *traditional line units* of government departments, and receive most of their funding by an annual appropriation from general revenues. The state and territorial surveys have no requirement to obtain external funding, but the AGSO has been encouraged, since 1993, to obtain 30% of its annual funding from external sources. In 1997-98, AGSO's total budget was approximately $62.5 million (Cdn.). Of this total, 76.5% was provided by appropriation; 4% came from sales of products (primarily large geophysical datasets of interest to the petroleum sector); 6%, from fees charged for use of the AGSO's research vessel (leased; lease has since expired); 10% from OGDs, and 3.5% from the private sector and international activities. This distribution of funding sources is illustrative of the relative amounts of funding that may be available to Canada's geological surveys, should they be directed to obtain external funding to supplement reduced appropriations.

ANALYSIS OF OPTIONS

The two preceding sections of this report have described funding mechanisms and organizational models that might be applied to Canadian geological surveys and summarized their application in geological surveys around the world. Two key questions must be considered in analyzing these options and reaching decisions on restructuring of the Canadian surveys to counteract the current trend of decreasing budgets and program levels:

Canada's geological surveys can only meet the current demand for geoscience knowledge if their funding is increased. A number of different funding mechanisms and organizational models are available that will increase funding for the surveys while preserving critical positive attributes of their current operating relationships with both industry and government.

- *how should the surveys operate?* - what combinations of organizational models and funding mechanisms will best enable the surveys to deliver the programs required by the mineral industry and their other clients, including government?

- *how much is enough?* - how should budgets be established?

How Should the Surveys Operate? - Identifying the Optimal Funding Mechanism and Organizational Model

The Task Force's review indicates that only a limited number of organizational models and funding mechanisms are used by geological surveys throughout the world. Canada's geological surveys could be operated under various different combinations of these organizational and funding arrangements. It is improbable that the same model will be applicable to all of the federal, provincial and territorial surveys, given their different jurisdictional mandates, objectives and operating regimes. These jurisdictional requirements aside, the following characteristics of the surveys should be retained in any new operating structure and environment:

- *objectivity and credibility* - Canada's geological surveys have a reputation of being objective, impartial providers of accurate information, knowledge and expertise. This reputation enables them to deal effectively with private sector clients that range from individual prospectors through multinational mining companies, as well as with decision-makers within government and non-governmental organizations (NGOs).
- *continuity of expertise* - The geoscientists of the surveys are an invaluable resource because of their knowledge of the geology and resources of their jurisdiction. This knowledge goes far beyond the data and information provided by maps and reports, and can only be acquired through many years of work in the same jurisdiction.
- *strategic, long term programming* - Strategic planning and delivery of programs allows the surveys to address both short term, high priority needs of both private sector clients and governments, and long term needs for a comprehensive geoscience

knowledge base for their entire jurisdiction.

- *influence on government policy decisions* - As parts of government departments, the geological surveys currently have an important ability to be part of decisions within government that affect the mineral industry.
- *delivery of other programs* - Canada's geological surveys are a significant, and often the sole, source of geoscience data, information and expertise that is used outside of the mineral resource industries. Examples of these important contributions include the national seismological network (earthquakes and participation in the international program to monitor nuclear explosions), environmental studies (including major contributions to studies of climate change and metals in the environment), geomagnetism, marine geoscience, and amelioration of risks from natural hazards (floods, earthquakes, tsunamis, landslides).

In addition to retaining these characteristics, any restructuring of the geological surveys should also incorporate the following tenets that the mineral industry considers essential:

- *productivity* - The organizational model and funding mechanism selected should not have a negative impact on the ability of the surveys to produce and disseminate databases, maps, reports and other products of importance to the mineral industry in a timely and cost-effective manner.
- *additional cost to industry* - There should be no new, additional and involuntary cost to the mineral industry, which already contributes significantly through a range of taxes, fees, royalties, levies and other payments to government (see Appendix C).
- *subsidized competition with the private sector* - The surveys should not be placed in a position of subsidized competition with the explorationists, consultants or others in the private sector.

Alternative Funding Mechanisms

The Task Force's review of geological surveys worldwide shows that, with few exceptions, these organizations receive most, if not all, of their funding from internal government sources. Moreover, the largest part of this funding typically comes by appropriation. This probably reflects the reality that funding from government sources is the most likely to preserve what stakeholders consider to be essential characteristics of geological surveys.

The majority of national geological surveys, including the Geological Survey of Canada, have pursued funding from sources other than appropriation, but this rarely exceeds 20 to 30% of the total budget. Funds from sources external to government are generally 10% or less of the total. There are benefits from diversified funding sources in terms of client focus and efficiency of operations, but these must be weighed against the impact on the core program of geoscience for the public good.

	Funding Mechanisms	Objectivity	Credibility	Continuity of Expertise	Strategic Programs	Policy Influence	Public Good Programs	Maintains or Improves Productivity	No New Cost to Industry	No Subsidized Competition with Private Sector
Internal	Increased A-base Appropriation	✓	✓	✓	✓	✓	✓	✓	✓	✓
Internal	Other Government Departments	✓	✓	×	×	✓	✓	✓	✓	✓
Internal	Dedicated Revenue Streams									
Internal	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓
Internal	New	✓	✓	✓	✓	✓	✓	✓	×	✓
External	Partnerships	×	×	×	×	×	×	✓	×	×
External	Revenue Generation									
External	Product Sales	✓	✓	✓	✓	✓	✓	✓	×	✓
External	Contracting In	×	×	×	×	×	×	×	✓	×
External	User Fees	✓	✓	✓	✓	✓	✓	✓	×	✓

Organizational Models	Objectivity	Credibility	Continuity of Expertise	Strategic Programs	Policy Influence	Public Good Programs	Maintains or Improves Productivity	No New Cost to Industry	No Subsidized Competition with Private Sector
Departmental Line Units	✓	✓	✓	✓	✓	✓	✓	✓	✓
Special Operating Agencies	✓	✓	✓	✓	×	✓	✓	✓	✓
Separate Statutory Agencies	✓	✓	✓	✓	×	✓	✓	✓	✓
Crown Corporations	✓	✓	✓	✓	×	✓	✓	✓	✓
Not-for-profit Corporations	✓	✓	×	×	×	×	✓	✓	✓
For-profit Corporations	×	×	×	×	×	×	×	×	×

✓ - preserves attribute
× - damages attribute

(See Appendix G for additional comments and explanation)

Any new funding and organizational arrangement for Canada's geological surveys should preserve their existing attributes.

While revenue generation from sales of products and other user fees does not inherently undermine the fundamental characteristics of a geological survey, these sources can make only a small contribution to operating budgets. Because the market for most geological maps, reports and data is limited, prices would have to be raised beyond what most junior companies and prospectors can afford if these sales are to make a significant contribution. Revenues from the provision of professional services, or *contracting in*, can be significant, but such activity rarely contributes to the core mandate of the geological survey. There is also a danger that contracting in will detract from the core program by diverting key expertise or that it will put the survey into direct competition with the private sector. This is not to say that there are not valid reasons for

contracting in, such as the promotion of technology transfer or to meet foreign policy objectives. It should be recognized, however, that these goals are quite distinct from what the mineral industry views as the primary role of a geological survey, which is to provide the geoscience knowledge base required for exploration.

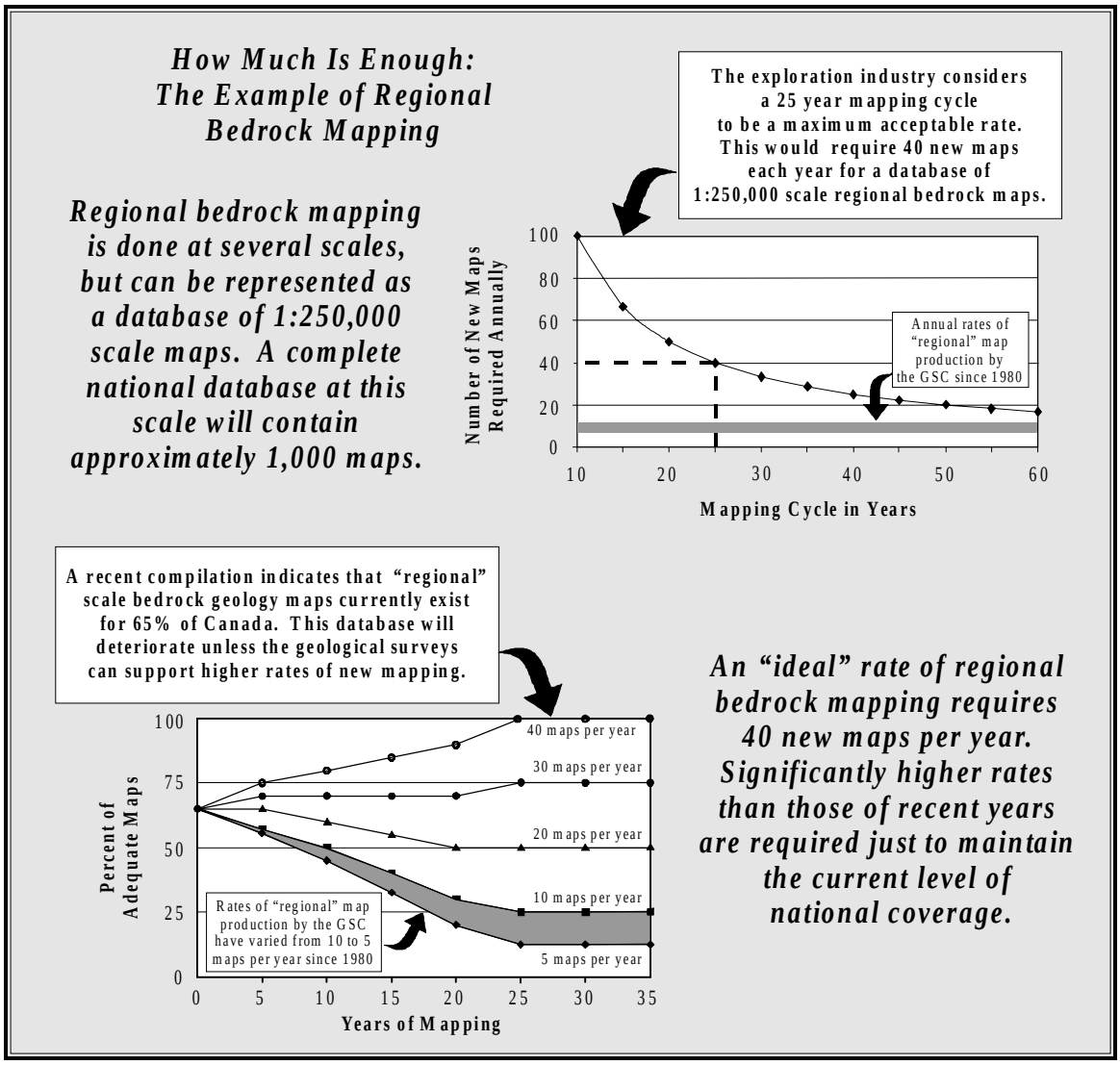
Alternative Organizational Models

The Task Force is unaware of any geological survey organization which operates as a purely commercial enterprise and does not consider this to be a viable option. Most of the other models described previously have been used successfully by one or more surveys around the world. Where a government chooses to situate its geological survey in the spectrum from line unit to not-for-profit enterprise will reflect the degree to which it would like the organization to operate at arms length. If a model affording greater autonomy is associated with an expectation of significant revenue generation from external sources, there will likely be a cost in terms of the organization's credibility in providing scientific input to policy decisions. On the other hand, greater autonomy from the constraints under which the public service operates could result in increased operating efficiency and "more bang for the buck". The choice of organizational model in itself does not change the underlying requirements of a geological survey.

How Much Is Enough - Establishing Program Levels

Determining the level of geoscience programming that the geological surveys must deliver to meet governments' commitments to the mineral industry and the public requires a careful analysis that is beyond the mandate of the IGWG-appointed Task Force. This analysis will have to include decisions about what kinds of geoscience information are required, a thorough assessment of the existing knowledge base, and a review of the surveys' individual and collective capacities. Two underlying principles are critical to this exercise:

- The mineral industry requires up-to-date geoscience information in the form of maps and underlying databases with which it can make investment decisions. The amount of detail required in the maps and databases depends upon the scale of decision - from initial broad targets on the scale of thousands of square kilometers to local areas of high mineral potential on the scale of less than one square kilometer. Hence, mapping must be done at a variety of scales, to suit the end use of the information.
- Because of regular advances in science, changes in technology and accumulation of new information, the geoscience knowledge base must continually be revised and updated. The mineral industry considers a 25 year mapping cycle to be the maximum acceptable rate for areas of mineral potential. Degradation of the geoscience knowledge base will occur if this mapping cycle cannot be maintained.



Using these principles, the Task Force made two simple analyses of *How Much Is Enough* for one component of the national geoscience knowledge base to illustrate the severity of the problem that the geological surveys face. In these analyses, the Task Force used 1:250,000 scale bedrock geology maps to represent a regional-scale component of the national knowledge base that should be maintained to industry standards. It is important to remember, however, that regional bedrock mapping is done at several scales, ranging from 1:100,000 to 1:1,000,000, and that 1:250,000 is only a convenient proxy for mapping at all of these scales.

In the first instance, the Task Force assumed that the surveys would maintain bedrock mapping programs at a level sufficient to map the entire country in a 25 year cycle, what might be termed an *ideal mapping rate*. There are approximately 1,000 maps sheets at 1:250,000 scale across all of Canada. Assuming that no maps currently exist, a rate of 40 new maps per year is required to achieve the target of complete coverage in 25 years. At the end of this cycle all 1,000 map sheets will have been completed. The cycle then starts

over again, as the first 40 maps produced become more than 25 years old and, therefore, obsolete.

In the second instance, the Task Force calculated the effects of different rates of mapping on the existing database of 1:250,000 and equivalent scale bedrock maps. A 1996 review by the Geological Survey of Canada indicated that maps classified as fully adequate or adequate currently exist for 650 of the 1,000 maps sheets (see Appendix F). Maps for the remaining 350 sheets either do not exist or are greater than 25 years old and, therefore, considered inadequate. An age distribution was assumed for the existing 650 maps in this analysis, and changes in the 650/350 ratio of adequate/inadequate maps calculated for different rates of map production. Again, this analysis shows that 40 new maps per year must be produced if the objective of complete coverage with no maps older than 25 years is to be achieved. A rate of 20 new maps per year eventually results in a stable position of 50% coverage, which is a significant degradation from the current position of 65% coverage. Lower rates of mapping result in greater degradations of the existing database.

Bedrock mapping at regional scales such as 1:250,000 is done in Canada primarily by the Geological Survey of Canada. The average annual production rate for such regional maps in the GSC has declined from 11 for the period 1980-89 to 7 for the period 1990-97, and will decline further as the recent budget cuts come to bear. These rates are inadequate to maintain this component of the national geoscience knowledge base.

This problem is more pronounced for maps at more detailed scales, because of their much greater numbers. The vast majority of bedrock mapping done by the provincial and territorial surveys is at detailed scales ranging from 1:10,000 to 1:50,000. Most of the regional 1:250,000 scale sheets comprise 16 1:50,000 sheets. Eliminating the map sheets that underlie water (major lakes, coastal areas) still leaves some 15,000 1:50,000 map sheets across Canada, illustrating the magnitude of the problems for the provincial and territorial surveys.

These analyses, although simplistic in their approach, clearly show that the bedrock geology map components of the national geoscience knowledge base will deteriorate significantly unless higher rates of mapping are undertaken. Similar problems exist for other types of geoscience information that are integral parts of the knowledge base (*e.g.,* geophysical, geochemical and surficial geology surveys and maps).

As much as the mineral exploration industry would like to see fully adequate coverage for all types of geoscience information over 100% of the country, it recognizes that governments do not have the financial or human resources to achieve this goal over the short to medium term. The current rates of erosion of the geoscience knowledge base, on the other hand, will make it difficult for Canada to compete for mineral exploration investment in the future. A more detailed analysis to determine a realistic rate of replenishing the store of geoscience knowledge is therefore warranted.

CONCLUSIONS
(Prepared by Industry Members of the Task Force)

In 1996, the Canadian mining industry contributed $21.3 billion to the GDP, almost $2 billion in direct taxation to federal and provincial treasuries and directly employed approximately 365,000 people. A variety of other industrial sectors directly depend on the minerals industry, contributing an additional $25 billion to the GDP and almost 300,000 jobs to the economy.

The industry members of the IGWG/Industry Task Force on Alternative Funding Arrangements for Government Geological Surveys have concluded that:

1. Mineral exploration is fundamental to the survival of the Canadian mining industry. Without continuous exploration to replace depleted reserves, there will be no mining in Canada in the future.
2. Historically, Canada's strong advantage has been its ability, at all levels of government, to provide a reliable, impartial geoscience knowledge base to attract investors to the Canadian mineral exploration industry.
3. The Canadian geoscience knowledge base has been adversely affected by total expenditure cuts of 66% over the period 1987-1998. The situation has gone beyond critical. Without an adequate geoscience knowledge base to stimulate mineral exploration, there will be no mining in Canada in the future.
4. Canadian mining companies raise more than 25% of the funds used around the world for mineral exploration, but are increasingly spending their money elsewhere. Less than a third of the $1.8 billion of the venture capital raised in Canada for exploration in 1996-97 was actually spent in Canada, and only 30% of the money raised by Canadian junior companies was spent in Canada.
5. No studies have been done to determine how much mapping, surveying or other data collection is appropriate. Preliminary assessment by this Task Force suggests that the levels of mapping deemed inadequate range from 30% to 97%, depending on map type. It is clear that current coverage is totally inadequate.
6. Because our understanding of geological processes changes with time, most geoscience data has a useful shelf life of only 20 and 30 years before it needs to be reviewed and perhaps totally re-done.
7. Fundamental to our review of alternative funding arrangements are certain principles and assumptions:
    a) Government geoscience must be provided by agencies that are both impartial and objective;
    b) Continuity of expertise is important;
    c) Government geoscience agencies must have sufficient funding stability to allow effective long-term program planning and delivery;
    d) Government geoscientists must operate in a structure that allows them to represent government to industry and industry to government; so as to influence policy formulation,

e) Other geoscience programs, unrelated to the mining or energy industries, must also be maintained;
f) Productivity should be maintained or improved;
g) There should be no new levies or other costs to industry; and,
h) No government should compete with the private sector.

9. Funding sources for government geoscience can be classified in three broad categories:
   a) Annual allocation by a government to its departments, *i.e.*, the "status quo";
   b) Funds generated by work for other government departments, through partnerships with industry or other governments and/or from sales of products and services, most likely used as an enhancement to (a) rather than a prime source of funding; and,
   c) Funds obtained from a Dedicated Revenue Stream related to industry contributions, *e.g.*, Peru, Portugal and Mines Ontario proposal.

15. The advantage of continuing to fund government geoscience from annual allocations from government is that most of the principles in Conclusion 7 are met. The principal disadvantages are that, in practice, current allocations are neither stable nor sufficient, long-term program planning is virtually impossible and continuity of expertise is not maintained.

16. The advantage of enhancing current budget allocations through partnerships or sales of products and services is that additional funds would be available. The principal disadvantages are:
   a) This source of funding might be erratic, which could be detrimental to strategic program planning,
   b) Funding derived from other government departments is normally directed at short term priorities but does not address strategic planning,
   c) Industry-government partnerships are often limited to the larger companies.

17. The advantages of a Dedicated Revenue Stream based on existing industry contributions are the ability to establish stable, adequate levels of funding, based on the existing significant contribution of industry, and to maintain continuity of expertise.

18. Several organizational models could be used to deliver government geoscience, based on specific jurisdictional needs and operating philosophies. Further study of these options by industry and government is required.

19. It is unlikely that one funding alternative or one organizational model is appropriate for every government.

20. The mining industry is opposed to additional levies to fund geological surveys over and above existing fees and taxes.

RECOMMENDATIONS TO MINISTERS
(Prepared by Industry Members of the Task Force)

The industry members of the IGWG/Industry Task Force on Alternative Funding Arrangements for Government Geological Surveys recommend that:

4. The Task Force work with the National Geological Surveys Committee to determine appropriate levels of geoscience map coverage as a basis for determining future funding requirements of geological surveys.

5. A commitment be made by all governments to establish stable, adequate funding levels to generate geoscience programs that will stimulate investment in mineral exploration.

6. Funding for geoscience agencies be derived from:
   d) The annual appropriation to government departments,
   e) A dedicated revenue stream generated from existing taxes, fees and levies collected by governments from the mining industry, and
   f) Joint programs cooperatively funded by government and industry, as enhancements to funding from (a) and (b).

5. Organizational arrangements for geological surveys be further reviewed, with the clear understanding that this should not impact on the immediate need to address funding issues.

ACKNOWLEDGMENT

The Task Force would like to recognize the outstanding contribution made to this study by Dr. Michael Cherry, Chief Geoscientist's Office, Earth Sciences Sector, Natural Resources Canada. Dr. Cherry coordinated all of the activities of the Task Force, carried out much of the research, and prepared the draft and final reports. It is not an easy task to synthesize the opinions of such a diverse group into a logical, cohesive document, and we believe that Dr. Cherry has done an excellent job.

Appendix A. Terms of Reference of the IGWG Task Force on Alternative Funding Arrangements for Government Geological Surveys

Background

A multi-stakeholder workshop held in conjunction with the 54th. Annual Mines Ministers' Meeting in St. John's, Newfoundland, documented the continuing decline in funding levels of government geological surveys in Canada. At the same time, mineral industry representatives emphasized that the geoscience knowledge base provided in large part by geological surveys is one of this country's competitive advantages in attracting and maintaining investment in mineral exploration. A key recommendation coming out of the workshop and accepted by Ministers was that a Task Force be struck to examine alternative funding arrangements for government geological surveys and that this Task Force report back to the Mines Ministers' Meeting to be held in Calgary, Alberta, in July 1998.

Objective

In view of the continued decline in funding levels of government geological surveys in Canada, and of the importance of geoscience knowledge to the competitive position of Canada as a target for mineral exploration investment, to review alternative funding mechanisms for geological survey activities.

Membership

The Task Force will comprise 8 members, three to be appointed by the Prospectors and Developers Association of Canada (PDAC); three, by the Committee of Provincial Geologists; one by the British Columbia - Yukon Chamber of Mines, and one, by the Geological Survey of Canada. A liaison person will be identified from each provincial and territorial geological survey.

Accountability

The Task Force will be accountable to the Intergovernmental Working Group on the Mineral Industry (IGWG).

Scope of Investigation

The Task Force report should include, but not necessarily be limited to

- A review of the sources and mechanisms of funding currently used by geological surveys in Canada and abroad
- Identification of other potential funding mechanisms
- A documentation of the current financial contributions (*e.g.*, fees, levies and taxes) by the mineral industry to governments.

Deliverables

1. Interim report, to be presented to IGWG at its meeting at the PDAC convention in March 1998.
2. Final report, to be presented to the Mines Ministers' Meeting in July 1998.

Approved by IGWG
October 16, 1997

Appendix B. Membership of the IGWG Task Force on Alternative Funding Arrangements for Government Geological Surveys

Appointed by the Prospectors and Developers Association of Canada

Mary-Claire Ward (**Task Force Chairperson**)
Vice President
Watts, Griffis and McOuat, Toronto, Ontario

Ed Yarrow
Vice President, Exploration
Hudson Bay Exploration and Development Company, Flin Flon, Manitoba

Kevin Brewer
Executive Director
Newfoundland and Labrador Chamber of Mineral Resources, St. John's, Newfoundland

Appointed by the British Columbia and Yukon Chamber of Mines

Walter Sellmer
President
Energold Mining Ltd., Vancouver, British Columbia

Appointed by the Committee of Provincial Geologists

Ron Smyth
Director and Chief Geologist
Geological Survey Branch
British Columbia Ministry of Energy and Mines, Victoria, British Columbia

Andy Fyon
Senior Manager
Precambrian Geoscience Section
Ontario Geological Survey
Ontario Ministry of Northern Development and Mines, Sudbury, Ontario

Scott Swinden
Director
Mineral and Energy Resources Division
Nova Scotia Department of Natural Resources, Halifax, Nova Scotia

Appointed by the Geological Survey of Canada

Murray Duke
Director General
Minerals and Regional Geoscience Branch
Geological Survey of Canada, Ottawa, Ontario

1. Exploration

	Prospecting Licences	Claim Recording Fees	Claim Renewal Fees	Lease Rentals	Other	Totals
British Columbia	$141,650	$441,540	$3,129,180	$692,394	$2,674,687[1]	$7,079,451
Alberta		$1,200,150		$2,407,460		$3,607,610
Saskatchewan		$587,784				$587,784
Manitoba	$2,800	$34,200	$46,000	$1,310,066		$1,393,066
Ontario	$32,736	$725,815		$593,470	$1,405,319[3]	$2,757,340
Québec	$12,000	$1,598,000	$1,234,000		$352,000	$3,196,000
New Brunswick	$267,304[4]					$267,304
Nova Scotia						$222,075
Newfoundland						$6,298,000
NWT	$11,658	$915,358	$884,126	$1,143,580	$173,615[5]	$3,128,337
Yukon		$187,840	$1,200,405	$55,203	$92,619	$1,536,067
Totals	**$468,148**	**$5,690,687**	**$6,493,711**	**$6,202,173**	**$4,698,240**	**$30,073,034**

1. Includes maps, searches, publications, tags, documents and coal fees, rents, etc.
2. Surface lease fees.
3. Acreage tax.
4. Includes claim recording and renewal.
5. Certificate of extension fees.

2. Health and Safety Fees and Levies

Province	Fees and Levies
British Columbia	$30,485,262
Alberta	
Saskatchewan	$2,002,715
Manitoba	$6,600,000
Ontario	
Québec	$68,041,836
New Brunswick	$3,211,000
Nova Scotia	
Newfoundland	
NWT	
Yukon	
Total	**$110,360,813**

3. Production

	Direct Tax Payments		Provincial Tax Payments				Municipal Tax Payments			Totals
	Federal Tax	Income Tax	Mining Tax	Capital Tax	Sales Tax	Leases & Rentals[1]	School Tax	Municipal Tax	Levies & Other	
British Columbia	$62,000,000	20,000,000	33,000,000	6,000,000	57,000,000	37,000,000	9,000,000	19,000,000	4,000,000	**247,000,000**
Alberta	2,349,000	20,822,000	315,000,000	5,365,000		94,395,000	169,950,000	235,300	582,900	**608,699,200**
Saskatchewan	34,000,000	20,000,000	164,000,000	60,000,000	8,800,000	4,708,900		19,350,000		**310,858,900**
Manitoba	46,900,000		15,000,000	4,792,000	13,200,000	7,200,000		15,300,000		**102,392,000**
Ontario	89,100,000	126,707,000[2]	85,293,000					46,000,000		**347,100,000**
Québec[3]	17,845,400	6,531,400	10,659,400	13,338,900	3,134,900	4,136,300	3,105,800	21,068,200	6,130,500	**85,950,800**
New Brunswick	6,953,000		18,279,800		3,174,000	410,500	48,000	4,454,000	7,682,000	**41,001,300**
Nova Scotia		3,921,600	5,986,000			80,200		1,400,000		**3,886,000**
Newfoundland		4,717,000	21,711,000		23,721,000	11,681,000		5,491,000		**67,321,000**
NWT										
Yukon										
Totals	**259,147,400**	**202,699,000**	**668,929,200**	**89,495,900**	**109,029,900**	**159,611,900**	**182,103,800**	**132,298,500**	**18,395,400**	**1,814,209,200**

1. Includes gasoline tax, where given, and water tax.
2. Includes provincial corporate income and capital taxes, retail sales taxes and employer's health tax and workers' compensation.
3. Does not include asbestos mining.

Appendix D. Expenditures by Canadian Geological Surveys in 1996-97

Geological Survey	Survey Expenditures[1]	Value of Mineral Production[2]	Survey Expenditure as % of Production	Area (sq. km.)	Survey Expenditure per sq. km.	Population	Survey Expenditure per capita
British Columbia	$6,459,017	$4,248,218,000	0.15%	948,000	$6.81	3,725,000	$1.73
Alberta	$2,531,951	$26,039,407,000	0.01%	661,000	$3.83	2,697,000	$0.94
Saskatchewan	$2,452,273	$5,215,467,000	0.47%	652,000	$3.76	990,000	$2.48
Manitoba	$3,735,800	$1,023,909,000	0.36%	650,000	$5.75	1,114,000	$3.35
Ontario	$13,456,500	$5,643,612,000	0.24%	1,069,000	$12.59	10,754,000	$1.25
Québec	$12,751,200	$3,319,996,000	0.38%	1,541,000	$8.27	7,138,000	$1.79
New Brunswick	$2,820,300	$924,758,000	0.30%	73,000	$38.63	738,000	$3.82
Nova Scotia	$2,466,000	$597,472,000	0.41%	55,000	$44.84	909,000	$2.71
Prince Edward Island	nil	$3,395,000	-	6,000	-	135,000	-
Newfoundland	$3,494,573	$934,095,000	0.37%	405,000	$8.63	552,000	$6.33
NWT	$2,370,836	$798,403,000	0.30%	3,380,000	$0.70	64,000	$37.04
Yukon	$2,463,100	$423,069,000	0.58%	483,000	$5.10	31,000	$79.45
Geological Survey of Canada	$74,237,000	$49,171,801,000	0.15%	9,923,000[3]	$7.48	28,847,000	$2.57

1. Data from the 1997 Provincial Geologists Journal and the GSC's Annual Report for 1996-97. Comparisons across jurisdictions are difficult because of differences in methods of reporting data. Expenditure data do not include industry grant programs.
2. Production figures include metals, non-metals, structural materials and coal. Alberta figures also include natural gas, natural gas by-products, and crude oil. The figure listed for the GSC is the sum of the provincial and territorial data.
3. Does not include the more than 6,500,000 sq. km. offshore area for which the federal survey operates programs. Including this area reduces the GSC expenditure per sq. km. to $4.49.

Appendix E. Comparative Information on Geological Surveys around the World

Country	Geological Survey(s) Information						National Information			
	No. of Surveys	Organizational Model(s)	Total Budget ($ millions)	Funding Sources (%)			Area (millions of km^2)	Population (millions)	GDP ($ billions)	Non-fuels Mineral Production ($ billions)
				Appropriation	Other Internal	External				
North America										
Canada	1 federal, 9 provincial, 2 territorial	Line Units, except Que (SOA) and Ab (SOA)	GSC – 75.5 Provs – 55.0	92 Variable, but mostly appropriation.	2	6	9.98	30.3	983.1	17.1
United States	1 federal 50 state	Line Units	USGS – 348.5 States – 211.3	75 Variable, but mostly appropriation.	25	0	9.63	268.0	10,400.0	52.8
South America										
Brazil	1 national + states	Federal – state enterprise	128.2	Data unavailable			8.51	164.5	1,400.0	12.3
Chile	1 national	Agency	12.7	92	0	8	0.76	14.5	164.4	
Peru	1 national	Agency	10.8	97	0	3	1.29	25.6	125.4	4.2
Argentina	1 national	Line Unit	14.6	90	6	4	2.77	35.8	404.8	1.0
Bolivia	1 national	Agency	5.9	52	48	0	1.10	7.7	29.3	0.3

Explanatory Notes: Financial data are given in 1996 Canadian dollars. Non-fuels mineral production includes precious and base metals, industrial minerals and aggregates, but excludes coal, petroleum and natural gas. GDP is expressed as parity purchasing power (Source: CIA World Factbook 1997).

Appendix E (continued)

Country	Geological Survey(s) Information						National Information			
	No. of Surveys	Organizational Model(s)	Total Budget ($ millions)	Funding Sources (%)			Area (millions of km^2)	Population (millions)	GDP ($ billions)	Non-fuels Mineral Production ($ billions)
				Appropriation	Other Internal	External				
Europe										
Finland	1 national	Agency	74.8	89	3	8	0.34	5.1	132.4	
Norway	1 national	Crown Corporation	27.5	72	18	10	0.32	4.4	155.6	
Germany	1 national + states	Line Units	Federal – 113.3	80	20	0	0.36	82.1	2,300.0	
United Kingdom	1 national	Agency	85.2	42	19	39	0.24	57.6	1,600.0	4.5
Ireland	1 national	Line Unit	4.5	94	0	6	0.07	3.6	81.7	
Africa and Australasia										
South Africa	1 national	State Enterprise	18.8	Data unavailable			1.22	42.3	309.5	13.9
Australia	1 national, 6 state, 1 territorial	Line Units	Federal – 63.5 States – 36.3	77 100	10 0	13 0	7.69	18.4	587.0	14.2
New Zealand	1 national	Crown Corporation	1.8	80	10	10	0.27	3.6	89.4	

Explanatory Notes: Financial data are given in 1996 Canadian dollars. Non-fuels mineral production includes precious and base metals, industrial minerals and aggregates, but excludes coal, petroleum and natural gas. GDP is expressed as parity purchasing power (Source: CIA World Factbook 1997).

Appendix F. Supplementary Information - Current Status of the National Geoscience Knowledge Base

The graphic on page 87 of this report summarizes the results of a preliminary review by the Task Force of the existing coverage of Canada for a number of different types of geological maps. The following definitions apply to the column headings in the graphic:

Scale	The graphic emphasizes industry's need for at least two scales of mapping: one regional scale to set initial targets and one detailed scale for more thorough exploration. In practice, there is neither a single regional scale nor a single detailed scale that is everywhere applicable. There are, however, two scales that are convenient as proxies for regional and detailed. Topographic maps and data, which are used as the information bases for geological maps, are produced in regular intervals. One widely used regional scale is 1:250,000 (approximately 1 inch to 4 miles). Approximately 1,000 of these sheets are required to outline Canada's landmass. A widely used detailed scale is 1:50,000 (approximately 1.25 inch to 1 mile). In all but the far northern reaches of Canada, there are 16 1:50,000 sheets in one 1:250,000 sheet.
Approximate number of maps	The numbers in this column represent the approximate total of maps sheets at 1:250,000 (regional) and 1:50,000 (detailed) scales across Canada that would be usefully produced as a particular kind of geological map. Bedrock and surficial geology maps are required for all of the sheets at both scales. A significant number of the 1:250,000 sheets would not benefit from lake/stream geochemistry surveys.
Fully adequate	Fully adequate maps are ones that are supported by comprehensive studies such as petrology, geochemistry, paleontology and geochronology. These maps can be fully interpreted in terms of modern geoscience theory.
Adequate	Adequate maps are those that accurately display the distribution of the geological attributes being mapped, but lack the supporting data of fully adequate maps. They often do not contain sufficient information to be fully interpreted in modern theory.
Inadequate	Inadequate maps are those with dubious representations of the distribution of the attributes, or maps that are more than 25 years old and therefore considered obsolete, or map areas for which the particular geological mapping has not been done.

Appendix G. Supplementary Information - Identifying the Optimal Funding Mechanism and Organizational Model

The Task Force's assessment of the advantages and disadvantages of possible alternative funding arrangements that could be applied to Canada's geological surveys is summarized in the diagram on page 100. This graphic representation of the options is a distillation of many comments, opinions and concerns expressed by members of the Task Force. This background information is provided here as explanatory information for the graphic summary on page 100.

Alternative Funding Mechanisms

	Advantages	**Disadvantages/Concerns**
Increased A-base Appropriation	Preserves all of the positive attributes of the geological surveys **if the annual allocation is stable from year to year and at an adequate level.**	
Other Government Departments		Might impose program directions based on the availability of funds rather than a long term strategy. Might direct survey resources away from the needs of the mineral industry. Relatively limited capacity to generate revenue. Might have a negative impact on continuity of expertise if amounts vary greatly from year to year.
Dedicated Revenue Stream (Existing Levy)	Industry will accept this source.	Loss of funds for other purposes, so a cost to government. Cost to central treasury might lead to pressure to decrease the A-base allocation. Might lead to pressure to direct entire program to needs of single use, perhaps at the expense of "public good" programs.
Dedicated Revenue Stream (New Levy)		**Will not be accepted by the mineral industry** ("We've already paid"). Government might be perceived to be a strong advocate of industry and not the public at large. Stability of funding and ability to carry out long term programs might be affected by strength of industry (amounts of funds available). Might lead to overzealous promotion by the surveys to stimulate exploration activity and increase levy revenues. Might lead to pressure to direct entire program to needs of single use, perhaps at the expense of "public good" programs.

Appendix G (continued).

Alternative Funding Mechanisms (continued)

	Advantages	Disadvantages/Concerns
Partnerships	Source of funds to extend A-base allocation. Leads to skills exchange between survey and partners.	Might divert resources from core and strategic programs because of opportunistic nature of funding. Almost always includes an exclusive-use period for the partners, and therefore delays in public release of information - confidentiality clauses might also be challenged by others who want the information. Might be seen as competition with the private sector. Relatively little capability to generate revenue. Soft funds will make it difficult to retain expertise.
Revenue Generation (Product Sales)	Easy to implement.	Relatively little capacity to generate revenue without damaging the client base. Increased cost to clients, and may add to processing costs. Not all governments allow revenue-retention. Industry might not accept increased costs ("We've already paid").
Revenue Generation (Contracting In)	May be advantageous when client's objectives coincide with survey's long term strategic plans.	Client's needs for confidentiality might cause problems. Relatively little capacity to generate revenue. Contracts might not be in survey's own jurisdiction – diverting resources from the core program. Soft funds will make it difficult to retain expertise.
Revenue Generation (User Fees)	Target the users of service.	Relatively little capacity to generate revenue. Allows services to continue, but may restrict access to information to those who can afford new user fees. Increased cost to clients.

Appendix G (continued).

Alternative Organizational Models

	Advantages	Disadvantages/Concerns
Departmental Line Units	Preserves all of the positive attributes of the geological surveys **if funding is increased to meet, or exceed, minimum needs.**	Subject to changes in government priorities and budget cuts. Must follow government processes to execute operational program.
Special Operating Agencies	Some increased operational flexibility. Retains trust of client group. Well-defined government structure. Government directs priorities, rather than client group.	Impact on productivity uncertain. Uncertainty in stability and amount of funding would affect strategic planning and continuity of expertise.
Separate Statutory Agencies	Some increased operational flexibility. Retains trust of client group. Well-defined government structure. Government directs priorities, rather than client group.	Uncertainty in stability and amount of funding would affect strategic planning and continuity of expertise.
Crown Corporations	Increased operational flexibility.	Uncertainty in stability and amount of funding would affect strategic planning and continuity of expertise. Increased separation from government reduces ability to influence policy for the industry. Public good programs might suffer.
Not-for-profit Enterprises	Enterprise could negotiate with government to deliver specific geoscience programs. Mineral industry would direct spending and priorities through Board of Directors. Flexible, empowered structure.	Public good programs might suffer. Loss of advocacy role on behalf of the mineral industry. Might not result in clear financial savings for government. Specifying contractual deliverables to government would be challenging.
For-profit Enterprises	Enterprise could negotiate with government to deliver specific geoscience programs.	Public good programs would probably suffer. Loss of advocacy role on behalf of the mineral industry. Loss of objectivity and credibility. Competition with private sector.

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