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Comité des géologues provinciaux

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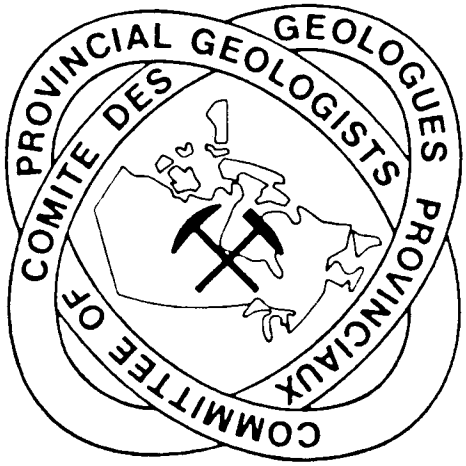
1987

PROVINCIAL GEOLOGISTS JOURNAL
JOURNAL DES GÉOLOGUES PROVINCIAUX



VOLUME 5

PUBLICATION ANNUELLE DU

COMITÉ DES GÉOLOGUES PROVINCIAUX

PUBLISHED ANNUALLY BY

COMMITTEE OF PROVINCIAL GEOLOGISTS

AVANT-PROPOS

Nous sommes heureux de vous présenter le volume 5 du Journal des géologues provinciaux. Lorsque nous avons accepté le mandat d'éditer et de publier ce cinquième volume, c'était avant tout pour nous l'occasion de témoigner de l'importance que nous accordons à cette publication et aussi afin d'assurer sa continuation.

Nous désirons remercier toutes les personnes ainsi que les institutions qui ont aidé à assembler le volume 5. Parmi celles-ci, mentionnons W.R. Smyth, Ministry of Energy, Mines and Petroleum resources, British Columbia; J. Boon et M. Prentice, Alberta Geological Survey; W.D. McRitchie, Energy and Mines, Manitoba; V. Milne et G. Kendricks, Ministry of Northern Development and Mines, Ontario; et P.S. Giles, Department of Energy and Mines, Nova Scotia.

Le Service de la géoinformation du ministère de l'Énergie et des Ressources du Québec a édité et compilé le présent volume. Nos remerciements s'adressent tout particulièrement à Patrick Rissmann et son équipe pour avoir permis la réalisation de ce volume avec un si bref échéancier.

Le Journal des géologues provinciaux est disponible dans chaque province et territoire au comptoir habituel servant à diffuser l'information géoscientifique.

Jean-Louis Caty
Directeur
Direction de la recherche géologique
Ministère de l'Énergie et des Ressources, Québec

FOREWORD

We are pleased to present Volume 5 of the Provincial Geologists Journal. When we accepted to edit and publish Volume 5, we did so because all of us recognized the importance the Journal has for our individual organizations and industries and the need to perpetuate the Journal was self-evident.

I would like to thank all the people and institutions that helped put together this volume. They include W.R. Smyth, Ministry of Energy, Mines and Petroleum resources, British Columbia; J. Boon and M. Prentice, Alberta Geological Survey; W.D. McRitchie, Energy and Mines, Manitoba; V. Milne and G. Kendricks, Ministry of Northern Development and Mines, Ontario; and P.S. Giles, Department of Energy and Mines, Nova Scotia.

The Geoinformation Service of the Ministry of Energy and Resources, Quebec, edited and compiled the present volume. Special thanks go to Patrick Rissmann and his team for producing the volume in such a short period of time.

The Provincial Geologist Journal is available in each province and territory through the offices of geological surveys or relevant information centres or distribution offices of mineral resources departments of provincial or territorial governments.

Jean-Louis Caty
Directeur
Direction de la recherche géologique
Ministère de l'Énergie et des Ressources, Québec

THE COMMITTEE OF PROVINCIAL GEOLOGISTS
CHAIRMAN'S REPORT 1987

The Committee of Provincial Geologists was formed eleven years ago at the 33rd annual meeting of Provincial Mines Ministers in St. John's, Newfoundland. The Committee comprises the directors, or their equivalents, of the various provincial and territorial geological surveys, and meets twice a year, before the annual Mines Ministers' Conference and in association with the spring meeting of the Prospectors and Developers Association (PDA).

The Committee provides an excellent forum for the discussion of geological affairs between the provinces and territories, and maintains an effective liaison with industry on matters relating to mineral exploration and development. Liaison with the Geological Survey of Canada is accomplished through the National Geological Survey's Committee, and membership in the Geoscience Council of Canada provides an additional avenue for information exchange between the Committee and the geoscience community in Canada.

Committee members maintain close liaison with industry through their representation on the various Mineral Exploration Liaison Committees, which have been established in most provinces and territories, and through their involvement in the Prospectors and Developers Association Convention.

This year the Prospectors and Developers Association Convention featured a Provincial Day in which provincial geological surveys were invited to present papers reviewing the provincial exploration scene. Seven papers were selected for presentation at the "Provincial Activities" session. Titles and authors of these presentations are as follows:

— Meguma Gold in Nova Scotia: The Best Kept Secret in The Canadian Mining Industry — D.J. Kontak and P.K. Smith.

— The Early Proterozoic LaRonge Gold Belt, Saskatchewan — David J. Thomas and Thomas Sibbald.

— The Geology of Granite-Related Tin-Tungsten Deposits in the Burnthill Area of Central New Brunswick — H.E. McLellan, W.W. Gardiner and R.P. Taylor.

— Exploration Opportunities for Industrial Minerals in British Columbia — Where is the Lustre? — Gilbert McArthur and the Industrial Minerals Staff.

— Controls on Gold Mineralization in The Pickle Lake Region, Ontario — Gregg Stott.

— Gold and Associated Trace Elements in Lake Sediments: Their Application to Gold Exploration in Newfoundland — John W. McConnell and P.H. Davenport.

— Gold in the Schefferville Area of Quebec: a Case Study — Marc Belanger.

In addition, all provinces and territories, with the exception of Prince Edward Island, participated in the provincial poster session, which was held for the full three days (March 9-11) of the convention. This session provided the various provincial and territorial surveys with the opportunity to display the results of recent geoscientific work.

During March of this year, the Committee of Provincial Geologists released Volume Four of the Provincial Geologist Journal. The Journal, which is published annually, continues to provide up-to-date information on the operations and activities of the provincial and territorial surveys, and is becoming increasing popular to the many client groups of the various surveys.

This year, the Committee presented a brief at the Mines Ministers' Conference in St. John's, Newfoundland. The Committee recognizes the important role that Mineral Development Agree-

ments have played in this country in finding new mineral deposits, in developing new exploration techniques and technologies, and in discovering new uses for minerals and metals. The Committee recommended that "both levels of Government initiate action to ensure new MDAs are implemented at the conclusion of the current agreements so as to assist the mining industry locate, mine and produce minerals and metals at the lowest possible cost for expanding world markets and for expanding the related manufacturing sectors across Canada".

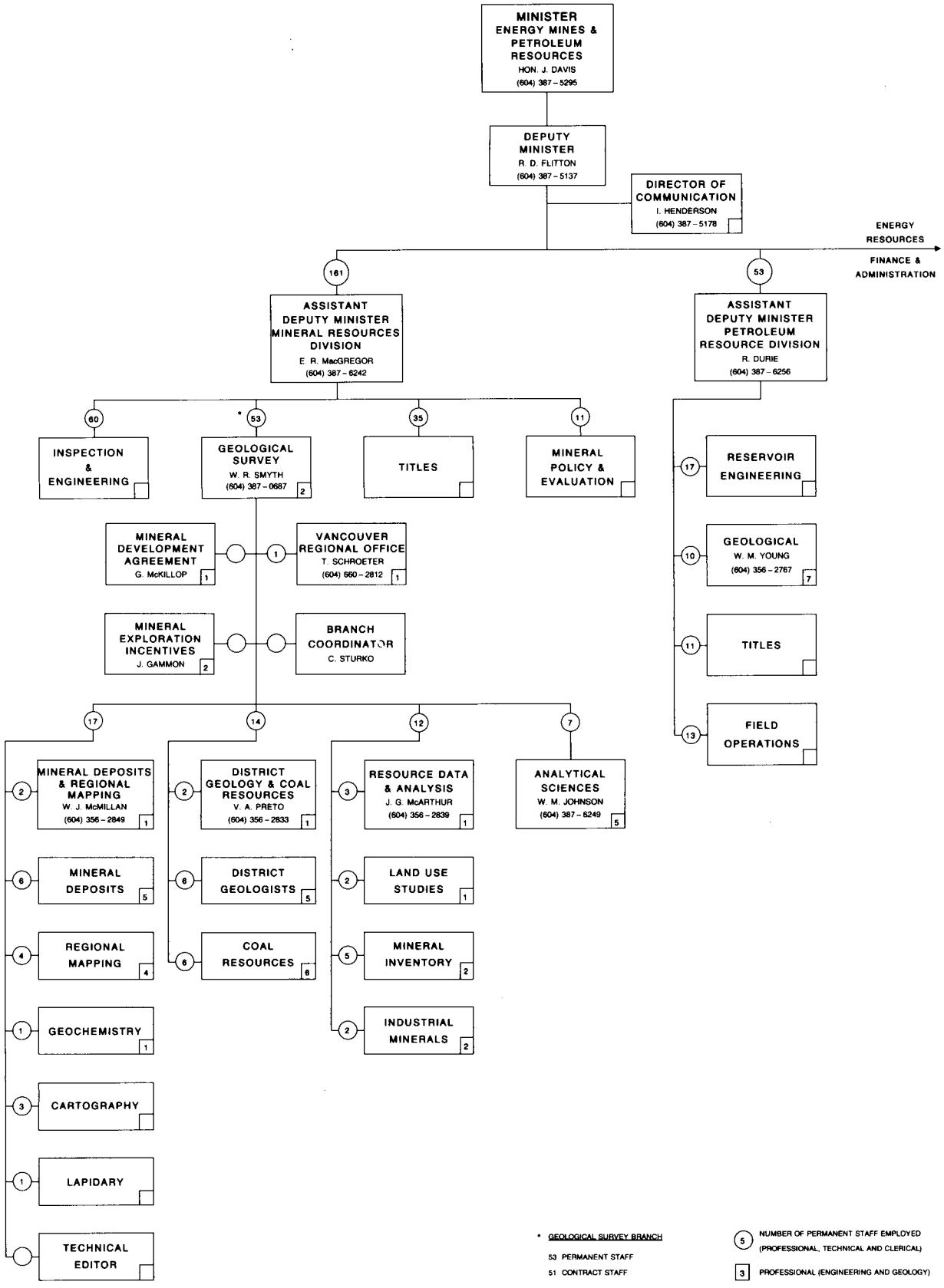
There have been a number of changes in the membership of the Committee of Provincial Geologists in the last year. Mr. Ivo Tyl (Alberta) and Dr. Jim Christopher (Sask.) have retired and Dr. J. Morin is on temporary leave from the Yukon Survey. The Committee recognizes the valuable contribution that these individuals have made to the Committee over the years and it wishes to take this opportunity to thank them for their efforts.

Wayne MacQuarrie

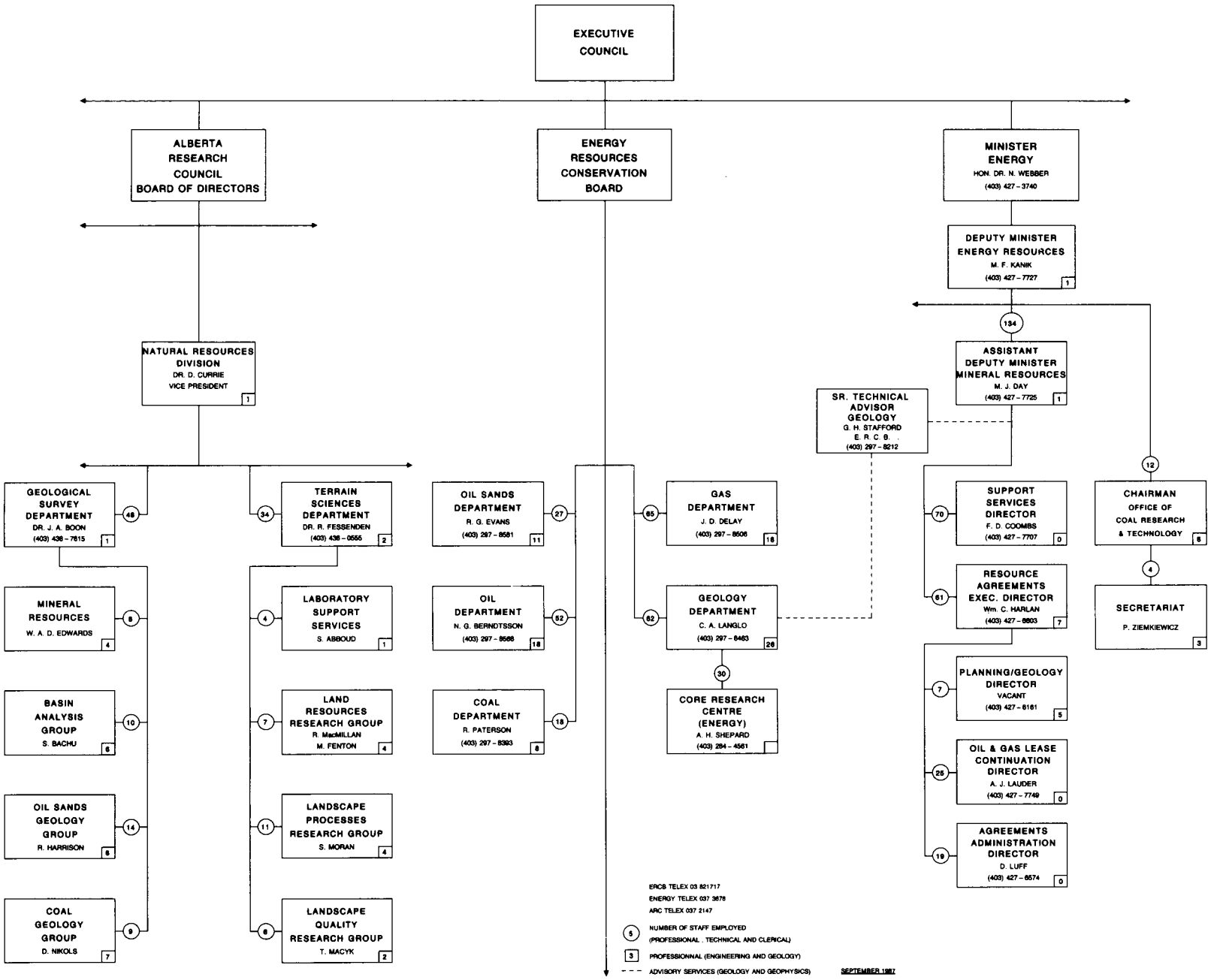
GEOSCIENCE ORGANIZATION CHARTS

Each provincial and territorial government in Canada has developed its own organizational structure for conducting geoscientific survey and research work. Some provinces have what is formally called a Geological Survey (e.g. Ontario Geological Survey), but in most jurisdictions the main elements of the geological survey function are embraced in one or more Branches or Divisions of provincial Mines/Energy/Natural Resources Departments (e.g. the British Columbia Ministry of Energy, Mines and Petroleum Resources is divided into a Mineral Resources Division and a Petroleum Resources Division, with the bulk of geological survey and research work conducted in the Geological Branch of the Mineral Resources Division). The following organization charts are set out in standard format to help alleviate confusion amongst potential users of provincial geoscience services. The charts contain reference to the lines of reporting of the various units in each hierarchy, the manpower associated with each separate jurisdiction, and the names and telephone numbers of key individuals in each system.

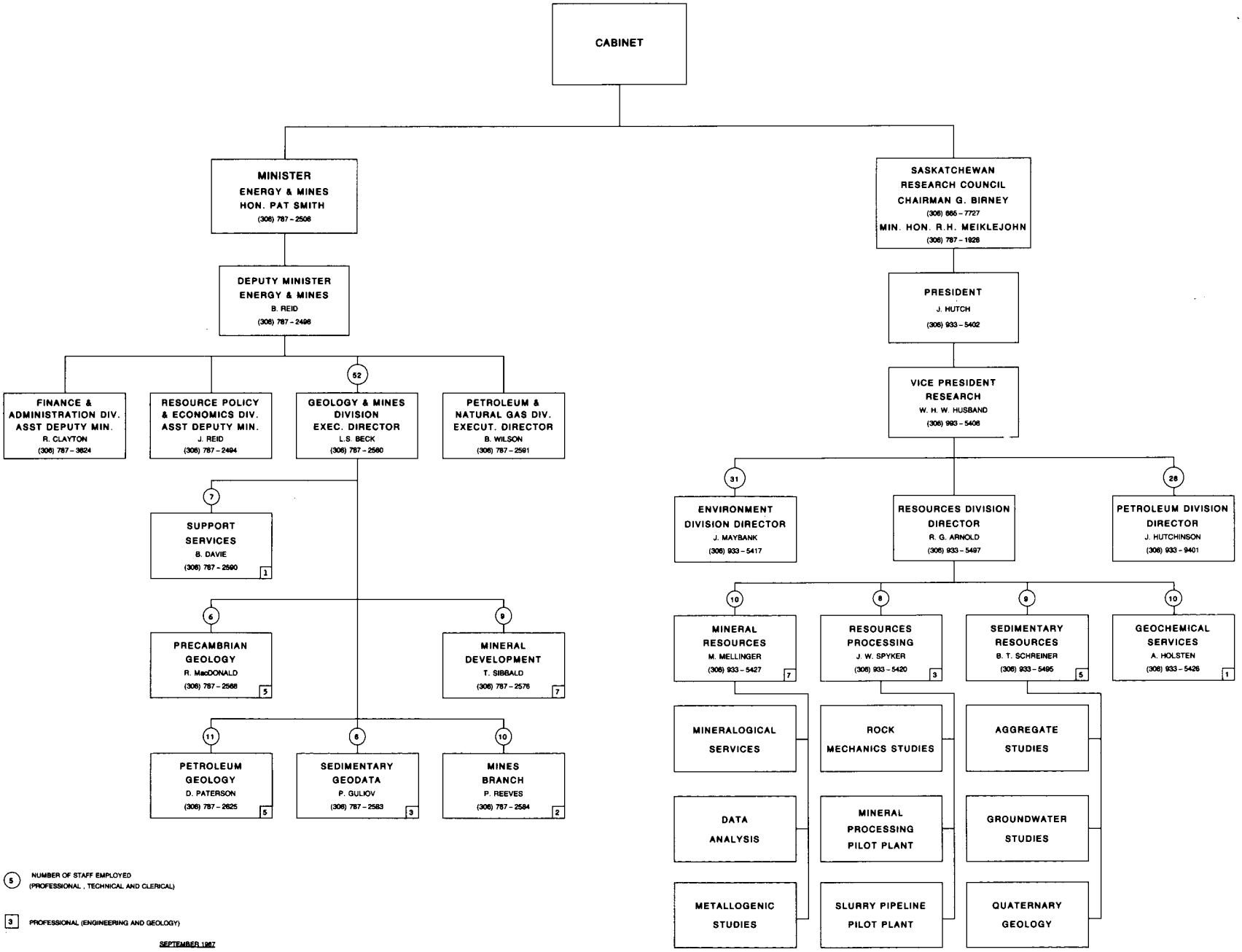
BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART



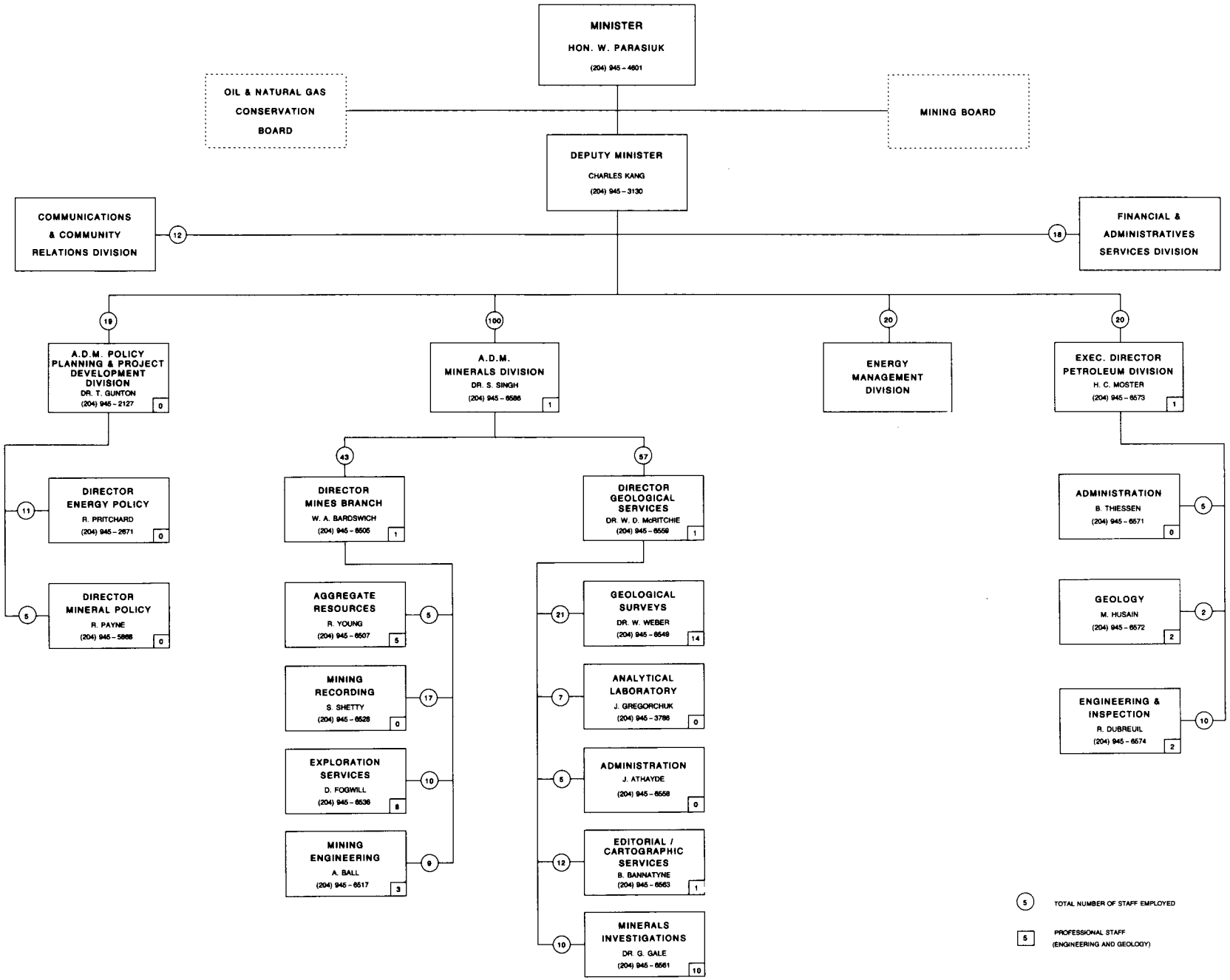
ALBERTA GEOSCIENCE ORGANIZATION CHART



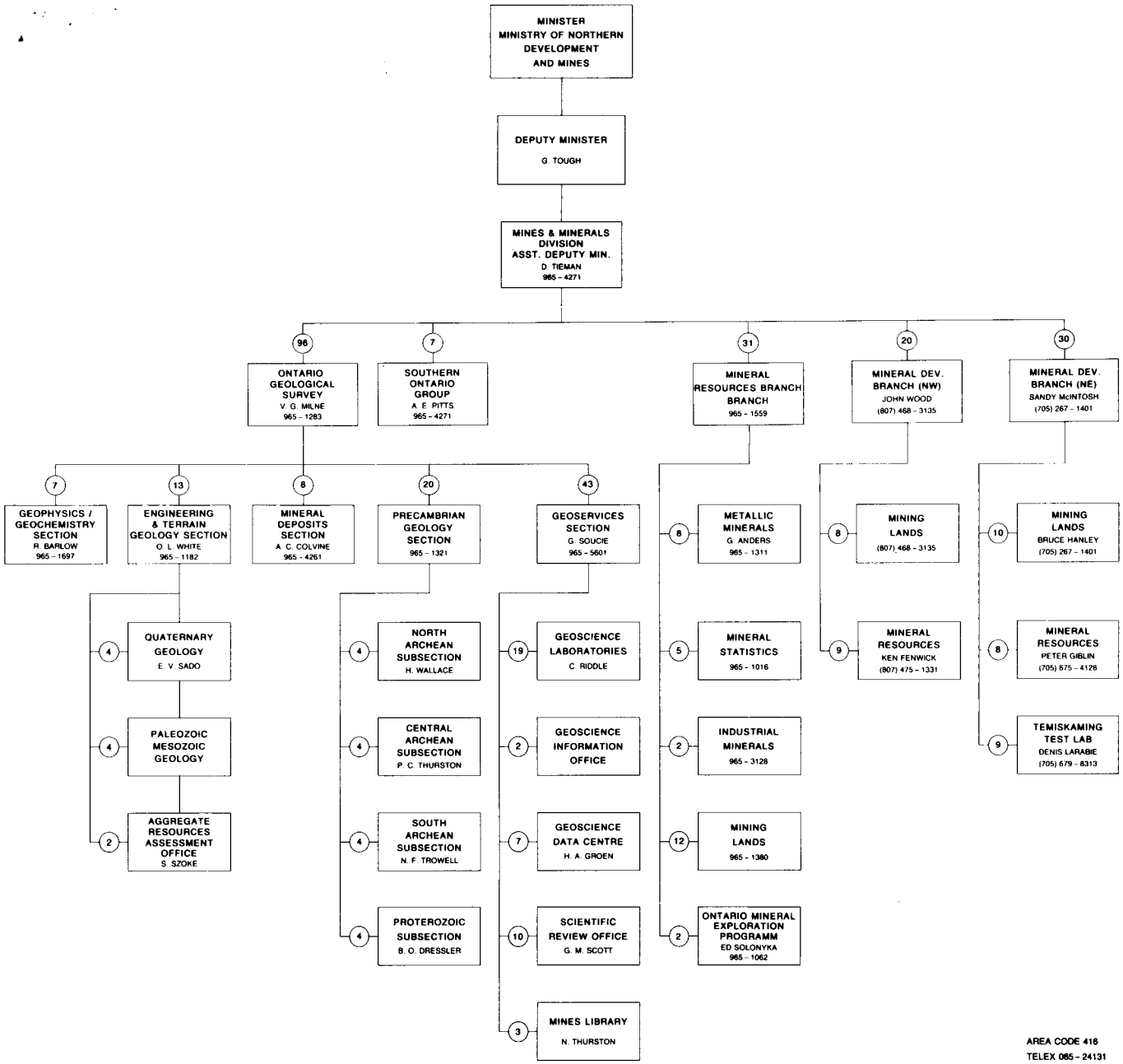
SASKATCHEWAN GEOSCIENCE ORGANIZATION CHART



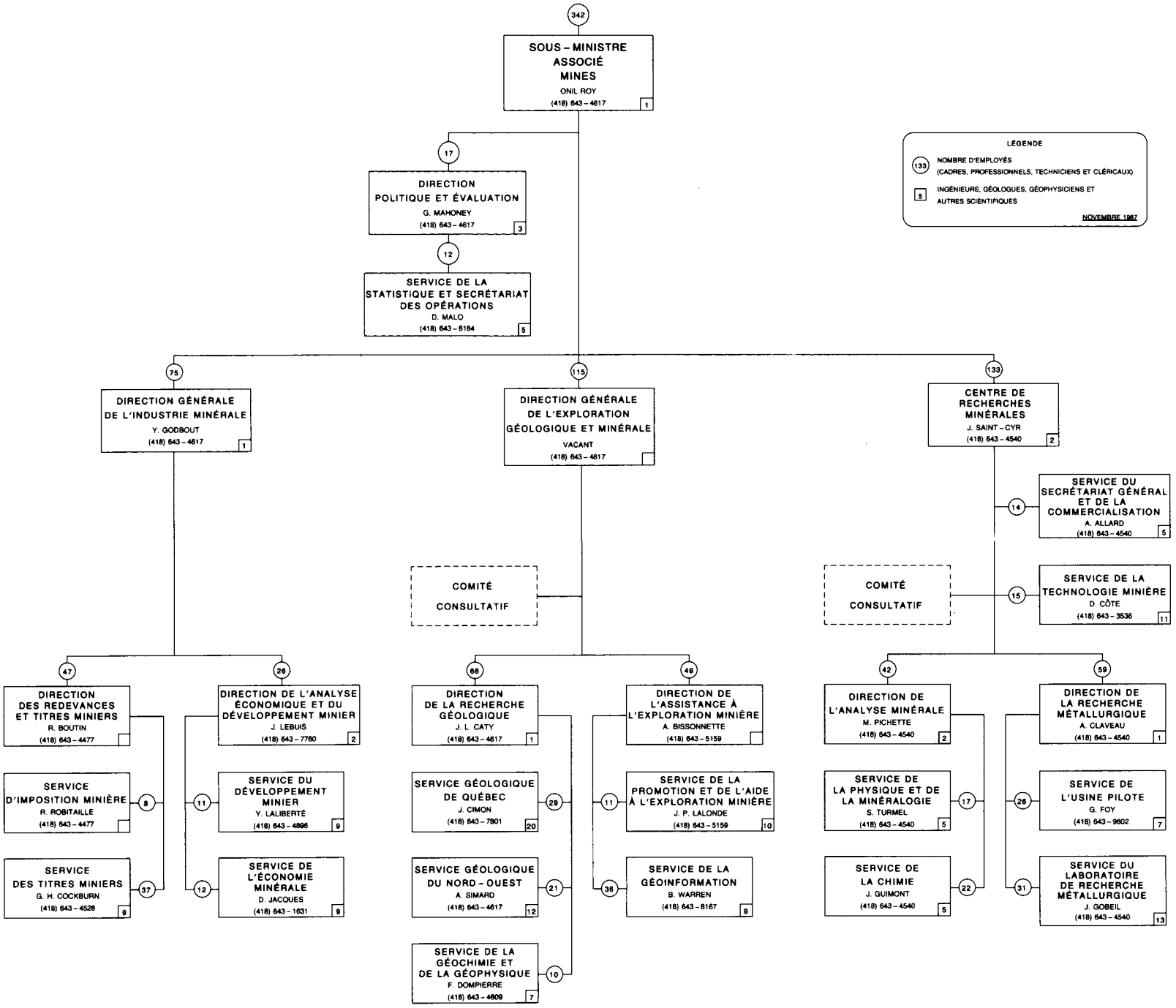
MANITOBA GEOSCIENCE ORGANIZATION CHART



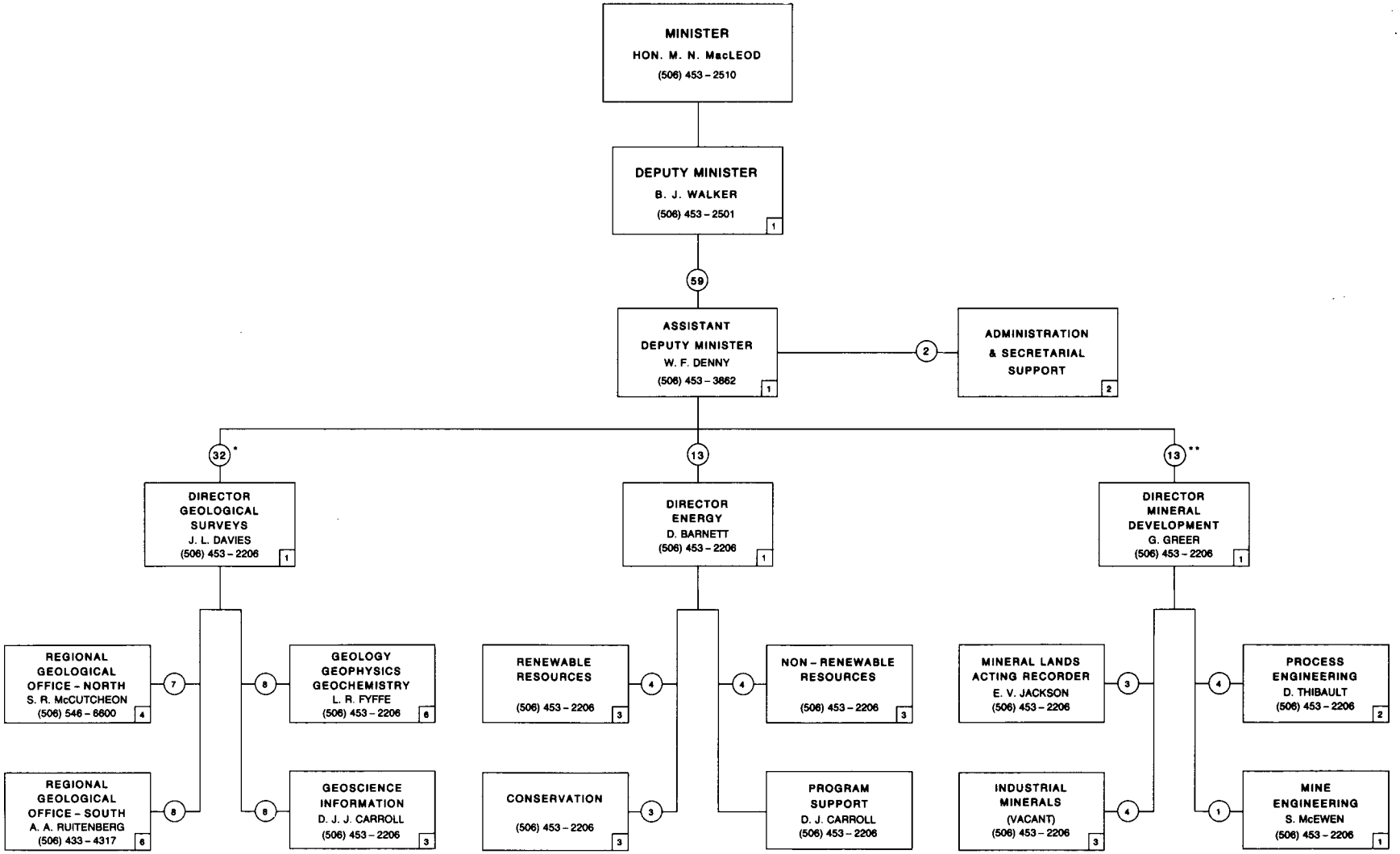
ONTARIO GEOSCIENCE ORGANIZATION CHART



ORGANIGRAMME GÉOSCIENCE DU QUÉBEC



NEW BRUNSWICK GEOSCIENCE ORGANIZATION CHART



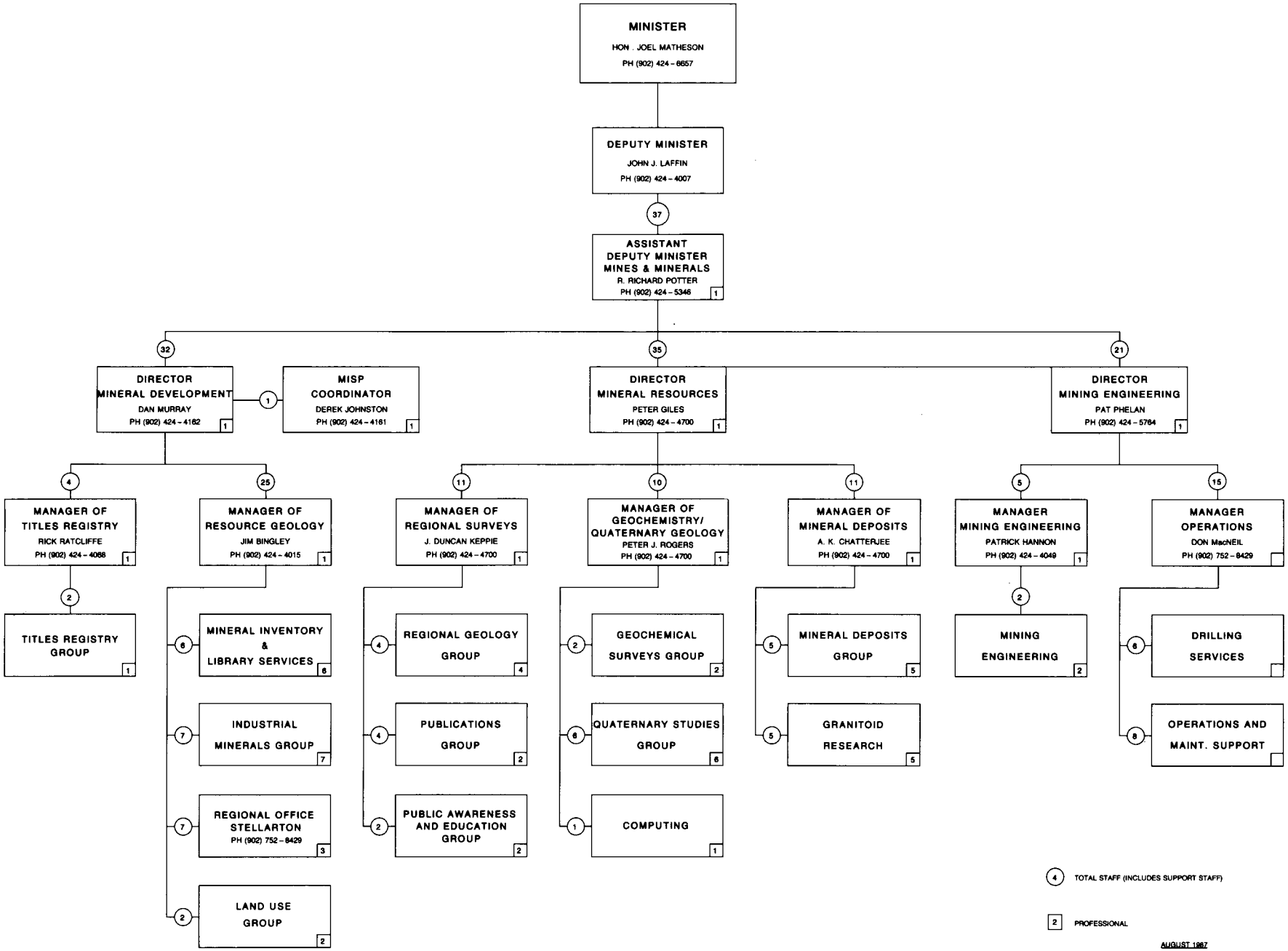
* INCLUDES TEN GEOLOGISTS AND ONE TYPIST SUPPORTED BY CANADA – NEW BRUNSWICK MINERAL DEVELOPMENT AGREEMENT FUNDS

** INCLUDES THREE POSITIONS SUPPORTED BY CANADA – NEW BRUNSWICK MINERAL DEVELOPMENT AGREEMENT FUNDS

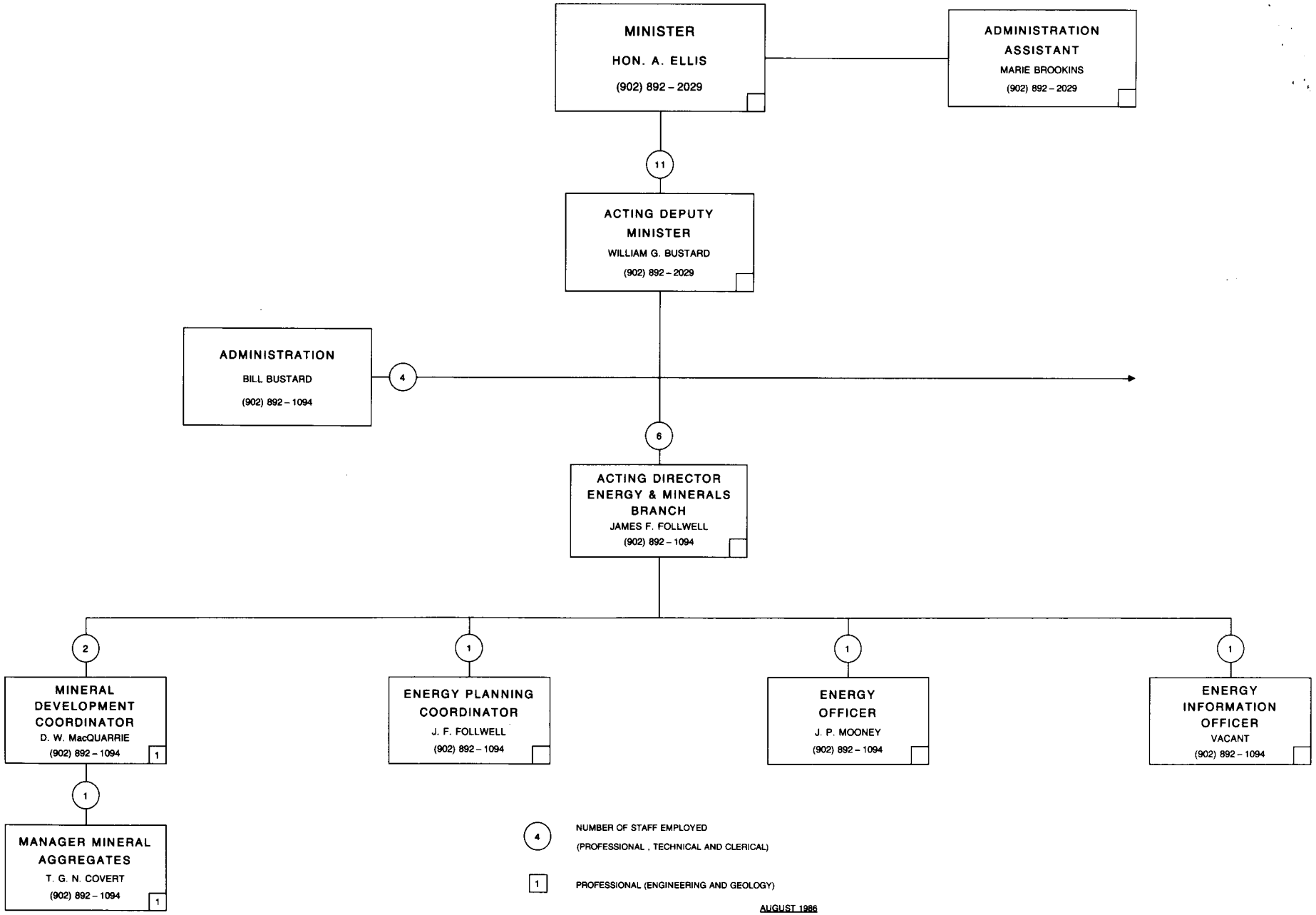
(2) TOTAL PROFESSIONAL, TECHNICAL AND CLERICAL STAFF

[2] TOTAL PROFESSIONAL STAFF

NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART

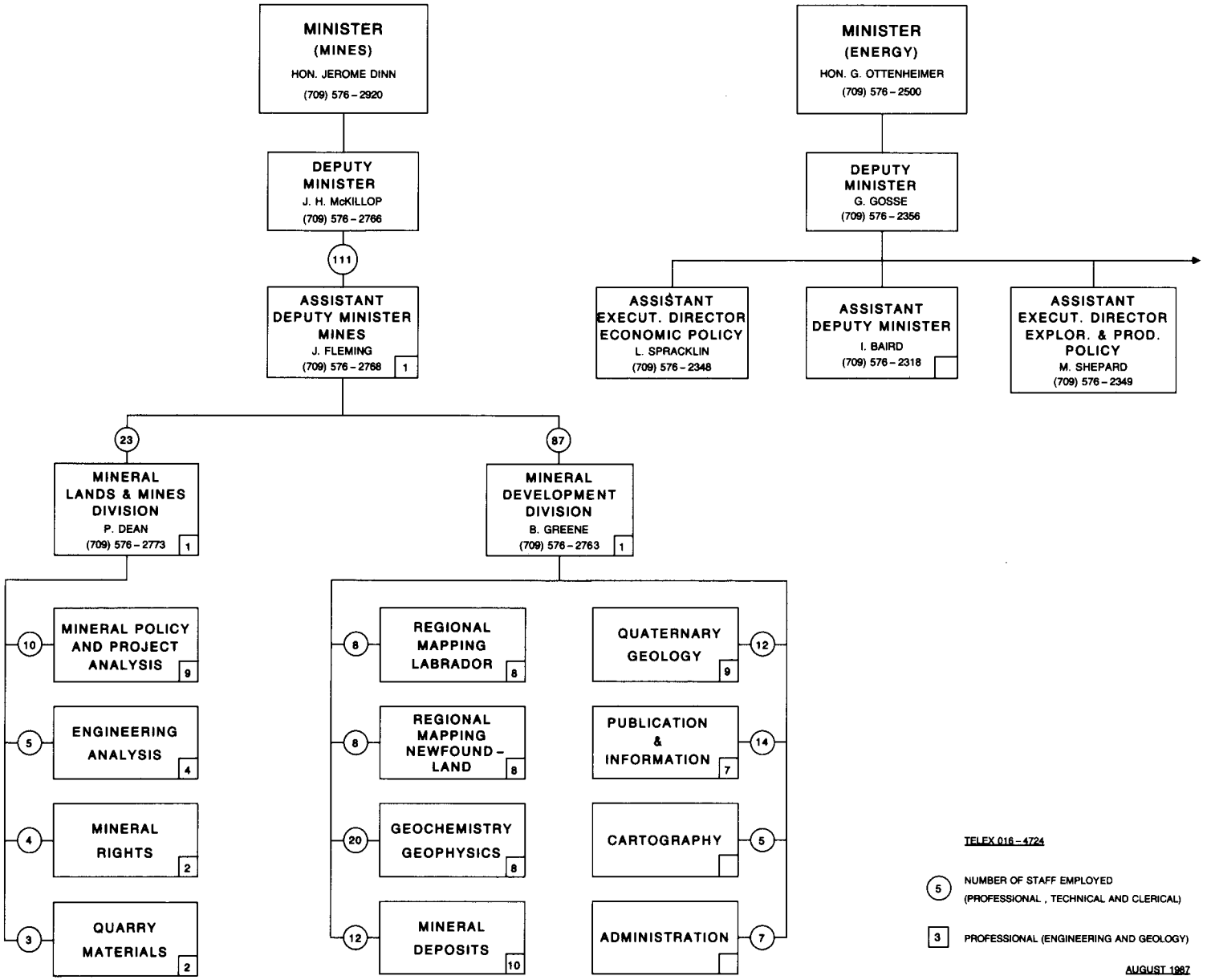


PRINCE EDWARD ISLAND GEOSCIENCE ORGANIZATION CHART

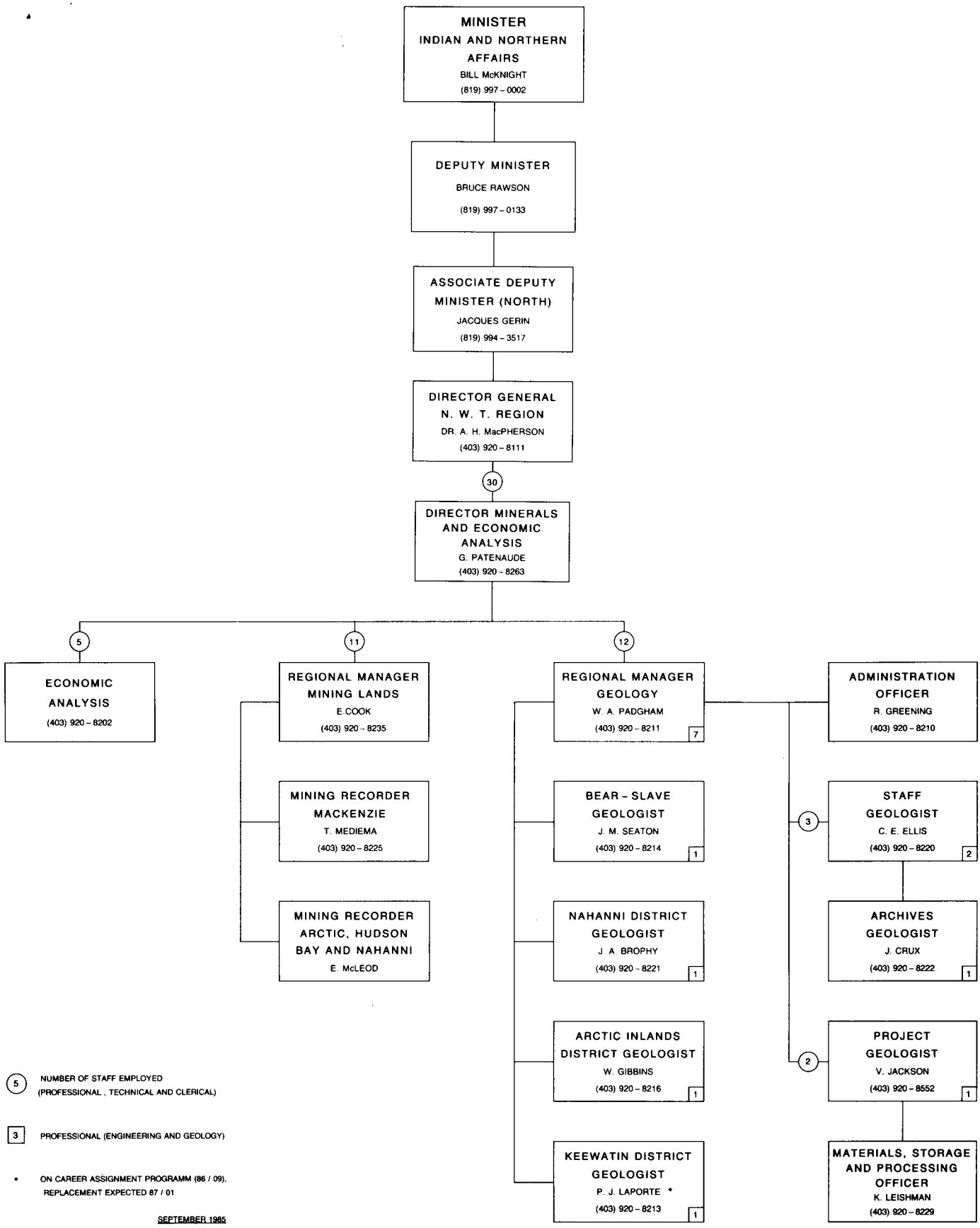


AUGUST 1986

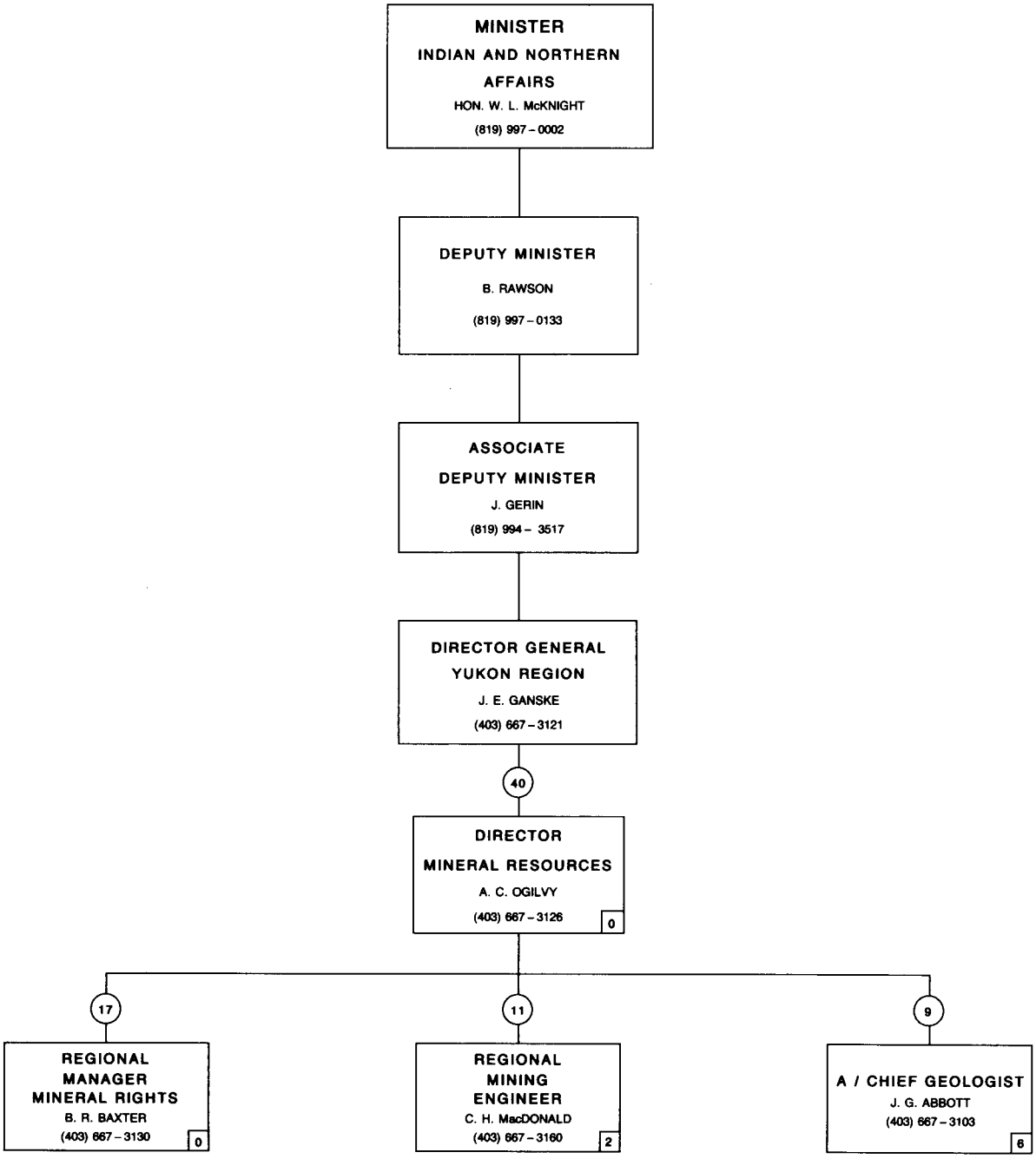
NEWFOUNDLAND GEOSCIENCE ORGANIZATION CHART



NORTHWEST TERRITORIES GEOSCIENCE ORGANIZATION CHART



YUKON GEOSCIENCE ORGANIZATION CHART



PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES, 1986-1987

PROVINCIAL GEOSCIENCES EXPENDITURES
1986—1987

PROVINCE/ TERRITORY	SURVEY EXPENDITURES $ x 10^6	% OF TOTAL	TOTAL 1986 VALUE OF PROVINCIAL MINERAL PRODUCTION* $ x 10^3	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA OF PROVINCE/ TERRITORY $km^2 x 10^3$	SURVEY $ SPENT/km^2	POPULATION (1986) $x 10^3$	SURVEY $ SPENT/ CAPITA
Newfoundland	5.9	9.1	764 169	0.77	405	14.6	568	10.4
Nova Scotia	5.3	8.2	356 673	1.49	55	96.4	873	6.1
Prince Edward Island	0.1	0.2	1 700	5.88	6	16.6	127	0.8
New Brunswick	1.3	2.0	526 018	0.25	73	17.8	709	1.8
Quebec	18.0	27.9	2 275 750	0.79	1 541	11.7	6 532	2.8
Ontario	13.2	20.4	4 715 983	0.28	1 069	12.3	9 102	1.5
Manitoba	3.2	5.0	663 752	0.48	650	4.9	1 063	3.0
Saskatchewan	2.6	4.0	1 168 257	0.22	652	4.0	1 010	2.6
Alberta	7.4	11.5	1 623 997	0.45	661	11.2	2 366	3.1
British Columbia	5.1	7.9	2 629 897	0.19	948	5.3	2 883	1.7
Yukon	1.1	1.7	183 533	.60	483	2.3	24	45.8
Northwest Territories	1.4	2.1	656 239	2.10	3 380	0.4	52	26.9
TOTALS	**64.6**	—	**15 565 968**	—	**9 923**	—	**25 309**	—

[1]Source: Canadian Mining Journal, February 1987

PROVINCE: BRITISH COLUMBIA
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT[1] SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $	TOTALS $
Chief's Office	GB (MRD)	EMPR/ EMR	2	3	6	114 300	120 000	60 337	294 637
Core Repositories	GB (MRD)	EMPR	1[2]	1	—	21 000	—	1 000	22 000
Geochemical Surveys:									
(1) Bedrock	GB (MRD)	EMPR	—	—	—	—	—	—	—
(2) Drainage	GB (MRD)	EMPR/ EMR	4	—	—	—	—	335 837	335 837
(3) Soil	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:									
(1) Reconnaissance (>1:100 000)	—	—	5	—	7	—	260 000	1 027 436	1 287 436
(2) Detailed (>1:50 000)	GB (MRD)	EMPR/ EMR	20	18	5	843 466	100 000	255 977	1 199 443
Geological Surveys, Surficial:									
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—	—
(2) Detailed (>1:50 000)	GB (MRD)	EMPR	1	—	—	—	—	—	—
Geophysical Surveys:									
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	OM	—	—	—	—	—	—	—	—
Education	GB (MRD)	EMPR	5	1	—	33 456	—	21 155	54 611
Laboratory Analysis	GB (MRD)	EMPR	8	7	—	270 861	1 500	365 200	637 561
Mineral Deposit Inventory and Analysis	GB (MRD)	EMPR/ EMR	4	12	3	446 426	39 000	266 902	752 328
Oil and Gas Inventory and Analysis	GB (PRD)*	EMPR	1	4	—	200 000	—	70 000	270 000
Publications	EMPR	EMPR	32	2	—	—	—	—	—
District Geologist's Office	GB (MRD)	EMPR	7	7	1	331 705	8 000	147 045	486 750
Petroleum Subsurface Investigations	GB (PRD)*	EMPR	1	6	—	266 000	—	102 000	368 000
Water Resource Inventory and Analysis	OM	—	—	—	—	—	—	—	—
TOTALS									
GB (MRD)	—	—	—	**49**	**22**	**2 061 214**	**528 500**	**2 480 889**	**5 070 603**
GB (PRD)	—	—	—	**10**	—	**466 000**	—	**172 000**	**638 000**

[1]Full Time Employees
[2]Charlie Lake
*GB (MRD) — Geological Branch (Mineral Resources Division)
GB (PRD) — Geological Branch (Petroleum Resources Division)
EMPR — Ministry of Energy, Mines and Petroleum Resources
OM — Other Ministries
EMR — Energy, Mines and Resources Canada
(Canada — B.C. Mineral Development Agreement)

PROVINCE: ALBERTA
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL $	SUPPLIES & SERVICES $
Chiefs Office	ARC/ERCB	ARC/ERCB	3	11.9	—	459 930	—	99 000
Core Repositories	ARC/ERCB	AE	1	1	—	50 000	—	12 000
Geochemical Research/Surveys	ARC	ARC	1	1	—	101 000	—	28 000
Geological Surveys, Bedrock:								
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	ARC	FLW	1	4	1	178 000	18 000	51 000
Geological Surveys, Surficial:								
(1) Reconnaissance	ARC	ARC	5	2.5	.6	188 700	21 500	55 600
(2) Detailed	ARC	ARC	1	.02	—	4 400	—	—
(3) Reclamation/Environmental Impact	ARC	ARC/SRC RRTAC/TAU LML/AE/AF SI/U of C DSSE	10	10	.6	980 990	23 900	429 600
Geophysical	—	—	—	—	—	—	—	—
Hydrogeological	ARC	ARC/AENV ISPG	4	9	—	390 000	—	144 000
Information and Education	ARC/ERCB	AE/ARC	3	3.6	—	138 770	—	34 500
Laboratory Analysis	ARC	ARC	1	3	—	234 000	—	16 000
Mineral Deposit Inventory and Analysis	ARC	EMR/FLW	4	3	1	126 000	20 000	55 000
Energy Resource Inventory and Research:								
(1) Petroleum and Natural Gas	ERCB	ERCB	2	23.3	—	875 830	—	202 000
(2) Oil Sands	ARC/ERCB	ARC/AOSTRA AE	7	25.3	2	1 109 080	42 000	243 000
(3) Coal Geology	ARC	ARC/AE	6	7	1	300 000	18 000	79 000
Stratigraphic Research	ARC/ERCB	ARC	3	6.4	—	267 880	—	94 000
Other	ARC/ERCB	ARC/ERCB	4	5.4	—	252 300	—	85 000
TOTALS	—	—	**56**	**116.42**	**6.2**	**5 656 880**	**143 400**	**1 627 700**

ARC — Alberta Research Council
AENR — Alberta Energy and Natural Resources
AOSTRA — Alberta Oil Sands Technical Research Authority
ERCB — Energy Resources Conservation Board
LCRC — Land Council and Reclamation Council
TAU — TransAlta Utilities Ltd.
FLW — Forestry, Lands and Wildlife
EMR — Energy, Mines and Resources
AENV — Alberta Environment
ISPG — Institute Sedimentary and Petroleum Geology
SRC — Smoky River Coal
RRTAC — Reclamation Research Technical Advisory Committee
LML — Luscar Mines Limited
AE — Alberta Environment
AF — Alberta Forestry
SI — Suncor Inc.
U OF C — University of Calgary
DSSE — Environment Canada

PROVINCE: SASKATCHEWAN
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $
Administration (Head Office)	SGS	SGS	1	5.0	0.8	198 700	20 000	79 200
* Core Repositories	SGS	SGS	1	7.0	1.3	152 400	23 000	32 700
Geochemical Surveys:								
(1) Bedrock	UofR	SGS	—	—	—	—	—	28 000
(2) Drainage	—	—	—	—	—	—	—	—
(3) Vegetation	—	—	—	—	—	49 500	—	—
Geological Surveys, Bedrock:								
(1) Reconnaissance (1:100 000)	SGS	SGS	5	4.0	8.3	211 100	157 800	213 800
(2) Detailed (1:50 000)	UofR	SGS	2	—	—	—	—	21 000
Geophysical Surveys, Surficial:								
(1) Reconnaissance (1:100 000)	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	—	—	—	—	—	—	—
Geophysical Surveys:								
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—
(6) Geothermal	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—
Information and Education	SGS	SGS	1	—	—	—	—	—
Laboratory Analysis	SRC/UofR Carleton, etc.	SGS	4	—	—	—	—	23 000
Mineral Deposit Inventory and Analysis Including Industrial Minerals	SGS	SGS	8	5.0	2.8	244 500	41 700	113 000
Oil and Gas Inventory and Analysis	SGS	SGS	2	6.0	2.0	176 200	49 000	20 600
** Publications	SGS	SGS	—	4.0	—	142 000	—	106 400
*** Resident Geologist's Office	SGS	SGS	2	3.0	—	112 600	5 500	22 800
Subsurface Investigations	SGS	SGS	5	6.0	—	250 300	—	11 000
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—
Metallogenic Mineral Deposit Studies	SGS	SGS	1	1.0	—	49 500	3 500	41 000
TOTALS	**—**	**—**	**—**	**41.0**	**15.2**	**1 586 800**	**300 500**	**712 500**
Grand Total	**$2 550 300**							

SGS — Saskatchewan Geological Survey
SRC — Saskatchewan Research Council
UofR — University of Regina
*Sedimentary rocks
**Includes cartography
***Includes igneous-metamorphic core storage

PROVINCE: MANITOBA
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL/ TERM SMY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $
Core Repositories	MM	MAN	4	1.37	1.06	61 000	22 900	69 900
Geochemical Surveys:								
(1) Bedrock	—	—	—	—	—	—	—	—
(2) Drainage	—	—	—	—	—	—	—	—
(3) Soil	MGS	MAN	1	1.00	.39	42 900	11 600	37 600
(4) Peat	MGS	MAN	—	—	—	—	—	—
Geological Surveys, Bedrock:								
(1) Reconnaissance (1:100 000)	MGS	MAN	1	1.00	1.03	46 400	23 700	2 900
(2) Detailed (1:50 000)	MGS	MAN	13	8.00	2.41	395 800	56 400	115 800
(3) Phanerozoic	MGS	MAN	2	1.00	—	48 900	—	15 600
Geological Surveys, Surficial:								
(1) Reconnaissance (1:50 000)	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	—	—	—	—	—	—	—
(3) Resource Management	—	—	—	—	—	—	—	—
Geophysical Surveys:								
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—
(2) Airborne Magnetic, Gradiometer	—	—	—	—	—	—	—	—
(3) Ground Magnetic	MGS	MAN	1	1.00	.13	37 300	4 200	4 000
(4) Gravity	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—
(7) Remote Sensing	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—
Information, Education, Assessment Services and Compilation	MGS/MM	MAN	9	3.00	—	99 100	—	39 300
Laboratory Analysis	MGS	MAN	3	10.34	3.00	337 400	63 200	55 600
Mineral Deposit Inventory and Analysis	MGS/UNIV	MAN	16	5.00	5.26	253 100	135 600	244 300
Industrial Minerals	MGS	MAN	3	3.00	0.41	99 000	12 900	30 200
Oil and Gas Inventory and Analysis	—	—	—	—	—	—	—	—
Publications	MGS	MAN	32	—	—	—	—	43 600
Resident Geologist's Office	—	—	—	—	—	—	—	—
Subsurface Investigations, Industrial Mininerals Drilling and Management	MGS	MAN	2	.18	.32	14 000	10 900	23 300
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—
Other:								
(1) Administration	MGS	MAN	—	5.00	2.00	182 800	36 300	137 200[1]
(2) Drafting	MGS	MAN	—	9.25	2.35	302 600	55 900	24 300
(3) Uranium/Lead and Rubidium/Strontium Analyses	MGS/UNIV GSC	MAN	5	—	—	—	—	21 100
TOTALS	—	—	—	**49.14**	**18.36**	**1 920 300**	**433 600**	**864 700**

GSC — Geological Survey of Canada
MGS — Manitoba Geological Services Branch
MM — Manitoba Mines Branch
UNIV — Universities
MAN — Manitoba
[1]Includes 40.0 for Field Equipment and Capital

PROVINCE: ONTARIO
1986—1987

PROGRAMS	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	MAN-YEARS PERMANENT	MAN-YEARS CASUAL	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTALS $
Administration (Head Office)	MNDM	—	5	2	275 400	58 100	91 300	424 800
Core Repositories	MNDM	7	5	5	165 400	127 000	300 000	592 400
Geochemical Surveys/Research	—	—	—	—	—	—	—	—
Geophysical Surveys	MNDM	6	9	3	272 200	64 900	217 500	554 600
Airborne Electromagnetic	—	—	—	—	—	—	—	—
Gravity	—	—	—	—	—	—	—	—
Seismic	—	—	—	—	—	—	—	—
Geological Surveys:								
Precambrian	MNDM	16	20	11	869 900	296 300	254 100	1 420 300
Geological Surveys:								
Phanerozoic	—	—	—	—	—	—	—	—
Quaternary	MNDM	10	17	7	497 200	201 600	120 000	818 800
Aggregate	—	—	—	—	—	—	—	—
Geoservices:								
Publications	MNDM	—	19	3	359 400	67 700	296 000	723 100
Laboratory Analysis	—	—	22	4	632 100	84 800	177 300	894 200
Assessment Services	—	—	—	—	—	—	—	—
Equipment, Vehicles	—	—	—	—	—	—	—	—
Information, Education, Library	MNDM	—	14	4	382 500	92 700	129 100	604 300
Mineral Deposits Studies Including Industrial Minerals	MNDM	12	10	4	351 100	116 900	122 000	590 000
Resident Geologist's Offices	—	—	—	—	—	—	—	—
Geoscience Research Grants Program	MNDM	24	—	—	—	—	500 000	500 000
COMDA	CAN./ONT.	52	—	72	—	2 240 800	1 022 500	3 263 300
Other Projects	—	6	—	45	—	1 250 000	1 570 500	2 820 500
TOTALS	**—**	**—**	**121**	**160**	**3 805 200**	**4 600 800**	**4 800 300**	**13 206 300**

MNDM — Ministry of Northern Development and Mines
COMDA — Canada–Ontario 1985 Mineral Development Subsidiary Agreement

PROVINCE: QUÉBEC
1986—1987

PROGRAMMES	MAÎTRE D'OEUVRE	FINANCEMENT	NOMBRE DE PROJETS OU D'INSTALLATIONS	EMPLOYÉS PERMANENTS PERS.-ANNEE (P-T-C-)**	EMPLOYÉS OCCASIONNELS PERS.-ANNEE	BUDGET ALLOUÉ*** $
Lithotèques	DGEGM	MER	4	0,5P	—	79 500
Levés géochimiques	DGEGM	MER/EMR*	19	3P-2T-1C	6,5	1 557 800
Levés géophysiques	DGEGM	MER/EMR*	19	2P-1T	—	1 946 700
Levés géologiques	DGEGM	MER/EMR*	53	13P-3C	27,6	5 949 000
Minéraux industriels et pierre de taille	DGEGM	MER/EMR*	8	4P-1T	2,3	279 400
Opérations et équipement	DGEGM	MER	—	1P-4T	11,5	1 049 100
Documents promotionnels et compilations	DGEGM	MER	—	5P	—	160 000
Edition	DGEGM	MER	—	4P-17T-1C	1,4	947 000
Diffusion	DGEGM	MER	—	3P-1T-8C	4,0	172 500
Bureaux de géologues résidents	DGEGM	MER	7	7P-3T-8C	7,0	385 500
Subventions:	DGEGM	MER	—	2P-1C	—	—
(1) travaux d'exploration	DGEGM	MER	19	—	—	2 400 000
(2) infrastructures d'accès	DGEGM	MER	3	—	—	81 200
(3) nouvelles technologies	DGEGM	MER	5	—	—	200 000
(4) exploration en chantier	DGEGM	MER	3	—	—	1 900 000
Promotion	DGEGM	MER	—	—	—	182 000
Analyses minérales	CRM	MER	—	—	—	300 000
Informatique et bureautique	DGEGM	MER	—	—	1,0	452 000
TOTAUX	**—**	**—**	**—**	**44,5P-29T-22C**	**61,3**	**18 041 700**

* Entente auxiliaire Canada–Québec sur le développement minéral, programme I
** P — Professionnel
T — Technicien
C — Clérical
*** Excluant le salaire des employés permanents

PROVINCE: NEW BRUNSWICK
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	STAFF-YEARS PERMANENT	STAFF-YEARS CONTINUING AUXILIARY	STAFF-YEARS SUMMER AUXILIARY	SALARIES PERMANENT $	SALARIES CONTINUING AUXILIARY $	SUMMER AUXILIARY $	OPERATING EXPENDITURES $
Core Repositories	GSB	DNRE	5	1	—	0.5	35 000	—	3 000	5 400
Geochemical Surveys:										
(1) Bedrock	—	—	—	—	—	—	—	—	—	—
(2) Drainage	GSB	DNRE	1	—	—	—	—	—	—	27 000
(3) Soil	—	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:										
(1) Reconnaissance (1:100 000)	—	—	—	—	—	—	—	—	—	—
(2) Detailed (1:20 000)	GSB	DNRE	2	2	—	1.0	70 000	—	14 000	60 000
Geological Surveys, Surficial:										
(1) Reconnaissance (1:100 000)	—	—	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	1	—	—	—	0.5	—	—	13 000	15 000
Geophysical Surveys:										
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—	—	—
Information and Education	GSB	DNRE	2	3	—	—	77 000	—	—	54 000
Laboratory Analysis	GSB	DNRE	1	2	—	0.5	54 000	—	6 000	13 000
Metallic-Mineral Deposit Inventory	GSB	DNRE	1	1	—	0.5	37 000	—	6 000	8 000
Industrial Minerals:										
(1) Evaporites	MDB	DNRE	1	1	—	—	37 000	—	—	20 000
(2) Limestone	MDB	DNRE	1	—	—	—	—	—	—	—
(3) Granular Resources	MDB	DNRE	2	2	—	0.5	65 000	—	6 000	14 000
Coal and Inventory Analysis	EB	—	1	1	—	—	33 000	—	—	10 000
Oil and Gas – Oil Shale Inventory and Analysis	EB	DNRE	1	1	—	—	35 000	—	—	10 000
Publications	GSB	DNRE	1	3	—	—	85 400	—	—	20 000
Resident Geologist's Offices	GSB	DNRE	2	8	—	0.5	230 000	—	6 000	100 000
Subsurface Investigations	—	—	—	—	—	—	—	—	—	—
Peat Inventory	MDB	DNRE	1	1	—	0.25	35 000	—	3 000	10 000
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—	—	—
Other Studies*	GSB	DNRE	2	1	—	0.25	48 000	—	6 000	17 000
TOTALS	**—**	**—**	**24**	**27**	**—**	**4.5**	**841 400**	**—**	**63 000**	**383 400**

Grand Total **$1 287 800**

GSB — Geological Surveys Branch
MDB — Mineral Development Branch
EB — Energy Branch
DNRE — Department of Natural Resources and Energy
*Includes mineral economic, and mining studies and various research projects supported by GSB

PROVINCE: NOVA SCOTIA
1986—1987

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT STAFF MAN-YEARS	CASUAL STAFF MAN-YEARS	BUDGET ALLOCATIONS $
Core Repositories	NSDME	NSDME NSDOD	3	3	1	91 300
Geochemical Surveys:	NSDME	NSDME NSDOD	2	1	1	136 300
(1) Bedrock	—	—	—	—	—	—
(2) Drainage	—	—	—	—	—	—
(3) Soil	—	—	—	—	—	—
Geological Surveys, Bedrock:	—	—	—	—	—	—
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NSDME	NSDME NSDOD	3	3	8	782 600
Geological Surveys, Surficial:						
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NSDME	NSDME	2	1	5	317 400
Geophysical Surveys:						
(1) Airborne Radiometrics	—	—	—	—	—	—
(2) Airborne Magnetic (includes VLF-EM)	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—
Information and Education	NSDME	NSDME NSDOD	2	2	2	385 900
Laboratory Analysis	—	—	2	—	—	287 600
Mineral Deposit and Analysis	NSDME	NSDME NSDOD	9	4	6	1 077 400
Mineral Deposit Inventory	NSDME	NSDME NSDOD	3	3	2	136 500
Coal and Peat	NSDME	NSDME NSDOD	3	7	2	312 000
Oil and Gas Inventory and Analysis	NSDME	NSDME	2	5	—	536 200
Publications	NSDME	NSDME NSDOD	N/A	3	7	271 100
Resident Geologist's Office	NSDME	NSDME	N/A	15	—	297 900
Subsurface Investigations	NSDME	NSDME	N/A	4	6	570 300
Grants for Mineral Development (MISP)	—	—	N/A	—	1	118 000
TOTALS	—	—	**31**	**51**	**41**	**5 320 500**

NSDME — Nova Scotia Department of Mines and Energy
NSDOD — Nova Scotia Department of Development

PROVINCE: NEWFOUNDLAND
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT[1] SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CONTRACT[1] $	OPERATING CASUAL $	OPERATING EXPENDITURES $
Director's Office	NDME	NDME	—	6	2	150 800	33 800	8 400	145 500
Core Repositories	NDME	NDME	1	2	2	37 200	29 900	7 000	67 600
Geochemical Surveys:									
(1) Bedrock	—	—	—	—	—	—	—	—	—
(2) Drainage	NDME	NDME	3	4	7	125 700	17 900	22 300	182 000
(3) Soil	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:									
(1) Reconnaissance (>1:100 000)	NDME	NDME DEMR	6	7	24	183 200	110 700	131 600	905 800
(2) Detailed (>1:50 000)	NDME	NDME DEMR	7	8	6	136 600	173 900	20 600	374 400
Geological Surveys, Surficial:									
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NDME	NDME	7	10	15	88 000	258 800	72 600	521 800
Geophysical Surveys:									
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	NDME	NDME	1	1	2	—	7 500	6 900	42 200
(4) Gravity	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—	—
Information and Education	NDME	NDME	—	—	—	—	—	—	—
Laboratory Analysis	NDME	NDME DEMR	2	11	3	151 600	92 900	3 100	162 700
Mineral Deposit Inventory and Analysis	NDME	NDME DEMR	13	12	9	190 200	211 200	58 500	540 800
Publications	NDME	NDME DEMR	6	15	—	251 100	108 700	—	267 900
Resident Geologist's Office	—	—	—	—	—	—	—	—	—
Subsurface Investigations	—	—	—	—	—	—	—	—	—
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—	—
TOTALS	**—**	**—**	**46**	**76**	**70**	**1 314 400**	**1 045 300**	**331 000**	**3 210 700**

Grand Total **5 901 400**

[1]Includes long term temporary staff
NDME — Newfoundland Department of Mines and Energy
DEMR — Department of Energy, Mines and Resources, Canada

TERRITORY: NORTHWEST TERRITORIES
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $
Head Office (Administration, General Support)	INA	INA	1	4.4	—	220 000	5 000	135 000
Core Repositories	INA	INA	1	0.4	0.3	20 000	5 000	15 000
Geochemical Surveys:								
(1) Bedrock	INA	INA	1	.1	—	10 000	—	10 000
Geological Surveys; Bedrock Surficial:								
(1) Reconnaissance (1:100 000)	INA	INA	1	0.2	—	5 000	10 000	30 000
(2) Detailed (1:50 000)	INA	INA	11	1.5	2.75	70 000	26 800	175 000
(3) Surficial	INA	INA	1	—	.2	—	5 000	30 000
Education	INA	INA	—	.2	—	10 000	—	5 000
Laboratory Analysis	INA	INA	—	.1	—	5 000	—	12 000
Mineral Deposit Inventory and Analysis	INA	INA	—	2.0	.7	70 000	35 000	200 000
Publications	INA	INA	15	2.7	.3	140 000	10 000	10 000
Other:								
(1) Prospectors' Assistance	INA	INA	—	.2	—	20 000	—	12 000
(2) Geological Contracts	INA	INA	—	.2	—	20 000	—	63 000
Grand Totals								
	—	**—**	**N/A**	**12**	**4.25**	**590 000**	**96 800**	**697 000**

INA — Indian and Northern Affairs, Canada

TERRITORY: YUKON
1986—1987

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $
Head Office (Administration, General Support)	INA	INA	1	3.0	0.25	82 000	7 000	110 000
Core Repositories	INA	INA	1	0.5	0.25	15 000	7 000	5 000
Geological Surveys	INA	INA	—	—	—	—	—	—
(1) Detailed (1:50 000)	—	EDA	3	—	6.0	—	180 000	180 000
Geological Surveys, Surficial:								
(1) Detailed (1:50 000)	INA	INA	1	0.5	0.5	25 000	28 000	15 000
Education	INA	INA	1	—	—	—	—	10 000
Laboratory Analysis	INA	INA/EDA	3	—	—	—	—	15 000
Mineral Deposit Inventory and Analysis	INA	INA	12	3.5	2.5	205 000	17 500	106 500
Publications	INA	INA	2	0.5	—	18 000	—	25 000
TOTALS	**—**	**—**	**24**	**8**	**9.5**	**345 000**	**239 500**	**466 500**

INA — Indian and Northern Affairs Canada
EDA — Canada — Yukon Economic Development Agreement

GEOLOGICAL PROGRAM HIGHLIGHTS

PROVINCIAL AND TERRITORIAL GEOLOGICAL SURVEYS 1986-1987

BRITISH COLUMBIA GEOLOGICAL SURVEY

BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM

INTRODUCTION

The British Columbia Geological Survey is one of four branches in the Mineral Resources Division. Its mission is:

> To aid and stimulate the growth of the mining industry for the social and economic benefit of the people of British Columbia by conducting geoscientific surveys and by inventorying and analysing the geology and mineral deposits of the Province.

A sister branch in the Petroleum Division is responsible for the geological assessment of oil and gas resources situated onshore and offshore British Columbia.

In late 1986 the new Vander Zalm Social Credit Government appointed a Mineral Industry Task Force to examine the state of the mining industry in British Columbia and to make recommendations to ensure its survival and growth. The findings and recommendations centred on the following areas:

- Direct taxation and Government mandated costs
- Energy
- Transportation
- Exploration Incentives
- Geological Database
- Access to Land
- Regional Infrastructure
- Environment
- Research and Development

The Task Force presented an assessment of the British Columbia exploration database and budget of the Geological Survey Branch. It concluded that the present level of activity of the Branch fell "short of providing (an) important stimulus to new exploration activity" and recommended that the Branch's budget be increased. Subsequently the Government allocated an additional $2 million to the Branch's base budget in 1987-88. This allowed new regional mapping and geochemistry programs, initiated in 1986 under the Canada-B.C. Mineral Development Agreement (MDA), to be delivered from the base budget. The accelerated level of geoscientific programs under the MDA continued in 1987 and new projects on platinum group elements, gold skarns, coal deposit modelling and a coal quality file were begun.

In January 1987 the Branch held its fifth annual Open House in Vancouver, in conjunction with the Cordilleran Roundup of the British Columbia & Yukon Chamber of Mines. Over 1000 people attended this annual event which has achieved the status of Prospectors West'. With the recent significant growth of junior mineral exploration companies, the demand for services from the Branch has increased significantly. Consultations and sales of publications are at an all-time high.

MINERAL DEPOSITS

The focus of this program continued to be field studies of gold mineralization, including the Bralorne gold camp (B.N. Church), Stewart/Sulphurets camp (D.J. Alldrick), Rossland camp (T. Hoy), Quesnel gold belt (A. Panteleyev), Hedley camp (G. Ray), Babine Range-Dome Mountain (D. MacIntyre) and gold skarns (A. Ettlinger). A metallogenic study of mafic and ultramafic rocks for platinum group elements was begun by G. Nixon under the MDA. Work in 1987 concentrated on Alaskan-type intrusions near Tulameen, Hope and in the Skeena River area near Prince Rupert. T. Schroeter continued his investigations of major gold deposits in British Columbia.

REGIONAL MAPPING

The four 1:50 000 scale regional mapping projects, begun in 1986 under the MDA, were continued in 1987. These comprise Sicker belt (N. Massey), Taseko area (K. Glover), Whitesail area (L. Diakow) and Midway-Cassiar (J. Nelson). Three new mapping projects, funded from the

enhanced budget, were initiated in 1987: Atlin-Bennett Lake area (M. Mihalynuk), Manson Creek area (F. Ferri), and Kokanee Glacier Park area (D. Brown). Map data and field notes are available in digital format on floppy diskettes.

REGIONAL GEOCHEMISTRY

Results of the joint Federal-Provincial Regional Geochemical Survey of the Smithers and Whitesail map sheets were released in August 1987. The Smithers release contained gold analyses for the first time. The 1987 survey was centred on the Stewart/Sulphurets gold camp and covered the Iskut River, Sumdum and Telegraph Creek 1:250,000 map sheets.

A geochemical orientation survey was carried out in Northern Vancouver Island (P. Matysek) in advance of a planned regional program in 1988. The aim is to determine background and anomalous geochemical values, to establish appropriate sampling and analytical techniques, and to assess the effectivenes of silt geochemistry as an exploration guide in the coastal rain forest environment.

Release of results of past R.G.S surveys on floppy disks proved to be popular with the exploration community and the 1987 survey data will also be converted and released in this format.

DISTRICT GEOLOGY

The seven district geologists maintain an up-to-date inventory of the geology, mineral deposits, exploration trends and developments in their districts. Advice and consultation to the mineral and coal industry and prospector training are also provided.

In 1987 most district geologists undertook field studies in selected "hot" exploration camps.

The Eleventh Annual Mineral Exploration Course for Prospectors was delivered by this group, with assistance from representatives of the Vancouver exploration community, at Cowichan Lake Forest Research station from April 23 to May 9, 1987. Twenty-seven students attended. A Prospecting Manual written by district geologist Ted Faulkner and published in 1987 forms the basic instruction tool for this course. This $10.00 manual may become an all-time Ministry best seller.

COAL RESOURCES

Coal projects undertaken by the Branch in 1987 continued to move away from regional to deposit-oriented studies as coal companies restricted exploration and focused on the mineability of established reserves.

A new project to collect and compile coal quality and quantity data for British Columbia coals was initiated. The aim is to provide a complete inventory of the province's coals by quality, distribution, quantity and potential uses, in order to enhance the promotion of these resources to domestic and foreign customers.

MINERAL INVENTORY

The Mineral Inventory Subsection collects, compiles, and collates mineral exploration data submitted by industry. It maintains a library of over 14 000 mineral assessment reports and approximately 1000 reports are added annually.

The section is responsible for maintaining a computerized mineral inventory file - MINFILE - on the known mineral occurrences in British Columbia. The redesign of the file, begun in 1985, was completed in 1987. Approximately 60 percent of the 9,000 known occurrences have been recoded to end of 1987. The data are being released in hard copy, microfiche and floppy diskette format. A microcomputerbased search system, developed on dBase III, is provided free of charge to customers who purchase the data. Graphic capabilities are being developed.

INDUSTRIAL MINERALS

Industrial Minerals projects undertaken in 1987 include: an evaluation of the potential of Tertiary basins for clays, zeolites, diatomite, germanium and beryllium (Geotex Consultants); phosphate

assessment of Northeast Rocky Mountains (S. Butrenchuk); a dimension stone study (G. White); evaluation of the olivine potential of the Tulameen complex (G. White); and assessment of glass and ceramic grade feldspar resources (G. White).

LAND USE

In 1987, the Government of British Columbia introduced a new parks creation policy designed to minimize the conflict between preservationists and resource development. All proposed Class A parks must be geologically mapped to assess their mineral potential prior to a final land use decision.

Therefore, a geological mapping and stream sediment sampling program was undertaken on Kokanee Glacier Park and adjacent areas prior to a decision on which areas of the park would have their status upgraded and where to permit mineral resource development.

ANALYTICAL SCIENCES

This section provides a complete range of analyses of rocks, minerals and ores, in support of projects conducted by Branch geologists.

It is responsible for certifying assayers in the Province and for managing the Regional Geochemical Survey Program.

In 1987, the section took delivery of a new atomic absoption spectrophotometer.

GEOSCIENCE RESEARCH

In 1987 the Branch was able to reinstate the B.C. Geoscience Research Grant Program.

Twenty grants totalling $120 000 were awarded to researchers in eight Canadian universities, in support of research on the geology and mineral deposits of the province.

FINANCIAL ASSISTANCE FOR MINERAL EXPLORATION

The 1986 program of cash grants in support of private sector mineral exploration was continued in 1987. Five million dollars was allocated to the 1987 program, which was administered by the Geological Survey Branch.

The program has three components; prospector assistance, mineral exploration incentive, and accelerated mine exploration. Grants of up to one third of exploration costs were awarded to 156 prospectors, 84 exploration projects, and 20 mine exploration projects in 1987. Major criteria applied in awarding the grants were: technical quality, state of project advancement, incremental benefits, local economic impact, and the applicant's financial commitment and financial need.

A detailed analysis of provincial coal deposits, using computer-based digital modelling techniques, was initiated by W. Kilby and B. Wrightson. Deposit models of Mount Klappan, Quintette and Bullmoose are in progress.

A multi-year 1:10 000 scale mapping project of the Elk Valley Coalfield by D. Grieve was completed in 1987.

A major publication, "Coal in B.C.", was published in late 1986. The report outlines the coal resources of British Columbia, as currently known, and examines factors which might influence the development of the Province's coal industry over the next 20 years.

ALBERTA GEOLOGICAL SURVEY
ALBERTA RESEARCH COUNCIL

The activities of the Alberta Geological Survey in 1987 were organized into four groups, namely: Basin Analysis, Coal Geology, Mineral Resources, and Oil Sands Geology. The following overview adheres to this organizational scheme. Much of this work is funded jointly with government departments and provincial government agencies, whereas some projects are carried out under contract to industry or government. Further information regarding the Geological Survey's projects or operations can be obtained by reference to the publication list or to the Annual Report of Investigations of the Alberta Geological Survey.

BASIN ANALYSIS

The main research thrusts of the Basin Analysis Group over the past year have been directed towards waste disposal and petroleum exploration.

Deep waste disposal research continued in both the Cold Lake and Lloydminster areas. These ongoing projects address concerns regarding the effects of deep waste disposal of liquid residues from the oil sands or heavy oil activities in the area. Areas of research include the effects of injection in terms of pressure build-up, fracturing, water-rock interactions, contaminant transport and thermal effects.

The investigations into abnormal pore pressures in the Beaufort-Mackenzie Sedimentary Basin also continued over the past year. Research was directed towards possible relation of abnormal pore pressure with flow and temperature regimes of the formation water and possible links with hydrocarbon deposits.

The Basin Analysis Group has undertaken projects related to stratigraphy and sedimentology in two areas: an investigation of the Peace River Arch and an evaluation of the Jurassic-Cretaceous boundary in the Niton Field. The main objectives of the Peace River Arch project are: to increase the level of understanding of the nature, origin and geologic history of the arch, especially with regard to its formation and behavior through time; and its effects on sedimentation, fluid flow, geothermal regimes and oil and gas distribution. This ongoing work is being undertaken in collaboration with the Institute of Sedimentary and Petroleum Geology. The regional study of the Jurassic-Cretaceous Boundary has defined the relation between the Jurassic and the lower Cretaceous associated with hydrocarbon pools in the Niton Field of West-Central Alberta.

The Basin Analysis Group is also responsible for developing the new Geology Atlas of the Western Canada Sedimentary Basin. This is an ambitious product which is jointly sponsored by the Alberta Department of Energy, the Canadian Society of Petroleum Geologists and the Alberta Research Council. A large number of volunteers, from industry, both levels of government and the universities, are contributing to this effort. Phase I, a design and feasibility study, has been completed. The project is now in Phase II, which consists of software development, data acquisition and verification, mapping and geological interpretation. The Atlas, along with its consistently interpreted electronic data base and mapping software, is projected to be completed in 1991.

COAL GEOLOGY

Since last year's completion of a major program evaluating the plains coal deposits of Alberta, research in the Coal Geology Group has taken a new direction. A summary and critical account of what is known about the geology of coal in Alberta was presented in a position paper, together with a set of recommendations for future work derived from a survey of industry, provincial, federal and state geological surveys, and research institutions. Based on this information, coal quality studies have been given priority for the remainder of the program until 1989.

Detailed coal quality studies for both plains and mountains/foothills coal as well as sedimentological and structural studies in the mountains/foothills region are needed. The objective of these studies is to put coal quality data in a geological framework and to obtain predictive models for coal quality variations.

The Coal Geology Group has established four main projects, two related to the coal quality in the mountains/foothills region and a third in the plains region. The fourth project deals with the construction of a coal data base to support the three previous studies and to develop applications of a Geographic Information System.

MINERAL RESOURCES

The Mineral Resources Group investigates the metallic and industrial mineral resources and geology of Alberta. The Group is also responsible for recording and storage of data, providing advice and disseminating information on the resources of the province.

The Minerals Deposits File/Map of Alberta Project, which continued over the past year, involves the collection of mineral deposits data in a systematic file. The graphic display of this file, upon completion of the project, will be a Minerals Map of Alberta.

Metallic and Industrial Minerals studies in the last year comprised a major portion of the Group's research. Several important mineral resource commodities were evaluated, including silica, gypsum, phosphate and dimension stone. Prospective filler-grade limestone deposits were also investigated.

The Mineral Resources Group is the collection agency for geologic data acquired through metallic mineral exploration in the province. These data are made available to industry according to the Metallic Minerals Regulations. This year, core from two exploration programs was received at the Minerals Core Research Facility (MCRF) and an additional 7500 square meters of core storage capacity was added to existing space.

Investigations into the aggregate resources of the province continued to be an important part of the Minerals Resources Group's research. Sand and gravel resources were mapped, through synthesis of existing data and new field data, at scales suited to the needs of the major users. Studies completed over the last year include evaluations of the sand and gravel deposits in the Rocky Mountain House, Calgary, Pelican, and Peerless Lake areas. The mapping at 1:250 000 scale was completed and deposits were classified on the basis of gravel content, cleanliness and content of deleterious materials.

The Mineral Resources Group also looks after needs of government and industry and provides access to GEODIAL, Alberta's geological, bibliographic reference data base.

OIL SANDS GEOLOGY

The Oil Sands Geology Group studies Alberta's oil sands and heavy oil deposits on scales that vary from regional through detailed reservoir analysis, to site-specific.

A major program of this group focusses on resource characterization of the central Athabasca deposit and the northern portion of the Cold Lake deposit, in the northeastern plains region of Alberta. The central Athabasca project is delineating the stratigraphy, facies, reservoir characteristics and bitumen distribution in the unmapped portions of the deposit.

The smaller Cold Lake project documented the mineralogy of the Clearwater Formation in the northern portion of the deposit, and its relation to deleterious, mineral transformation reactions that may occur during thermal recovery of bitumen. In another project, an interdisciplinary, reservoir analysis of the Bodo heavy oil pool is producing detailed geological and petrophysical models for input into numerical thermal-recovery simulators. The estimation of parameters such as equivalent permeability and porosity is of critical importance in these studies. The establishment of an image analysis facility was one of this year's highlights. This facility will be used to study pore systems in oil reservoirs.

The Oil Sands Geology Group conducts proprietary investigations of the way in which geology affects bitumen production. For 1987 this includes: a synthesis of existing data on the Grosmont carbonate reservoir; a study of injectivity and mobile water; and work related to the underground test facility of the Alberta Oil Sands Technology and Research Authority (AOSTRA). In addition, the group provides site-specific geology support to a number of AOSTRA-industry, pilot projects.

SASKATCHEWAN DEPARTMENT OF ENERGY AND MINES

GEOLOGY AND MINES DIVISION

Introduction

As part of the general downsizing of the Public Service in May 1987, the Director of the Saskatchewan Geological Survey, Dr. James E. Christopher, elected to take early retirement and the position was eliminated. This resulted in re-organization of the former Geological Survey Branch into three smaller branches. The name "Saskatchewan Geological Survey", although eliminated from the organization chart, is retained to identify geoscience activities carried out by the Geology and Mines Division.

Fiscal year 1986/87 will be remembered as one of the most difficult and challenging in the history of Saskatchewan's mineral industry. The oil price collapse of early 1986 had a devastating effect on the health of the oil industry and the overall economy of the province. Drilling activity dropped to just over 1100 wells from the record-setting number of 3800 wells in 1985 and land sale revenues fell to $12.3 million from the previous year's amount of $122.7 million. Low commodity prices for potash and uranium continued to plague those sectors although production levels were relatively unaffected. The one bright spot was exploration for precious metals, with expenditures estimated at $18 million for 1986 as compared to $8 million in the previous year. The fiscal year also marked the first time since 1942 that the province had a producing gold mine, when the Star Lake mine poured its first gold brick early in 1987.

Increased interest in northern Saskatchewan was reflected in the attendance at the 1986 Saskatchewan Geological Survey Open House which had over 300 registrants, a 20 per cent increase from the previous year. The Open House was held in conjunction with the Saskatchewan Geological Society Symposium entitled "Economic Minerals of Saskatchewan".

Precambrian Geology

Geoscience activities in the La Ronge Gold Belt continued under the five-year $6.38 million Canada-Saskatchewan Agreement on Mineral Development (MDA) which was in its third year during 1986/87. The provincial effort includes geological mapping, geochemistry, isotope geology and related mineral deposit studies in areas which are currently undergoing active exploration for gold. Additional funds provided to the province in 1986/87 permitted a new bedrock mapping project in the Laonil Lake area and an acceleration of mapping in the La Ronge Central Volcanic Belt. The federal component of MDA, managed by the Geological Survey of Canada, comprised airborne geophysical surveys as well as detailed mineral deposit and regional geological studies.

A number of projects supportive of the regional geoscience program were mainly contracted out to, or joint ventured with, university personnel, as in previous years. Geochemical studies were undertaken in the La Ronge and "Kisseynew" areas and isotope geology studies were continued at Carleton University and through the University of Regina. A highly leveraged geochronology joint venture with the University of Kansas was extended into a fourth year. This work is designed to provide a chronological framework for classifying bedrock units in the north, leading to improved exploration models.

Petroleum Geology

The Well Information System was kept up to date with 1411 well logs being evaluated, the formation tops coded and entered directly through the interactive terminal system. Another 11 cross sections were added to the southern Saskatchewan grid series, bringing the total number produced to 24.

Two projects were completed during the year and published in the Open File Series: "Evaluation of Saskatchewan's Heavy Oil Reserves"; and "Subsurface Carbon Dioxide in Saskatchewan: Sources and Potential Use to Enhance Oil Recovery".

Reduced data inflow from petroleum exploration allowed for increased activity in subsurface geological investigations and four new stratigraphic projects were started during the year. In

addition, in the Office of Energy Research and Development, a detailed study of Saskatchewan petroleum source beds was initiated.

The Subsurface Geological Laboratory is a repository for cores and cuttings from oil, potash and coal test holes. During the year 4,721 boxes of core from 302 wells were received and 53,412 samples of cuttings from 207 wells were catalogued and stored. One hundred and twenty four geologists representing 69 companies made use of the laboratory and examined 30,664 boxes of core from 1,968 wells.

Mineral Development

This branch is responsible for maintenance of the mineral exploration assessment files and the Saskatchewan Mineral Deposits Index and for evaluation and geological studies of metallic mineral deposits in northern Saskatchewan. The branch operates field offices at La Ronge and Creighton and during the fiscal year more than 1800 visitors used the resident geologists' services.

Studies of metallic mineral deposits and their geological settings were continued under MDA. Projects centred on the gold-bearing Sulphide Lake area north of La Ronge and in the Mari and Schotts Lakes areas near Flin Flon. Another project evaluated gold anomalies disclosed by a lake bottom sediment survey carried out in an earlier phase of the Geoscience program.

The mineralized core collection at La Ronge received additions totalling 4302 metres from uranium deposits in the Athabasca Basin and from gold deposits in the La Ronge and Flin Flon areas. Thirty-six persons examined core from the collection during the fiscal year.

Work continued on the 1:250 000 scale metallogenic map series and one new map sheet was published during the year. The maps augment a similar scale bedrock geological compilation map series.

The annual six-week Prospectors School in La Ronge was run by branch staff in conjunction with the La Ronge Community College. A total of 15 students graduated.

Industrial Minerals

The primary function of the unit is to maintain a data base of the industrial minerals of the province and to provide an information service to industry and other government departments and agencies. A total of 181 technical enquiries were handled during the year.

During the fiscal year, four major projects were in progress. Three of these were related to potash and focussed on methodologies to predict and identify geological anomalies and brine inflow hazards in potash mines. The fourth project, on-going from previous years, is a comprehensive report on the geology and development of the province's industrial minerals.

Geodata

This section manages the manual and computerized storage of all information from wells drilled under the Oil and Gas Conservation Regulations and maintains records of geophysical exploration for oil and gas. It also provides an information service to industry and other agencies through direct consultation and by providing copies of non-confidential technical data.

During the fiscal year, 906 new well files were established, 1788 new wells were coded and added to the computerized file and supplementary data were added to 4,784 well records. Demand for data increased from the previous year; nearly 27, 000 files were made available for examination, 43,000 pages of data were photocopied and 557 geophysical maps and reports were reproduced.

REVIEW OF RESOURCE ACTIVITIES AT THE SASKATCHEWAN RESEARCH COUNCIL

Metallogenic Studies

An investigation of the origin of unconformity-type uranium deposits occurring in the Athabasca Basin has been concluded. The final phase of the project attempted to show that the diagenetic-

hydrothermal model for uranium concentration could be applied to the concentration of other metals, such as copper, in sedimentary environments. Athabasca Basin studies continuing include the dating of diabase dikes, fission track dating of specific formations and the development of lithogeochemical data files. A study of host rock alteration surrounding uranuim mineralization was completed for a mining company.

Data Analysis Projects
The evaluation of exploration data using image analysis techniques was undertaken during the year in cooperation with an exploration company. The processing of geophysical, geological, geochemical and other survey data was carried out using a remote sensing system and a generic image-analysis system. The results obtained indicate that this approach will aid exploration companies to integrate and evaluate their exploration data more effectively. A project has been initiated to re-interpret Saskatchewan regional, lake sediment geochemical data by defining new field variables and coding the lake sediment geochemistry data.

Geochemical Services
Geochemical services provided to in-house projects and to the exploration industry in Saskatchewan were expanded by the addition of two new services. A heavy mineral concentration facility was developed for concentrating gold, platinum minerals and uranium from sediments. The process uses a Deister concentrating table and a Mosely mineral concentrator, without any need for heavy liquid separation. An inter-laboratory test involving 8 laboratories and 7 samples confirmed the effectiveness of the concentrating process.

Quaternary Geology Studies
Quaternary mapping and sampling studies in the north were continued in the La Ronge-Reindeer Lake-Flin Flon region, to provide companies exploring for gold with the history of deglaciation, a description of glacial land forms and features, the distribution and description of sediments, to assist in interpreting till geochemistry and heavy mineral surveys. Work was concentrated in the Sulphide Lake - Hebden Lake area.

Compilation of a series of 1:250 000 scale surficial geology maps of the plains region at was continued. The maps identify and delineate surface materials and landforms. These maps will be combined with maps for the north to produce a Quaternary map of Saskatchewan on a scale of 1:1 000 000.

Aggregate Resources Inventories
Aggregate resource information was compiled for 28 rural municipalities on "Aggregate Resource Potential Maps" at a scale of 1:50 000 . The maps summarize the location, extent, quantity, quality and character of sand and gravel resources as an aid to local and regional development.

Groundwater Studies
Geology and groundwater maps at 1:250 000 scale were developed for Melfort (73A), Prince Albert (73H), St. Walburg (73F), Wood Mountain (72G), Kindersley (72N), Prelate (72K) and Weyburn (72E,F). A project to develop computer-aided map production has been initiated using the Saskatoon area for the test. An assessment was undertaken of the groundwater potential of the Regina aquifer, an important source of water for the city of Regina. Detailed studies of the rate of flow and chemistry of groundwater in glacial tills were completed at two research sites near Saskatoon. A study has been initiated to investigate the occurrence and migration of pesticides in groundwater beneath both irrigated and non-irrigated land. Routine monthly monitoring and sampling of surface and groundwater was continued at a Saskatchewan potash mine to evaluate the migration of brine in the subsurface, in the vicinity of waste disposal facilities.

Resource Processing Activities
Projects undertaken during the year included: continuing efforts to beneficiate Saskatchewan kaolin; uranium mine water treatment; bench scale uranium and gold ore processing; uranium tailings chemistry and mineralogy; and product contamination in multi-use pipelines.

Rock mechanics
The fabrication of stress cells, extensometers and data acquisition systems continued at a significant level during the year, as a result of problems related to the flooding of two Saskatchewan potash mines. Triaxial testing of large potash cores (20 cm diameter x 40 cm long) is continuing.

Remote Sensing
A remote sensing facility has been established under the Saskatchewan Technology Enhancement Program. Eight demonstration projects related to agriculture, forestry and terrain sciences have been undertaken.

Petroleum Research
Research projects are focussed on heavy oil, to assist the Saskatchewan oil industry solve some of its most pressing problems. Enhanced oil recovery projects are underway in the areas of steam injection, in situ combustion and immiscible CO_2 flooding. Production problems being worked on include sand control, emulsion treatment and pipeline transport of oil-in-water emulsions.

MANITOBA ENERGY AND MINES

GEOLOGICAL SERVICES BRANCH

HIGHLIGHTS 1987

During 1987 an accelerated level of geological surveys and investigations was undertaken by the Provincial and Federal Geological Surveys in this fourth year of the (1984-89) Canada - Manitoba Mineral Development Agreement (MDA). This year's program reflected a slight shift in emphasis from field investigations to office compilation, data analysis, and report production.

The joint workplan for Sector "A", Geoscientific Activities, was approved in March by the MDA Management Committee and copies were distributed to members (6) of the newly expanded Mineral Exploration Liaison Committee (MELC).

A total of 46 Provincial and 22 Federal projects were mounted with operational budgets of $791 K and $1521 K, respectively. The combined expenditures were directed 23% toward Lynn Lake and 37% toward the Flin Flon — Snow Lake region. The remaining 40% of programming is evenly divided between Southeast Manitoba, the Churchill-Superior Boundary Zone, the Gods and Island Lake regions, and Winnipeg-based compilations.

Ten Applied Geoscience Research Agreements were sponsored under the MDA with the Department of Geological Sciences, University of Manitoba (5 through the GSC and 5 through Manitoba Energy and Mines).

In 1987, although most projects represent a continuation of work initiated in earlier years, several new projects were introduced as outgrowths of recommendations from industry. Where possible, other projects were modified to respond to specific requests from exploration personnel.

An outline of the intended programming was presented in each of the mining districts prior to the field season, and at the April meeting of the Winnipeg CIM. Pamphlets listing MDA projects scheduled for 1987 were distributed throughout the Province in late May.

A Sector "A" Progress Report for 1986/87 was tabled in manuscript form at the April CIM meeting and final printed copies distributed June 29.

Survey personnel gave field tours and demonstrations for industry, university and government geologists working in the Kisseynew region at Herb Lake, in the Churchill-Superior Boundary Zone, for building stone interests in Southeast Manitoba, and in support of ongoing research by personnel of the National Aeronautics and Space Administration (NASA) into the anorthosites and granitic plutons of the Bissett-Bird River region.

In the Phanerozoic sector of the Province, field tours provided detailed examination of the Paleozoic sequence as one of Manitoba's contributions to the 5th International Williston Basin Symposium, and the Canadian Society Petroleum Geologists (CSPG) hosted the 2nd International Symposium on the Devonian System.

As part of the Canadian-hosted XIIth International Union for Quaternary Research (INQUA) congress, Branch personnel (in concert with the GSC and Saskatchewan) led a 13-day field demonstration of Quaternary chronology and glacial deposits stretching from Churchill, Manitoba to Waterton Park, Alberta.

Advice and guidance in the field were also provided in support of a feasibility study investigating the probable impact of iceberg scouring on seafloor pipelines.

Seven papers were given by Branch geologists at Geological Association of Canada sponsored Symposia on "Gold in Central Canada" and the "Trans-Hudson Orogen", convened in May at Saskatoon. Other information releases, open files, etc. continued throughout the summer.

In addition to their mandated activities, Branch personnel provided advisory and editorial services to other Sectors of the Agreement including production of a Geological Highway Map of Manitoba, a Schools' Movie series, various educational pamphlets, presentations and tours for foreign investment interests, and the production of a brochure on Manitoba's Industrial Minerals.

An Interim Evaluation of the MDA by Price Waterhouse Chartered Accountants was completed in July 1987. Comments from industry provided valuable insight into the usefulness of MDA activities, as well as suggestions for new initiatives and improved services and liaison. The evaluation concluded that "during the first three years of its implementation (the Canada — Manitoba MDA) is generally well founded, efficiently managed and producing tangible results".

In a broader context, at the Mines Ministers' Conference in St. Johns (Newfoundland), the MDA mechanism for delivering government sponsored, industry supportive, minerals programming received favourable comment from: industry — the Prospectors and Developers Association (PDA) and the Mining Association of Canada (MAC): the geological community — the Canadian Geoscience Council (CGC) and the Committee of Provincial Geologists (CPG); and senior officials from both levels of government.

Accordingly, Manitoba's MELC representatives were requested, in late September 1987, to canvas exploration interests in their respective regions for project proposals that could be considered for implementation during a successor agreement (1989-94), as well as suggestions for changes to the focus, level and emphasis of Survey programming in the longer term.

This year's "Report of Field Activities" contains written contributions from the Geological Survey of Canada, in the form of abstracts describing the results of their current MDA work in Manitoba. These valuable contributions, together with a GSC-generated preliminary geological map of the Elbow Lake area, complete the roster of progress reports covering government geoscientific activities conducted during the summer of 1987 under Sector "A".

In keeping with the expanded format of this year's publication, an introductory review of GSC projects is presented by Alan Galley (Federal Cochairman for Sector "A") at the beginning of the section entitled "Canada — Manitoba Mineral Development Agreement, Geological Survey of Canada Projects".

PROVINCIAL PROJECTS

Lynn Lake

Strong emphasis has been given to supporting industry's gold-oriented exploration programs in the Lynn Lake region. This year one of the Branch's activities focussed on the south flank of the Lynn Lake metavolcanic belt in the Gemmell Lake and Wasekwan Lake area. Deformed metavolcanics

at Gemmell Lake, containing quartz veins, sulphide mineralization and chloritic alteration veinlets, are thought to represent a westward extension of the Johnson Shear Zone which, elsewhere, has demonstrated a consistent track record for hosting small but significant gold occurrences.

Re-inspection of the Sickle conglomerates and associated arenites suggests a possibility for placer gold deposition derived from gold-bearing quartz veins in granodiorite lying beneath the Sickle unconformity.

Continued exploration interest along the length of the Agassiz Metallotect inspired the successful search in 1986 for western extensions of the metalliferous zone in the Sheila Lake and Margaret Lake area west of the town of Lynn Lake. In 1987 a detailed examination of the 700 m thick stratigraphic section west of Berge Lake demonstrated significant differences to the Agassiz Metallotect including a lack of high-magnesium basalts, and the absence of abundant sulphide mineralization, carbonatization and silicification. In a similar vein, searches at Frances Lake and Suttie Lake failed to encounter sections analogous to those of the metallotect.

A study of the MacLellan Mine revealed the presence of an early shear zone and associated zoned alteration pattern, paralleling the iron formations and high magnesium basalt that are the most obvious features of the Agassiz metallotect. The identification of this "paleo-shear zone" and its spawn, the "North Shear", echoes a recurring theme in which silicified shear zones and their associated splays appear to be spacially coincident with (and possible conduits for) gold mineralization in the Churchill Province, e.g. McLeod Road thrust (Nor-Acme), Johnson Shear Zone, Rusty Lake fault (Vol), Tartan Lake and numerous others reported in the Athapapuskow and Flin Flon regions (see Report GS-7).

The recent discovery of gold at Farley Lake in sulphidized magnetite-rich banded iron formation has elevated interest in the metallogenic significance of the associated Agassiz Metallotect. Geological mapping at 1:50 000 and geochemical sampling initiated in the Eagle Lake-Farley Lake area (in direct response to requests from exploration companies active in the area) demonstrated a good correlation between specific rock units and airborne INPUT anomalies as well as a consistent stratigraphy over much of the area.

Near Ruttan, drill core from the Darrol Lake deposit was sampled to determine the level of gold and associated pathfinder elements. Outcrops in the vicinity of the Vol gold deposit were mapped and sampled, and it was noted that the associated sulphide zones may represent splays from the major east-trending fault that transects the Rusty Lake metavolcanic belt.

Till examinations in the region of the Vol fault were extended east, as well as to the south in the Darrol Lake area.

Vegetation geochemical surveys continued in the Lynn Lake area and in Southeast Manitoba.

Scheelite identified at Nickel Lake within the Agassiz Metallotect, may have applications as a pathfinder mineral.

Several MDA-sponsored M.Sc. theses and a Ph.D. thesis were completed on studies initiated in earlier years on the LAR deposit, the Fox Mine, Cartwright Lake, and the felsic volcanic rocks of the Ruttan area.

Flin Flon-Snow Lake

Documentation of the structure and stratigraphy of the Amisk Group north of Flin Flon extended the block-bounding faults, mafic intrusions and volcanic sequences (demonstrated in the White Lake region) north and west towards Saskatchewan. Structural and compositional features were used to categorize the three mafic intrusive complexes in the region and to discriminate between complete and incomplete/tectonized stratigraphic sequences. Several new occurrences of mineralization were encountered, the most prominent lying within or close to the margins of the supracrustal enclaves within the Tartan Lake Gabbro Complex.

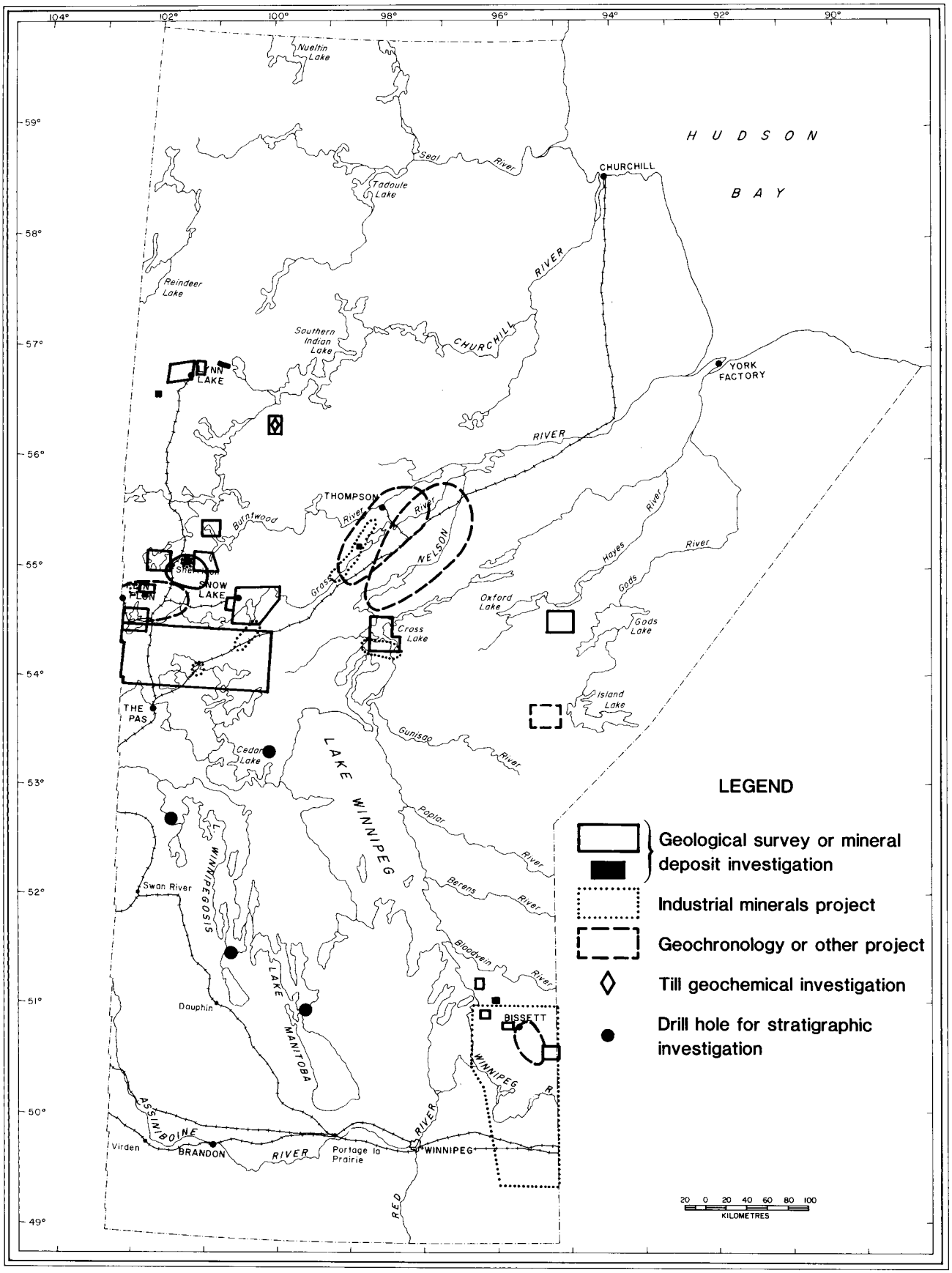


Figure 1. Manitoba field projects

In the Athapapuskow region 1:20 000 mapping encountered superbly exposed 0.3-1.9 km thick sections of proximal Missi conglomerates as well as basaltic sequences with a rare earth signature more akin to volcanics from "spreading centres" rather than the "island arc" affinity typical of the Flin Flon metavolcanics to the north. Three new rhyolite flow complexes were identified and all block-bounding faults traced through from the Flin Flon-White Lake area.

Repeated attempts over the last few years to isolate dateable zircons from the Flin Flon volcanic belt were finally successful and firm ages obtained for an Amisk rhyolitic crystal tuff from the Bear Lake Block (1886 Ma), as well as an unfoliated granodiorite from the Lynx Lake pluton (1847 Ma). The volcanic age is intermediate between that of the Wasekwan (1910 Ma) and the Ruttan volcanics (1878 Ma) but compares favourably with zircon ages of volcanic rocks in the La Ronge and Glennie domains, as well as the Hanson Lake Block.

Detailed mapping was extended north of the Baker Patton deposit to encompass the widespread fragmental rhyolitic, rhyodacitic, and associated dyke rocks between Flintoba Lake and Leo Lake. A wide variety of primary textures and structures including lithophysae and possible accretionary lapilli and spherulites are invariably overprinted east of Flintoba Lake by a penetrative axial planar foliation. Sporadic chloritization was noted throughout the northern half of the area whereas pyritization tended to be centrally localized.

Detailed 1:15 840 mapping continued in the Chisel Lake area with the prime objectives being to provide an improved understanding of the complex stratigraphic and structural relationships in this economically significant portion of the Flin Flon metavolcanic belt. This year's work succeeded in establishing the stratigraphic setting of the Chisel, Lost and Ghost Lake mineralized zones, confirmed the restriction of hydrothermally altered rocks to the stratigraphic footwall, identified a key marker horizon that can be used to guide future base metal exploration, and illustrated the fundamental role that interference fold structures can have in localizing the distribution of base metal mineralization.

Mineral occurrence documentation in the Snow Lake area continued together with 1:2500 and 1:5000 mapping around selected mineral occurrences. The mapping represents an outgrowth of site-specific work conducted since 1984. Detailed petrographic studies, geochemical sampling and mapping were initiated in the Squall Lake area on a variably textured biotite diorite, and on the Cook Lake alteration zone in conjunction with work being undertaken by the GSC. Much of the work requires extensive outcrop stripping in order to make definitive observations on the rock types and associated mineralization.

Examination of lithological sequences around the Pulver and Herblet gneiss domes revealed several possible similarities, with the attendant inference that Cu-Zn deposits (WIM deposit) and disseminated sulphide/gold mineralization (such as the BEE zone) may be subject to stratigraphic control and have analogues elsewhere in the region.

Further work on the south side of the Kisseynew gneiss belt attempted to pin down the key factors controlling the localization of base and precious metal mineralization in the paragneisses and associated migmatites.

The complex relationships of the Burntwood and 'Sherridon' gneisses on Kississing Lake were partially resolved into four fundamental 'type' lithological sequences with structural overprinting ranging from early recumbent folding, through synkinematic intrusion of major plutons and shear zone formation, to late stage conjugate faulting with varying degrees of associated retrograde metamorphism.

Gradiometer and total field surveys conducted in 1986 by the GSC were used extensively and with varying success to aid 1:20 000 and 1:50 000 geological mapping of the Kisseynew metamorphic complex in the Batty Lake, Limestone Point Lake and Star Lake area. Large areas previously designated as Sherridon and Nokomis paragneiss were reinterpreted as orthogneiss derived by dynamothermal metamorphism of intrusive rocks. Distinctive porphyroblastic gneisses at the

margins of the orthogneiss are thought to represent tectonized alteration zones comprising locally mineralized schuppen complexes of supracrustal rocks.

On Limestone Point Lake an outlier of locally fossiliferous, isoclinally folded Paleozoic dolomite with a pronounced fracture cleavage testifies to a post-Paleozoic deformational event for which there is little evidence elsewhere in the Province. Projections of the Paleozoic/ Precambrian surface from south of Reed Lake suggest the outlier is depressed by 500 feet below its original position; however, the nature and orientation of the bounding structures remain unknown.

Mineral occurrence documentation was continued on the southern flank of the Kisseynew gneiss belt at Batty Lake and Wood Lake, and surface mapping continued at the Puffy Lake Gold Mine.

At the west end of Burntwood Lake one of the few known aegirine-augite syenites in the southeastern Churchill Province was mapped and sampled in detail to obtain further information of this body's geochemistry and potential to contain rare elements. Although highly folded and deformed the intrusion exhibits unique igneous layering and cumulus textures confirming a well fractionated and differentiated magmatic history.

Gradiometer releases scheduled for October 1987 will provide 1:20 000 contoured total field and vertical gradient maps for the Namew Lake region in Saskatchewan and Manitoba as well as Hargrave Lake and northern Moose Lake areas. GSC Open Files released in May 1987 provided similar coverage for the Nokomis-Sherridon area north of the Flin Flon greenstone belt. The Province completed eight scout drill holes to test magnetic signatures in the heart of the Project Cormorant area, complementing eight holes drilled in the spring by the GSC in areas of remote access. In cooperation with the Federal Survey 55 representative company drill holes were relogged as part of the ongoing compilation of subsurface data for the area, which also includes a three-dimensional analysis of the geophysical data by the GSC.

Examination of the Cliff Lake tonalite as a source for building stone, resulted in a negative evaluation; however, work is continuing on reddish to purple dolomite from the Wekusko Lake area as well as buff to tan dolomite near the village of Cormorant. Sampling of the Naosap Lake quartz porphyry indicated that a distinctively coloured, good ornamental stone could be quarried but closely spaced fracturing would limit the size of extractable blocks. Work at Star Lake continued and was extended to the possibly equivalent garnet-anthophyllite occurrence northeast of Molly Lake.

Southeast Manitoba

A complex association of silicified pillow basalts, felsic pyroclastics, volcanic conglomerates, sandstones and argillites were encountered during detailed mapping of well burnt-over exposures in the Lily Lake area. Considerable lateral facies changes were documented from coarse proximal felsic pyroclastics to more distal sandstones. Gold-bearing veins appear to predate the development of major shear zones and their associated barren white quartz veins.

Detailed deposit examination and channel sampling continued also at Lily Lake, where previous work had identified visible gold in an array of quartz veins hosted in meta-arkose and sandstone. The systematic documentation of mineral occurrences in southeastern Rice Lake region is now complete.

In the Bissett district vegetation geochemical surveys indicate that dwarf birch twigs are a more effective concentrator for a wider range of elements than alder twigs and, consequently, dwarf birch is a preferred medium for biogeochemical surveys.

At English Lake, gabbros, gabbroic breccias and megabreccias were found to display some similarities to the Roby Zone in the Lac des Isles PGE occurrence; however, gabbros at Shallow Lake are small in size and PGE potential is deemed to be minimal.

Placer gold occurrences in littoral Quaternary sand and gravel deposits in the Manigotagan region were investigated further. At this time the origin of the placer gold grains remains uncertain.

In its final year the evaluation of dimension stone potential in southeast Manitoba concluded that the highest potential for building stone production lies within the Betula Lake Pluton. Possible conflicts with Parks' interests are currently the subject of debate between the respective Departments. Sources of "Black Granite" might be obtained from the McMunn diorite and gabbro, and the diorite of the Falcon Lake Igneous Complex; however, drilling and test quarrying would be required to confirm this potential.

U-Pb zircon ages from the Bissett region, generated as part of a co-operative program with the universities of Windsor and Kansas, confirmed the presence of older (2880 Ma) granitoid phases in the Wanipigow complex north of the Rice Lake greenstone belt, a 2730 Ma age for the main felsic volcanism and contemporaneous intrusive rocks, and a younger (2663 Ma) age thought to represent the main anatexis and Kenoran metamorphism in the English River gneissic belt. Synoptic geological compilations at 1:250 000 for NTS areas 52E and 52L have been released in preliminary form at the annual Meeting with Industry in November 1987.

Thompson

In the Thompson region detailed mapping of Pipe Pit lithologies, using low altitude high resolution aerial photographs, confirmed a Molson affinity for the diabase dykes and identified an early Hudsonian metamorphic and deformational event in the metasedimentary host rocks that predates dyke intrusion at 1884 Ma.

Mapping at 1:20 000 was completed in the central portion of Cross Lake, and the Pipestone Lake intrusive complex was extended to the west. Anorthosites near Jenpeg were also mapped and sampled. Northwest of the town of Cross Lake a single sample, from alteration haloes around quartz pods, assayed close to 6 g/t Au.

Monazite, sphene and zircons were sampled to provide additional geochronological data for the Thompson region. Preliminary results range from around 3000 Ma for zircons in gneisses from Manasan and Sasagiu Rapids, to the youngest Hudsonian event variously dated around 1770 Ma by monazite, sphene, and by zircons in late pegmatite.

The industrial minerals program returned a favourable first appraisal of the Ospwagan granite as having building stone potential. Thick overburden at Pipe Pit appears to constrain the potential of marble in this region. Migmatites at Sasagiu Rapids do not polish well, and the Moak Lake serpentinite does not appear to be a viable source for carving quality serpentine.

Near Jenpeg a Molson dyke shows good potential as a source for "Black Granite"; however, no readily accessible outcrops of good quality anorthosite appear available at this time.

Gods-Island Lakes

Only two Provincial field projects continued in this region during 1987, although a 1:250 000 synoptic compilation for NTS 53L is nearing completion, and compilation and report production for adjacent sheets continues in Winnipeg.

Uranium-lead zircon ages from the greenstones at Bigstone and Knight Lakes are comparable to those at Island Lake indicating a minimum age of 2890 Ma for the mafic volcanics in these regions.

Samples were collected from the Magill Lake granite and associated pegmatites at Magill and Knee Lakes, and near Hawkins and McLaughlin Lakes. With the exception of a single columbite-tantalite dyke crosscutting the Oxford Lake Group, rare-element minerals are typically absent within the pegmatite pods and dykes on Magill Lake. Spodumene was confirmed at McLaughlin Lake.

A MDA-sponsored thesis on the rare-element pegmatites from Red Sucker Lake was completed during the summer.

Southern Manitoba

A broad range of stratigraphic studies was conducted in Paleozoic rocks throughout the south part of the Province. Outputs include a comprehensive guidebook of the Devonian outcrop belt, five drill

holes in Winnipegosis reef settings, a preliminary study of caves in the Interlake area along with Parks personnel, and logging of the Paleozoic sections of core obtained from the Project Cormorant area.

This year's drilling (including holes drilled for industrial minerals purposes), encompassed 15 holes for a total of 1316 m. Cumulative drilling since the inception of the stratigraphic drilling project in 1969 now amounts to over 1300 m. Computerization of this data base has been initiated.

APPLIED GEOSCIENCE RESEARCH

Applied Geoscience Research agreements with the Department of Geological Sciences, University of Manitoba once again provided the means for focussing the unique expertise of university staff into projects complementing the work of the Provincial and Federal Geological Surveys.

Geochemical characterization of the felsic plutons in the Flin Flon region and the mafic/ultramafic sequences in the Thompson region expanded the sample collection program and provided new insights into the genesis of these formations. The initial results from the Thompson region are especially revealing in that volcanics from Ospwagan Lake appear to have an "ocean floor" chemistry not unlike that emerging from metavolcanic rocks of the Athapapuskow region.

In the Superior Province the final phase of field investigations focussed on the rare element bearing intrusives in the Magill Lake area.

Ongoing rubidium/strontium studies will analyze three samples from Cross Lake and four from the Thompson-Split Lake region this year.

EXPLORATION SERVICES (MINES BRANCH)

The Exploration Services Section continues to support Sector "A" MDA initiatives in the areas of drill core retrieval liaison with industry, and by generating compilations of various types. The Department's publications distribution function has been transferred to the Information Office, Room 555 on the fifth floor of Eaton Place.

The principal objective set for the core retrieval program during 1987 was to establish a computer-based master inventory of the northern Manitoba drill library holdings. By September approximately 70% of the inventories from The Pas, Thompson and Lynn Lake had been entered onto computer files.

Other projects conducted during the year included updating of inventories, field collection, reboxing and culling of core, and improvements to building site drainage.

One of the major new thrusts of the Section was the re-establishment in September of the Regional Geologist in The Pas, a position that fell dormant in 1977. David Prouse is welcomed to the position which will provide an elevated level of liaison and services to the mineral industry in northern Manitoba.

Exploration Services also continued to monitor and report on company activities in the Province as well as distributing large numbers of brochures and publications. Significant additions were made to the content and retrievability of the Bibliography of Manitoba Geology, as well as completing the updating of the mineral inventory for gold deposits/occurrences.

An Economic Geology Report "Gold Deposits in Manitoba" (produced jointly with the Geological Services Branch) was released in November 1987.

Assessment files were completely re-organized and new index maps completed for airborne geophysical surveys. Displays and brochures were prepared for several major public events, including the annual Prospectors & Developers Convention, the Careers Symposium, and articles for various journals.

GEOLOGICAL SURVEY OF CANADA

The Geological Survey of Canada contributed a broad array of geoscientific projects in keeping with the parallel program delivery concept of the MDA.

For the Lynn Lake region these encompassed an airborne electromagnetic INPUT survey of the MacMillan Lake area, basal till sampling in the Rusty Lake area and down-ice from Darrol Lake, and metamorphic and lead isotope studies undertaken to determine the history of crustal evolution in this sector of the Churchill Province.

In the Flin Flon region GSC personnel continued to investigate massive sulphide associated alteration zones at Wolverton Lake and Cook Lake and the Linda deposits, as well as cordierite-garnet-anthophyllite units in the Sherridon area. Scout drilling of remotely situated sub-Paleozoic basement anomalies was conducted prior to breakup in the Spring.

Gold deposit field studies continued in the Snow Lake area, as did kinematic studies of faults related to gold mineralization near Herb Lake. Open Files on Snow Lake and Elbow Lake were scheduled for late Fall 1987.

Samples from mafic/ultramafic complexes were analyzed to evaluate PGE abundances, specifically for the Reed Lake, Jackfish Lake and Chisel Lake intrusions.

Follow-up till sampling in the Kississing Lake map sheet (NTS 63N) was augmented by airphoto interpretation of the surficial geology in NTS areas 63O and 63N.

In The Pas region field parties ground-truthed airphoto interpretation of surficial geology for NTS areas 63C, F and K.

In southeastern Manitoba 1:50 000 geological mapping of the San Antonio Mine sequence and 1:10 000 mapping of the area south and east of Rice Lake were undertaken, as well as structural mapping along the Wanipigow fault and selected gold occurrences elsewhere in the Rice Lake-Beresford Lake region.

The petrochemistry of the Falcon Lake Stock was investigated and detailed mapping and sampling of chromitite seams in the Bird River Sill continued in conjunction with other MDA sectoral activities.

In the Thompson region uranium/lead dating of samples from Pipe Pit, Thompson Pit and Cross Lake continued as did a structural study covering a transect from the Superior Province across the Pikwitonei and Thompson belt into the Churchill Province. All exposures in the area surrounding the Thompson Ore Structure, and other nickel sulphide deposits in the belt will be examined and underground mapping undertaken where necessary to complete the definition of the structural controls constraining the nickeliferous sulphides. 1:20 000 mapping in and around the Thompson Pit was completed.

ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES

MINES AND MINERALS BRANCH

ONTARIO GEOLOGICAL SURVEY

During 1987, the Ontario Geological Survey (OGS) conducted diversified geoscience studies in locations across the province. Additional projects were undertaken in cooperation with Resident Geologists, universities and consulting firms. In all, the Ministry conducted 62 field projects and supported 23 applied research programs at Ontario universities, the latter through the Geoscience Research Grant Program.

Short-term funding for a number of regional stimulation projects was provided by the Ministry's Northern Development Fund and by the Canada-Ontario Mineral Development Agreement (COMDA).

PRECAMBRIAN GEOLOGY SECTION

As a consequence of progress in geological mapping and mineral deposit analysis, and the need for the integration of specialized research on the Shield area, the former Mineral Deposits Section was merged with the Precambrian Geology Section in January, 1987. This reorganization limits overlap and provides greater flexibility in the formation of cross-disciplinary project teams, merging mapping and applied research in a more concerted study of Precambrian geology and minerals potential in Ontario.

Several major new programs were undertaken in 1987. OGS will produce a centennial volume on the Geology of Ontario, to be accompanied by a 1:1 000 000 scale geological map of the Province, in 1991. This will provide an up-to-date synthesis of the geology of the Province and the evolution of the Precambrian crust, and at the same time provide an invaluable aid to planning of future programs.

The production of a new series of 1:250 000 scale compilation maps was started. These maps, incorporating greatly enhanced geological and mineral occurrence information, will replace the present compilation series which is widely used by the mineral exploration industry.

Working groups, representing diverse geological expertise, operated field-based programs in the Lake of the Woods, Dinorwic, Beardmore-Geraldton and Wawa areas. Geological mapping at both detailed and synoptic scales, combined with mineral deposits studies, is rapidly adding to the understanding of the stratigraphy, structure, and mineral potential of these locales. A still more intensive program, including applied geochronology studies, was begun in the Abitibi Subprovince, one of the world's great greenstone belts. This will be supplemented by a deep crustal seismic reflection transect of the belt, to be conducted by the University of Toronto through a cooperative research agreement with the Mines and Minerals Division.

Projects continuing in 1987 included: a detailed study of the stratigraphy and tectonic history of the Hemlo gold camp, investigation of Proterozoic mafic intrusive rocks and their potential to host Platinum Group Element (PGE) mineralization, an expanded program to document the geology of PGE occurrences throughout Ontario, investigations of Proterozoic sedimentary rocks in the Southern Province, detailed mapping in several greenstone terrains, and studies of industrial minerals. New projects included mapping of the Horseshoe Lake greenstone belt in the northern Uchi Subprovince, detailed mapping in the Grenville Province and in the Wawa greenstone belt, and investigations of applications of remote sensing techniques to interpretation of the geology of the Shield.

The study of Archean gold deposits, which had been the focus of the former Mineral Deposits Section since 1982, has continued in 1987 in a different form. Early work developed a genetic model for these deposits; this model is now being refined by testing it within all current mapping projects.

ENGINEERING AND TERRAIN GEOLOGY SECTION

Staff of the Quaternary Geology Subsection are involved in a wide variety of projects across the Province. Four COMDA projects, Parry Sound, Shining Tree, Geraldton-Beardmore and Fort Francis-Rainy River, continued with mapping and drift sampling. Field studies toward the goal of establishing drift exploration strategies, were completed in the Hemlo and Opapimiskan areas. Drilling formed the mainstay of work in the Black River-Matheson (BRIM) region. This project was designed to determine the glacial stratigraphy as a means of assisting overburden exploration and to produce a geochemical data base. In southern Ontario, investigations were undertaken in the urban areas of Brampton and Toronto. These studies are augmenting the known geological framework and expanding the urban geotechnical data base. Mapping to determine glacial history, stratigraphy and sediment distribution, commenced in the Barrie area.

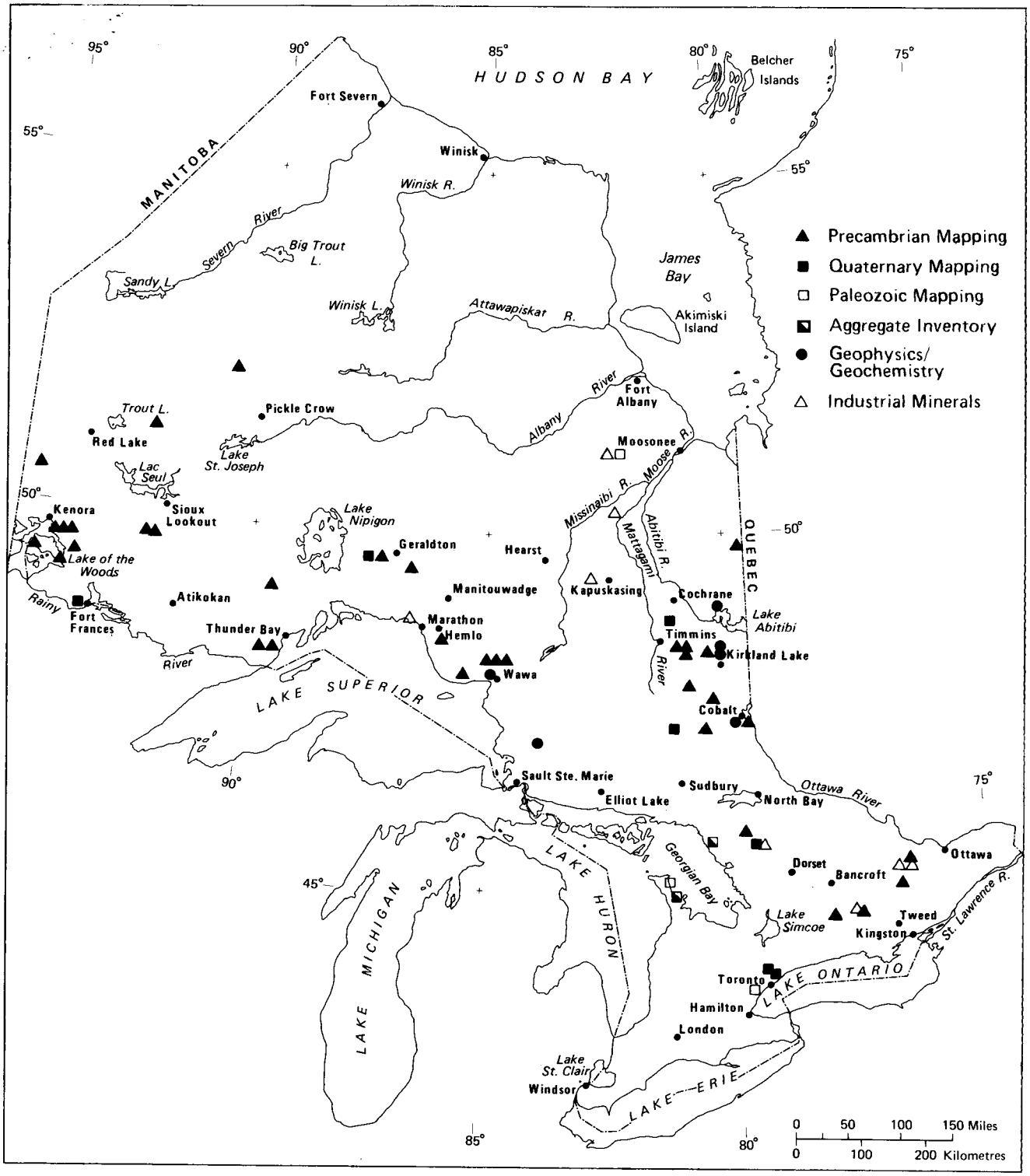


Figure 1. Distribution and types of programs in Ontario

Quaternary staff are active in the organization of scientific meetings and associations. Several field trips, guidebooks and presentations were prepared for the 12th International Congress of the International Union for Quaternary Research, held in Ottawa during August 1987. Staff also prepared a new map of the Surficial Geology of Northern Ontario at a scale of 1:200 000. This map summarizes the distribution and character of glacial and postglacial materials north of the French River.

The Paleozoic/Mesozoic Geology Subsection staff were involved in the preparation of geologic descriptions and sections for more than 150 active and abandoned quarries, as part of a review of the entire limestone/dolostone industry of Ontario. This project, funded and managed by the Ministry of Natural Resources, is being prepared by consultants, with geologic input from the Paleozoic/Mesozoic Subsection. On the Bruce Peninsula, field work was completed for a detailed study of the stratigraphic relationships and a resource assessment of the Erasoma Member of the Amabel Formation (Silurian). The dolostone of the Eramosa Member is a major source of building stone in Ontario.

The staff of the Aggregate Assessment Office continued with their assessment of the aggregate resources of 'designated' townships in southern Ontario and undertook, on request from the Ministry of Natural Resources, an assessment of the resources in the Echo Bay-Bruce Mines area to the east of Sault Ste Marie. An assessment of aggregate in Haliburton County in southern Ontario was initiated under COMDA.

GEOPHYSICS/GEOCHEMISTRY SECTION

During the 1987 field season, the Night Hawk geophysical test range near Timmins, Ontario was utilized for testing, research and instruction purposes by personnel from industry, universities and government. Section staff, together with personnel from Geoprobe Limited of Toronto, carried out field work using the new, scaled down Maxiprobe EM system. The test range was used to demonstrate Canadian geophysical equipment to delegates from 26 countries as part of the Exploration '87 field school held in September.

A project to research the potential for detecting and tracing conductive strata in Precambrian rocks under thick Huronian strata continued. Field testing was directed toward analysis of the EM noise conditions in the vicinity of the town of Cobalt; other activities included surveying in Coleman and Firstbrook Townships with ground transient EM equipment. Further computer modelling was undertaken for the purpose of improving existing interpretation techniques.

A gravity survey of the Iroquois Falls-Lake Abitibi area was undertaken to aid in the regional geological interpretation of a stratigraphically complex succession of komatiitic, tholeiitic and calc-alkalic volcanic rocks. Approximately 2000 gravity stations were established by an eight-man field party during the summer months. This work will aid in determining the geometry of technological units as well as the depth of infolding and large structural features of this portion of the Abitibi Belt.

Three airborne electromagnetic-magnetic surveys, covering areas of high mineral potential, were completed during late 1986 and 1987. Approximately 71 000 line kilometres of data were acquired in areas centred on the northern municipalities of Dryden, Timmins and Wawa. The survey in the Dryden area was funded COMDA. The surveys in the Timmins and Wawa areas were completed under a new five-year Airborne Survey Program, established by the Ministry of Northern Development and Mines and financed from the Northern Development Fund.

The fourth year of a reconnaissance till sampling project, carried out in cooperation with the Engineering and Terrain Geology Section as part of the BRIM program, will continue into 1988. This project is of particular value because of the paucity of outcrop in the area. Thus far, the presence of two glacial packages under the Matheson till are indicated from the detailed stratigraphic record preserved in unconsolidated cores recovered by drilling. Clastic sections of the core are subjected to heavy mineral separation so that independent gold grains may be counted and examined for their size and shape to help in determining their provenance. Quaternary stratigraphy and till geochemistry data are being compiled in data base format.

A regional lake-sediment geochemical survey in the Goudreau Lake area, situated 40 km northwest of Wawa, was completed during the summer season. The area is being actively prospected for gold and this survey will supply much needed orientation data which will be combined with other geoscience data bases developed simultaneously. Sampling was carried out using a unique coring technique that minimizes the inclusion of lake sediments which may have been modified during technological time. A total of 358 sample sites were established, increasing the sample density tenfold with respect to a previous reconnaissance data base established by the Canada-Ontario Uranium Reconnaissance Program in 1979.

A similiar geochemical survey was completed in the Wart Lake area north of Sault Ste. Marie. This survey, the first phase of a three-year project carried out under COMDA, will provide a summary of the geochemical behaviour of elements of importance to mineral exploration in the vicinity.

GEOSCIENCE LABORATORIES

The Geoscience Laboratories, together with the National Research Council of Canada — Division of Chemistry, was a co-organizer of the Second International Symposium on Applications of Inductively Coupled Plasma Mass Spectroscopy (ICP-MS). This two day meeting attracted 101 delegates from 14 countries and involved 23 presentations, 8 of them relating to geoanalysis. Proceedings are to be published in the Journal of Analytical Atomic Spectrometry in early 1988.

Dr. Tony Vander Voet, Supervisor Spectroscopy Section, accepted a seven-month assignment with the Canadian International Development Agency to advise the Department of Mineral Resources, Bangkok, Thailand. Using course materials developed at the OGS, he presented a course on 'Analytical Methods' to laboratory staff and provided expert assistance in instrumental methods and quality control.

GEOSERVICES SECTION

The Geoscience Data Centre has continued to compile and computerize mineral deposit data and rock chemical data.

New Mines and Minerals Division publications and exploration assessment work reports were indexed and added to both the in-house database (ONTINDX) and the national GEOSCAN bibliographic file. This file currently totals 20 045 Ontario Geological Survey entries. The "Supplement to the Index to Published Reports and Maps, Mines and Minerals Division", covering the period from 1978 to 1986, was published. Indexes to mineral deposit data and to rock chemical data were also published, on COMFICHE, as Open File Reports 5470 and 5570. The 'Database In A Box' project provides the public with downloaded versions of the mineral deposits data base, MDIR, and rock analytical database, PETROCH, on diskette for installation on PC microcomputers.

The Geoscience Data Centre also continued to develop a computerized geoscience information system (GEOSIS) for geoscience data covering Ontario. It is based on the philosophy of bringing together bibliographic and textual databases, and graphical background information (usually geoscience maps, sketches, etc.).

The GEOSIS system was successfully demonstrated, and presented at several meetings, for instance, the United Nations sponsored symposium in Sudbury. The Turkish Geological Survey received assistance from Geoscience Data Centre staff in the planning and implementation of a GEOSIS-like system in their country. The GEOSIS newsletter continues to inform the interested public on GEOSIS progress.

The Scientific Review Office has implemented an automated electronic publishing system and is planning to add fully automated, interactive editing capabilities for text, graphics, photographs and maps, so as to better meet the need for rapid release of geoscientific information about Ontario. As part of this plan, the production of several, computer generated, coloured geological maps has proved highly successful. The initiation of an 'on-demand' publishing system has also been successful, with the timely release of several significant reports.

The Mines Library provides an information and reference service to ministry personnel and the mining industry, on the geology and mineral resources of Ontario. During 1987, an IBM PC-AT was acquired, enabling automation of library records and provision of wider subject access. Progress was made towards a one-window' information source when the Mines Library and the Assessment Files Research Office were amalgamated.

GEOSCIENCE RESEARCH GRANTS

In 1987, the Ontario Geoscience Research Program (OGRP) awarded 23 grants totalling $500 000 to 11 Ontario universities. The grants finance mission-oriented research in Ontario, which is closely integrated with, but does not duplicate, the activities of the Ontario Geological Survey. Reports by OGRP recipients for the previous year were presented at the annual OGS Geoscience Research Seminar on December 4 and 5, 1986.

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES
GOUVERNEMENT DU QUÉBEC

SECTEUR «MINES»

Pour l'année financière 1987-88 l'objectif de base du ministre, en ce qui concerne le secteur Mines, est de promouvoir le développement de l'industrie minérale du Québec par un ensemble de mesures visant à appuyer l'initiative et le leadership du secteur privé, tout en s'assurant que l'exploitation des ressources minérales se fait selon les meilleurs intérêts des Québécois. Plus particulièrement, il s'agit de:

1. stimuler les investissements privés pour le développement de nouveaux gisements, l'expansion des capacités de production existantes et la modernisation des usines de première transformation;

2. localiser la recherche et le développement sur des projets spécifiques répondant aux besoins de l'industrie et pouvant aider à consolider notre position concurrentielle et susciter le développement industriel à court et moyen termes;

3. contribuer au renouvellement des réserves domestiques pour les minerais de cuivre et de zinc et favoriser la diversification de la production minérale dans les régions du Québec par la stimulation de l'exploration minière;

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

Chacune des trois directions générales du secteur «Mines» répond plus spécifiquement à l'un ou l'autre des grands objectifs cités.

LA DIRECTION GÉNÉRALE DE L'INDUSTRIE MINÉRALE (DGIM)

La DGIM a pour mandat de favoriser le développement, l'exploitation et la transformation des ressources minérales du Québec par l'entreprise privée. Elle administre des programmes d'assistance financière et les législations minières. De plus, cette direction générale analyse les facteurs économiques et réglementaires qui ont une incidence sur l'industrie minérale en vue d'en dégager les orientations et les programmes gouvernementaux susceptibles de contribuer à l'essor des entreprises minières oeuvrant au Québec.

Programmes d'assistance financière

Infrastructures de développement minéral:
Ce programme est inscrit dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement minéral. Son objectif est de favoriser l'implantation de nouvelles installations de production et de transformation de minéraux au Québec qui soient hautement productives et concurrentielles au plan mondial, grâce à une intervention gouvernementale qui assurera l'implantation des infrastructures nécessaires à leur avènement. En vertu de ce programme, la contribution des gouvernements au coût de construction des infrastructures (routes, lignes électriques, ponts, pipelines, sites résidentiels, aqueduc, égouts, etc.) pourra atteindre 20% du coût total du projet d'immobilisation.

Études technico-économiques:
L'objectif de ce programme est de favoriser l'élaboration de projets industriels miniers et d'inciter l'industrie minérale à analyser diverses avenues susceptibles d'améliorer sa productivité et sa compétitivité. En vertu de ce programme, une assistance financière de 50% du coût de réalisation d'études technico-économiques et de travaux d'expérimentation destinés à vérifier la praticabilité ou la viabilité économique d'un projet peut être accordée, avec un maximum de 250 000$ par projet. Cette assistance peut atteindre 75% des dépenses admissibles pour des études de marché et de commercialisation dans le secteur des minéraux industriels.

Fiscalité
Les entreprises qui oeuvrent dans l'industrie minière et les particuliers qui y investissent bénéficient, au Québec, de plusieurs avantages fiscaux susceptibles de favoriser le développement minier.

Droits payables par les exploitants:
Depuis le 23 avril 1985, les droits payables à même les profits annuels des entreprises sont fixés à 18%. De plus, l'exemption de base, qui était de 250 000$, a été remplacée par un crédit de droits de 90 000$. La partie de ce crédit qui n'est pas utilisée dans une année d'imposition peut être reportée sur les trois années ultérieures.

Par ailleurs, un régime de droits négatifs a été introduit dans la loi. Ainsi l'exploitant d'une mine au Québec et une société d'exploration minière peuvent se faire rembourser, à certaines conditions, 18% de la perte d'une année, jusqu'à concurrence de 18% des dépenses d'exploration, de mise en valeur et de la dépréciation des investissements en immobilisations effectués depuis le 24 avril 1985 au Québec. La partie d'une perte qui ne fait pas l'objet du crédit remboursable est assujettie à la nouvelle règle de report des pertes.

Cette dernière permet maintenant à un exploitant de reporter les pertes d'un exercice financier sur les trois années précédentes et sur les sept années suivantes.

Droits sur les mines:
Le 19 décembre 1985 l'Assemblée nationale a sanctionné la Loi 3 modifiant la Loi concernant les droits sur les mines. Les principales modifications apportées par cette loi sont les suivantes:

1. Certaines dépenses engagées depuis le 24 avril 1985 peuvent donner lieu à un remboursement au taux de 18%. Ces dépenses sont: les frais d'exploration et de mise en valeur, plus l'allocation pour dépréciation au taux de 30% des biens acquis depuis cette date. Les dépenses financées par actions accréditives ne sont pas admissibles. Le montant du remboursement ne doit pas excéder 18% de la perte de l'année, que l'exploitant ait ou non des revenus de l'exploitation d'une mine.

2. Le montant d'une perte qui n'a pas été admissible au remboursement peut être reporté sur les trois années antérieures et les sept années subséquentes.

3. Le profit minier est assujetti à un taux fixe de taxation de 18%.

4. L'exploitant peut soustraire un crédit annuel de 90 000 $ de ses droits à payer. Toute partie inutilisée de ce crédit est reportable sur les trois années ultérieures.

Impôt sur le revenu:
L'allocation de 66 2/3% pour frais d'exploration engagés au Québec par un particulier a été abrogée le 11 décembre 1986. Depuis cette date, les règles fiscales favorisant le financement de l'exploration sont sensiblement les mêmes au Québec et au fédéral: un contribuable peut déduire de ses revenus de toutes sources 100% de certains frais d'exploration, plus une allocation de 33 1/3% de ces frais, jusqu'à concurrence de 33 1/3% de son revenu (la limite est de 25% au fédéral).

Un particulier peut aussi déduire dans le calcul de son revenu imposable un montant variant de 50% à 100% du coût des actions admissibles au Régime d'épargne-actions du Québec. Le pourcentage varie selon la taille des actifs de la compagnie; il varie également suivant que les actions ont ou n'ont pas plein droit de vote.

Il convient aussi de signaler les nouvelles mesures fiscales concernant la recherche et le développement (R & D) qui ont été introduites dans le Discours du budget du 30 avril 1987. Pour les corporations, le crédit d'impôt sur les salaires versés à la R & D passe de 10% à 20%; le taux passe à 40% des dépenses courantes ou en capital si la R & D est faite dans une entité universitaire admissible. Les particuliers peuvent se prévaloir d'une déduction de 133 1/3% pour le financement de la R & D. La déduction est de 166 2/3% pour la recherche universitaire. Finalement, un chercheur étranger recruté par une entreprise peut bénéficier d'un congé fiscal de 24 mois.

Loi sur les mines
L'Assemblée nationale du Québec a adopté, le 23 juin 1987, la Loi sur les mines (projet 161, 1987, chapitre 64) dont la mise en vigueur devrait être annoncée au début de 1988. Le permis de prospection sera valide pour cinq ans; la période de validité du claim est portée à deux ans et il est renouvelable. La période de validité du bail minier est fixée à vingt ans et le délai pour commencer l'exploitation minière est de quatre ans.

Dans certains territoires du Sud du Québec, l'acquisition des claims se fera par désignation sur carte; au nord du 52° de latitude, le titulaire d'un permis d'exploration pourra enregistrer un claim sur tout le territoire (ou une partie du territoire) visé par son permis d'exploration.

Enfin, la loi assujettit certaines décisions du Ministre à la possibilité d'un appel à la Cour provinciale ainsi que d'un appel, sur permission, à la Cour d'appel.

LE CENTRE DE RECHERCHES MINÉRALES

Le Centre de recherches minérales (CRM) a, au cours de 1986-87, poursuivi avec vigueur ses activités, conformément aux orientations exprimées dans son plan triennal d'action 1985-1988. C'est sous l'inspiration de ce plan que le CRM a réussi à augmenter sa participation à la recherche de solutions pratiques aux problèmes rencontrés par l'industrie minérale. Les principaux secteurs d'activité du CRM sont le traitement des minerais en laboratoire et en usine-pilote, l'analyse et la recherche analytique, l'informatique instrumentale, la minéralogie appliquée et les divers domaines de la technologie appliquée à l'exploitation minière.

Tel que prévu, le CRM a été moins actif dans le domaine de l'analyse chimique de routine destinée à combler les besoins de sa clientèle externe. Il a toutefois consolidé sa position vis-à-vis les analyses plus complexes requérant une instrumentation sophistiquée et une expertise peu répandues dans les laboratoires privés.

Par ailleurs, nos données statistiques reliées à l'activité de recherche analytique proprement dite indiquent une nette progression par rapport à l'année précédente. Les projets commandités, réalisés directement pour le bénéfice des entreprises, ont augmenté de plus de 85% par rapport à l'an dernier. Cette augmentation apparaît clairement dans les trois secteurs d'activité de la direction

de l'Analyse minérale, qui sont la recherche analytique, l'informatique instrumentale et la minéralogie appliquée.

En Technologie minière, le CRM a réussi à progresser d'une façon marquée en regard des années antérieures. Les objectifs fixés pour l'année en cours ont aussi été atteints et même dépassés, spécialement en ce qui a trait au temps consacré à la réalisation de projets en commandite.

Le CRM, par le biais de son Service de technologie minière (STM), a porté une attention spéciale au transfert des technologies. Trois colloques importants ont été organisés par le STM, en collaboration avec diverses associations, pour diffuser et partager, avec les intervenants du secteur minéral (spécialement ceux de la région de l'Abitibi-Témiscamingue), les connaissances acquises par les chercheurs.

Au cours de l'année, tous les employés du CRM, surtout les cadres et les chercheurs, ont été appelés à promouvoir la recherche et le développement auprès de l'industrie minière.

Le CRM a toujours eu la conviction profonde que la recherche constitue l'un des éléments de base dans le succès d'une entreprise. Il a donc confié à une firme privée indépendante le mandat de vérifier l'impact d'un certain nombre de projets réalisés au cours des cinq dernières années. Cette étude démontre clairement que l'application des résultats de certains projets de recherche conduit à des bénéfices réels importants chez les entreprises impliquées tandis que les conclusions d'autres projets, même sans impacts positifs, peuvent faciliter des prises de décisions éclairées et conduire ainsi à des orientations sûres.

L'année 1986-87 a été particulièrement chargée au niveau de la recherche métallurgique effectuée aussi bien en laboratoire qu'en usine pilote. Ce fut en effet une excellente année si l'on considère, d'une part, le volume d'activités sans précédent réalisé pour le compte d'entreprises privées et, d'autre part, l'ampleur des problèmes et leurs difficultés.

Il faut souligner ici la valeur des projets réalisés en usine-pilote, qui a dépassé 1,5 million de dollars. Cette usine unique, au Québec, possède la flexibilité nécessaire pour répondre à toutes les demandes de services, quelle qu'en soit la nature: broyage, flottation, cyanuration, bouletage, lixiviation. Un deuxième point à noter est l'implication du CRM dans le secteur du traitement et de la transformation des minerais de fer, où il a réalisé des travaux pour une valeur d'environ 1,5 millions de dollars. Finalement, en raison de l'activité intense dans le secteur de l'or durant toute l'année, le CRM a réalisé, pour le compte de diverses entreprises, une bonne trentaine de projets de recherche dont la valeur totale a atteint près d'un million de dollars.

LA DIRECTION GÉNÉRALE DE L'EXPLORATION GÉOLOGIQUE ET MINÉRALE

L'année financière 1987-88 fut comme l'année précédente marquée par un haut niveau d'activités en acquisition de connaissances géoscientifiques et par la consolidation du programme d'assistance financière à l'exploration minière.

Ainsi, la DGEGM a consacré près de 11,1 millions $ sur le volet «acquisition de connaissances» et un montant de 9,5 millions $ a été consacré à des programmes d'assistance financière à l'exploration et à la préparation et à la diffusion de la géoinformation.

Service géologique de Québec

Division Gaspésie et les Iles:

La région de la Gaspésie a fait l'objet en 87-88 de 3 projets de terrain pour un montant global de 880 100$. Ces projets se regroupent comme suit: une compilation géologique de base à l'échelle de 1:50 000; une synthèse stratigraphique et tectonique du Siluro-Dévonien et une synthèse métallogénique et gîtologique du Centre-Nord.

Division Estrie - Laurentides:

En Estrie-Beauce, nous avons réalisé 6 projets pour un montant global de 667 300$. Parmi ces

projets, 4 étaient consacrés à la cartographie et aux études tectono-stratigraphiques et 2 portaient sur des synthèses métallogéniques régionales.

Division Côte-Nord - Nouveau-Québec:
Dans ce vaste territoire, un montant de 2.1 millions $ a été alloué à la poursuite de quelque 13 projets regroupés dans trois régions distinctes: La Fosse de l'Ungava, la Fosse du Labrador et ses environs et le Grenville à l'est de Havre-Saint-Pierre.

Dans la Fosse de l'Ungava, la cartographie systématique au 1:50 000 s'est poursuivie à l'ouest des régions couvertes antérieurement. Les études détaillées reliées à la pétrologie des volcanites et des filons-couches de même que les études gîtologiques et métallogéniques amorcées antérieurement se sont poursuivies.

Nous avons continué les travaux de métallogénie dans la partie nord de la Fosse du Labrador sur des gîtes de Cu-Ni. Une étude géochronologique y a aussi été entreprise. Dans la partie sud de la Fosse, dans le secteur du lac Retty, une étude métallogénique des éléments du groupe du platine a été entreprise. La cartographie de reconnaissance au 1:50 000 dans l'Archéen à l'ouest de Schefferville s'est poursuivie et s'est accompagnée d'une étude métallogénique des indices aurifères. Ces travaux de vérification et de synthèse géologique dans le secteur cartographié depuis 1983 ont marqué la dernière phase d'un programme intégré de cartographie dans la région de la rivière George.

Le programme de synthèse géologique du Groupe de Wakeham dans le Grenville près de Havre-Saint-Pierre a été complété. Nous avons aussi effectué une reconnaissance et un échantillonnage de roches mafiques et ultramafiques dans la région de Manicouagan-Fermont.

Division des minéraux industriels:
La Division des minéraux industriels a réalisé 8 projets en 1987-88 pour un total d'un peu plus de 250 000$.

Les minéraux industriels comme tels ont fait l'objet de 5 projets concernant des évaluations de gîtes et d'indices, des études spécifiques de substances et des travaux de cartographie détaillée. La plupart des travaux ont été effectués dans la Province de Grenville; les principales substances observées ont été la wollastonite, le marbre (calcite et dolomite) et la silice.

La tourbe a fait l'objet de 2 inventaires régionaux effectués dans le Sud du Québec et dans la région de Matagami. En ce qui touche les matériaux de construction, la Division a poursuivi dans la région de Portneuf son programme d'inventaire systématique des ressources en granulats du Sud du Québec.

Service géologique du Nord-Ouest
En 1987-88, 440 000 $ ont servi à la mise sur pied du Service (salaire de nouveaux effectifs principalement). Une somme de 2,6 millions $ répartie entre 19 projets a été consacrée à la recherche géologique. Cette somme représente une augmentation appréciable de 30% par rapport au dernier budget.

Les projets qui seront complétés au cours de l'année 1987-88 consistent en un levé régional (1:50 000), 10 levés détaillés (1:20 000), 7 études spécifiques (gîtologie, stratigraphie, géologie structurale) et un programme de sondages stratigraphiques. Neuf de ces projets ont été confiés à des universités ou instituts de recherche, les autres étant réalisés en régie. Nos travaux généreront 7 thèses (Ph. D.) et un mémoire (M.Sc.).

Les points saillants de la programmation 1987-88 sont les suivants:
1. L'intensification de nos activités dans la Bande de Caopatina-Quévillon au sud de Chibougamau (cartographie détaillée, gîtologie);
2. L'intensification de nos activités à l'intérieur et autour de la région dite de Casa-Bérardi, dans le district de Rouyn-Noranda (cartographie détaillée);

3. L'évaluation du potentiel en EGP des régions de Val-d'Or et Chibougamau (gîtologie);
4. L'étude des gîtes aurifères et cupro-zincifères de la bande qui s'étend de Rouyn-Noranda à Val-d'Or.

Service de la géochimie et de la géophysique

Le Service de la géochimie et de la géophysique (SGG) a investi au cours de l'année financière 1987-88, 2,2 millions $ dans des travaux orientés vers l'établissement de la connaissance géochimique et géophysique du territoire. Les travaux de terrain ont été réalisés en grande partie par des firmes privées dans trois grandes régions prioritaires du Québec: l'Abitibi-Témiscamingue, la Fosse du Labrador et les Appalaches.

Plusieurs travaux majeurs de terrain ont été effectués par le SGG en 1987:

— Un levé de sédiments de lac dans la région de Fermont, qui a pour fin d'inventorier le potentiel minéral d'une vaste région inexplorée, sise au sud-ouest de cette ville monominérale;

— Un levé de minéraux lourds au nord de Hull, qui servira à identifier des cibles régionales d'exploration dans un territoire grenvillien;

— Un levé gravimétrique dans la région de Chibougamau, qui donnera une information régionale de nature géophysique et permettra d'obtenir une interprétation plus quantitative des structures sous-jacentes. On profitera des travaux géophysiques pour réaliser en même temps un levé pédogéochimique.

En plus de ces levés majeurs, deux études de terrain seront réalisées. La première a pour but de vérifier, à l'aide de sondages de sismique réfraction, la présence de structures cassantes dans la région de Joutel. La seconde étudiera la relation exacte entre les cartes de résistivité apparente, déduites des données électromagnétiques héliportées, et les épaisseurs de dépôts meubles dans une région cible de l'Estrie-Beauce.

Le SGG continue en 1987 à assurer le suivi des travaux de terrain passés et présents. Parmis les projets géochimiques actifs les plus importants, mentionnons:

— Le projet *Géochimie des sédiments de ruisseau / Estrie et Beauce*, le plus important de ce type réalisé au Ministère (11 500 échantillons). Combiné avec le projet *Arsenic, sédiments de ruisseau / Estrie*, il permettra d'identifier de nouvelles cibles dans l'exploration aurifère de ce secteur des Appalaches;

— Le projet *Analyses de l'or / Cadillac*, qui donnera la teneur en or de 7 000 échantillons de tills prélevés en 1971 dans la partie ouest de l'Abitibi;

— Le projet *Eaux souterraines / Sherbrooke et Rivière-du-Loup*, qui donnera les résultats de plus de 19 000 échantillons d'eaux souterraines prélevés à partir des puits domestiques dans la partie nord des basses-terres du Saint-Laurent et la partie sud des Appalaches;

— Une étude portant sur les cas types en exploration géochimique est en voie d'édition. Il s'agit d'une description systématique de plus de 60 cas types où l'exploration géochimique a joué ou aurait pu jouer un rôle prépondérant dans l'exploration minière.

En ce qui concerne la géophysique, le SGG a publié au début de l'année 88 les différentes cartes thématiques qui mettent en valeur les résultats de levés géophysiques aériens réalisés en 1986 dans deux régions cibles du Québec, soit celles de Beauceville en Estrie et de la rivière Goodwood à l'ouest de la Fosse du Labrador. Trois projets de recherche importants sont en phase d'élaboration et seront réalisés prochainement. Un premier vise à améliorer la présentation des cartes électromagnétiques INPUT de la Fosse du Labrador, lesquelles ont été publiées sans traitement, pour faire le tri entre les trop nombreuses anomalies INPUT qui s'y trouvent. Le deuxième projet vise à extraire, à l'aide des technique informatiques de pointe, toutes les informations géologiques pertinentes à l'exploration minière dans la région de Joutel. On utilisera entre autres les images

SPOT (PUIS), un des derniers développements de la télédétection spatiale, suite à une entente dans le cadre des échanges franco-québécois sur des thèses à haut potentiel opérationnel. Un dernier projet a pour objectif l'établissement d'une carte de la géologie interprétée de la région à l'ouest de la ville de Rouyn-Noranda, à partir des données magnétiques, électromagnétiques, gravimétriques disponibles ainsi que toutes les informations géologiques et géophysiques complémentaires.

Le service a soumis pour publication, d'avril 1986 à avril 1987, 62 publications, ce qui constitue probablement un sommet.

Quatre publications sur la géochimie des sédiments de lac dans les régions de la rivière à la Baleine, de la rivière Caniapiscau, du lac Otelnuk et de Schefferville donnent à l'explorateur minier des indices importants sur le potentiel minéral d'un vaste territoire qui englobe la partie sud de la Fosse du Labrador et les secteurs limitrophes à l'est et à l'ouest. À noter que ce sont les résultats du levé de sédiments de lac de la rivière Caniapiscau qui ont servi de bougie d'allumage à l'exploration minière dans la partie ouest de la Fosse du Labrador.

Un répertoire des travaux de géophysique du MER a fait l'objet d'une publication récente. Il permettra au lecteur de se retrouver rapidement à travers le nombre et la variété grandissante de produits géophysiques.

DIRECTION DE L'ASSISTANCE À L'EXPLORATION MINIÈRE

Service de la promotion et de l'aide à l'exploration minière

Le programme d'assistance financière à l'exploration minière, qui a débuté en avril 1985, s'est poursuivi jusqu'au 31 mars 1987.

Pour l'année financière 1986-87, 3,77 M $ ont été versés en subventions. Sur les 59 projets présentés dans le cadre des trois volets du programme, 31 ont été retenus. Ainsi, 24 projets d'exploration minière se sont partagé 3,52 M $, 3 projets de construction de routes d'accès ont utilisé 81 000 $, tandis que 4 projets de mise à l'essai de nouvelles technologies en exploration minière ont reçu 168 000 $.

Les zones désignées de Matagami, de Chibougamau-Chapais, de la Gaspésie, de l'Estrie et de la Fosse du Labrador se sont partagé 93% de l'aide financière accordée. À eux seuls, les trois producteurs de la région de Chibougamau-Chapais se sont partagé 1.77 M $ en subventions accordées dans le cadre d'un programme *ad hoc*, soit 50% du total des subventions versées à l'exploration minière en 1986-87. Les objectifs de cet effort hors normes étaient d'augmenter substantiellement les travaux d'exploration des producteurs de cette région afin d'assurer la survie à court terme de la communauté minière.

La région de Chibougamau-Chapais a donc obtenu 70% du total des subventions versées aux zones désignées au cours de l'année. Le montant alloué à l'Estrie a presque triplé en 1986-87. En effet, ce montant est passé de 134 000 $ à 350 000 $. Par contre, les sommes d'argent allouées aux régions de Matagami et de la Gaspésie ont diminué. Des 568 444 $ et 590 000 $ qu'elles étaient en 1985-86, elles sont passées respectivement à 336 000 $ et 280 316 $.

À l'extérieur des zones désignées, c'est l'Abitibi qui a reçu la plus grande part des montants alloués avec 81% du total.

En tout, le programme a comporté l'exécution de 10 M $ de travaux d'exploration, surtout pour les métaux de base (Cu) dans des zones désignées. Un total de 133 000 mètres de forage ont été effectués et on a creusé 3700 mètres de galeries; la création d'emploi s'est chiffrée à environ 73 personnes/année.

En 1986-87, les travaux subventionnés ont permis à deux compagnies de la région de Chibougamau-Chapais d'augmenter leurs réserves de minerai et d'obtenir des indications très encourageantes pour la poursuite des travaux d'exploration.

Le principe d'un programme d'assistance financière à la prospection dans la région de la Gaspésie/Bas-Saint-Laurent fut négocié avec le gouvernement fédéral (MEIR-MEMR). Ce programme qui implique des dépenses de 4,5 M $ sur quatre ans fut lancé par le MER en juin 1987.

Quatre volets sont inclus:
I- Allocations journalières pour les frais de prospection;
II- Subventions pour des travaux de prospection sur des propriétés;
III- Subventions pour favoriser l'embauche de prospecteurs;
IV- Subventions pour favoriser le transfert de propriétés à des compagnies d'exploration minière.

Nous prévoyons que 50 à 60 prospecteurs se prévaudront de cette assistance en 1987-88.

Le Service a poursuivi pendant l'année sa stratégie de promotion de la mise en valeur du potentiel minéral de la province. Le but est d'intéresser des intervenant actifs ou potentiels à la diversification de l'économie minérale de la province.

La Division de la mise en valeur de la géoinformation a réalisé une mise à jour de 102 cartes de localisation des travaux géoscientifiques pour les régions de Rouyn et Val-d'Or. Depuis novembre 1986, une liste mensuelle de nouveaux indices minéralisés est mise à la disposition du public pour consultation. Les listes disponibles décrivent plus de 200 de ces nouveaux indices.

Dans le cadre de ses activités, la Division poursuit la mise à jour des cartes de localisation des travaux géoscientifiques et a aussi entrepris une refonte du fichier des gîtes. Un fichier informatisé, disponible sur Pc-compatible, en texte libre sans artifices de codification, devrait être réalisé au cours des prochains mois.

Service de la géoinformation
Dans le cadre d'une étude de faisabilité d'implantation de systèmes informatisés de production, de traitement et de diffusion de l'information géoscientifique, le Ministère a décidé d'entreprendre un projet pilote d'utilisation de tels systèmes.

Tous les types de données géoscientifiques disponibles concernant la coupure cartographique 32 D/6 dans la région de Rouyn-Noranda seront digitalisés et des essais de traitement et de production de cartes et rapports seront réalisés. Les résultats des essais et une analyse coût-bénéfice sont attendus pour l'automne 1988.

Une entente est intervenue avec la société IST Informathèque pour la diffusion commerciale des données bibliographiques sur les travaux géologiques et miniers contenues dans la banque québécoise EXAMINE. Dorénavant, toute personne ou compagnie peut avoir un accès direct aux données de cette banque, après entente avec la société concernée.

En 1986-87, le Centre de diffusion de la géoinformation a mis en vente quelque 150 nouveaux documents géoscientifiques produits par le Ministère; ces publications comportaient quelque 500 cartes géologiques, géochimiques ou géophysiques. En cours d'année, la clientèle a commandé quelque 28 000 copies de rapports.

MINERALS AND ENERGY DIVISION

NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES AND ENERGY

The New Brunswick Minerals and Energy Division, like its counterparts in other provinces, is responsible for all mineral and energy resources owned and controlled by the Province. The Division administers, through a number of Acts, all matters related to the exploration, development, production, smelting, refining, transportation and taxation of metallic, non-metallic and structural material resources.

The Division comprises the Geological Surveys Branch, the Mineral Development Branch, and the Energy Branch. The latter joined the Division in 1986.

Most of the geoscience activities of the Minerals and Energy Division are funded by a Canada-New Brunswick Mineral Development Agreement (MDA) that expires in 1989. The route toward a new agreement is presently being explored. In 1986-87, New Brunswick's share of the funding amounted to $1.42 million. The ordinary Provincial budget for the Minerals and Energy Division for the same period amounted to $2.692 million.

GEOLOGICAL SURVEYS BRANCH (Director, J.L. Davies)
The Geological Surveys Branch is responsible for the collection and dissemination of information pertaining to the geology and mineral resources of New Brunswick. Closely associated activities include the encouragement of mineral exploration, promotion of the mining industry, and assistance to government agencies who formulate resource and land use policies. The Branch is organized into the Geoscience Services Section, the Geoscience Information Section, and regional offices located in Bathurst and Sussex.

MINERAL DEVELOPMENT BRANCH (Director, G.J. Greer)
The Mineral Development Branch consists of four sections: Mineral Development, Mineral Processing, Mine Engineering, and Mineral Lands.

The overall goals of the Branch are: (1) to ensure that mineral deposits are developed at an optimum rate consistent with long-term income and employment objectives, (2) to enhance the economic viability of marginal mineral deposits, (3) to ensure that inactive or exhausted mines are rehabilitated to a state that avoids on-going costs to the public, (4) to ensure optimum recovery of minerals both in the mining and milling of the ores, and (5) to ensure the highest degree of in-province processing of mineral concentrates.

ENERGY BRANCH (Director, D.E. Barnett)
The Energy Branch has responsibility for all energy matters and, in this regard, is involved in a number of geoscience projects. These include assessment of coal, oil, gas, and oil shale resources by means of geological compilation of the Late Paleozoic Maritimes Basin and the Early Mesozoic Fundy Basin. The oil shales of Albert County are being drilled and analysed to determine the beneficiation potential of the kerogen and/or carbonate minerals. In 1986, a 22 megawatt test facility was built in Chatham to demonstrate co-combustion of oil shale and New Brunswick coal. A Mineral Development Agreement project is underway to study the sedimentology and diagenesis of the Stoney Creek oil and gas field near Moncton.

MINERAL DEVELOPMENT AGREEMENT PROGRAMS
The MDA programs are divided into four categories: (1) geoscience, (2) mining and mineral technology (3) economic development, and (4) public information, evaluation, and administration.

Geoscience
Studies of granitic plutons and associated mineral deposits continued in southern and central New Brunswick. M.J. McLeod outlines two divisions of the Late Devonian eastern Saint George Batholith representing deeper and shallower erosional levels (Figure 1, A). Tin- and tungsten-bearing greisen and associated alteration zones occur almost exclusively in irregularly shaped bodies of fine- to medium-grained porphyritic granite, feldspar porphyry and aplite.

In central New Brunswick, the Middle Devonian Burnthill pluton (385 + Ma), one of a cluster of five associated with tungsten-tin mineralization is, according to H.E. McLellan, a multiphase, high-silica granite emplaced at a high crustal level (Figure 1, B). The mineralization, presumably formed from fluorine-rich fluids, is associated with equigranular granite. The fluids originally concentrated in the roof of the magma chamber, which has subsequently been tilted to the south. W.W. Gardiner and K. Garnett completed studies on similar stocks to the east and north (Figure 1, C).

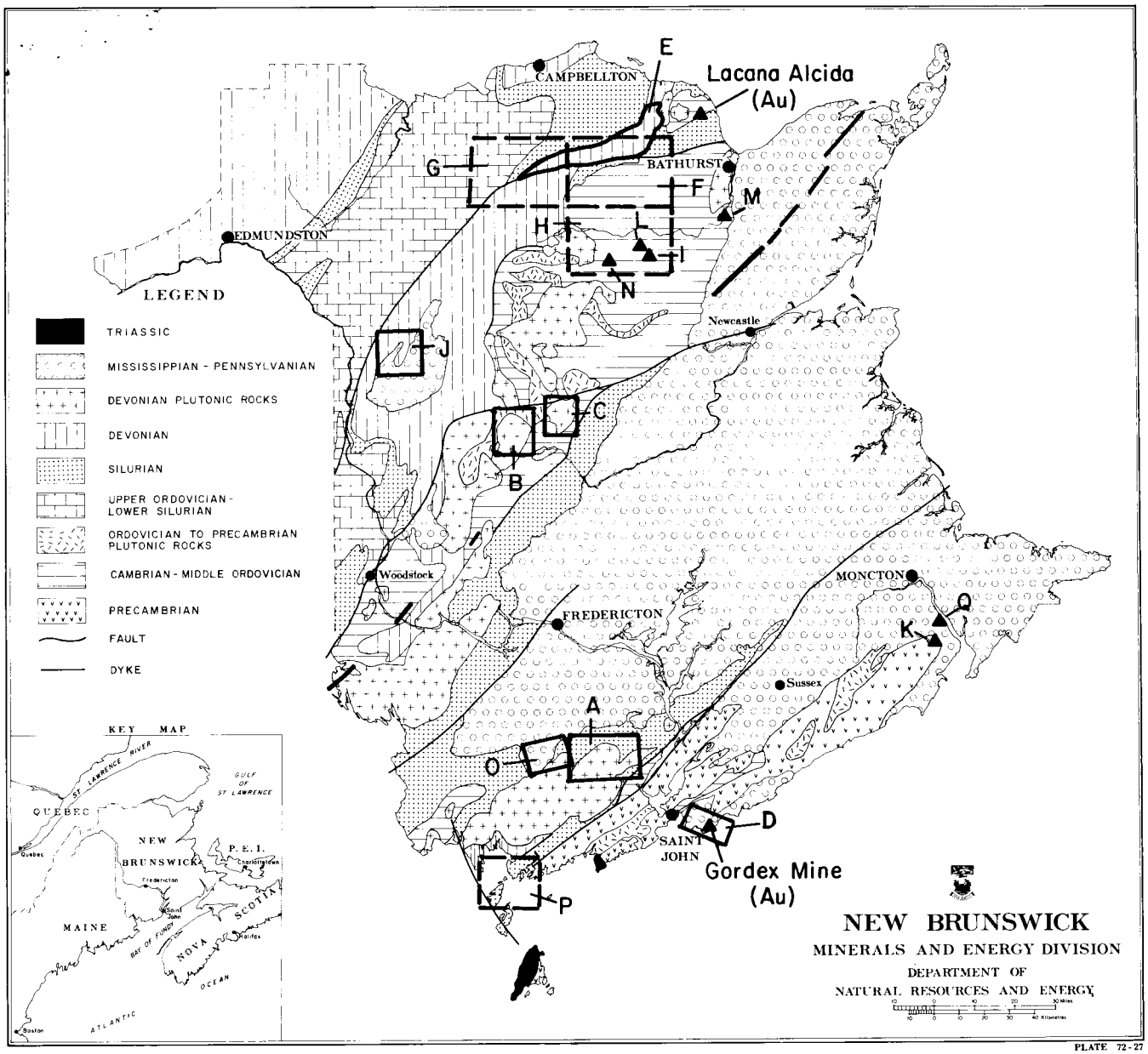


Figure 1. MDA-funded geoscience projects :

(A) Mapping, eastern Saint George Batholith; (B) mapping, Burnthill Pluton; (C) mapping, Dungarvon Granite; (D) mapping of gold-bearing rocks, Cape Spencer; (E) mineral resource potential along the Jacquet River Fault; (F) surficial geology of Tetagouche Lakes map area (21 O/9); (G) surficial geology of Upsalquitch Forks map area (21 O/10); (H) geoscience compilation (21 O/8); (I) Heath Steele mine structural geology; (J) geological mapping of New Denmark area; (K) Albert oil shale evaluation.

Provincially funded geoscience projects :
(L) Stratmat deposit study; (M) Key Anacon deposit study; (N) Halfmile Lake deposit study; (O) Mount Pleasant caldera project; (P) Mascarene Peninsula till mapping; (Q) Stoney Creek gas and oil field study.

In the Cape Spencer area, just east of Saint John, S.E. Watters continues to study highly deformed gold-bearing rocks (Figure 1, D). There are at least two generations of folds that have deformed the altered Carboniferous and older arkosic rocks. The gold, along with pyrite, is concentrated in shallowly plunging quartz-vein stockworks below major thrust planes.

In northern New Brunswick, D.R. Burton and G. Philpott assessed the mineral resource potential (particularly for gold) of the Lower Devonian volcanic and sedimentary belt that stretches 65 km from the Baie des Chaleurs to the Upsalquitch River (Figure 1, E). The area is underlain by a bimodal suite of mainly subaerial mafic and felsic rocks that contain numerous fracture fillings and base metal occurrences associated with alteration haloes. The region as a whole appears to lie on the south edge of a large caldera, outlined several years ago. Three hundred rock samples were collected for major and minor trace element analysis. The preliminary results indicate several localities worthy of detailed exploration.

In surficial geology, A.G. Pronk completed mapping (1:50 000 scale) of the Tetagouche Lakes (21 O/9) and Upsalquitch Forks (21 O/10) map areas (Figure 1, F and G respectively). The till cover is thin (about 0.5 m thick), probably a result of its proximity to the ice centre.

The Upsalquitch Forks sheet straddles the northeasterly trending Rocky Brook-Millstream fault system, which is known to have several gold occurrences along its length. The occurrences seem to be related to subsidiary fracture systems associated with the large faults. Gold anomalies were outlined in the tills overlying the faults.

To aid mineral exploration in the Bathurst-Newcastle mining district, a project to compile all exploration data filed with the Minerals and Energy Division was begun. The California Lake map area (21 O/8) was selected for a pilot study, and contracts for the work were awarded to two companies (Figure 1, H). The results are expected in mid-1987.

D.G. Rose and S.C. Johnson began a project to build a computerized file of New Brunswick mineral occurrences. The file is being assembled at the Sussex regional office using a microcomputer system. The basic information is being derived from existing inventories and compilations, and incorporates recent data from assessment reports.

The Heath Steele mine produced several million tonnes of Zn-Pb-Ag-Cu and Au ore since 1957, but was forced to close in the early 1980s due to poor metal prices. In 1986, a detailed structural study was begun to identify additional ore reserves (Figure 1, I). The MDA-funded project was contracted to the University of New Brunswick under the guidance of P.F. Williams and A.L. McAllister (Geology Department). The 1986 work entailed: digitizing all drill hole data, geological mapping on surface and underground, and extensive trenching and geophysical surveying.

A geological mapping (1:20 000 scale) project was begun in northwestern New Brunswick (parts of 21 J/13, J/14, O/3, and O/4) under the direction of R. Wilson (Figure 1, J). He reports that the Hazeldean anticline is the major feature of the geology. The oldest rocks in the area are fossiliferous Lower Silurian sandstones that are conformably overlain by mainly subaerial felsic flows and pyroclastics, and mafic flows intercalated with conglomerate, siltstone and sandstone. Mississippian redbeds unconformably overlie the Silurian rocks. No significant mineral occurrences have been found.

Economic Development

Geoscience projects in this section include: (1) a continuing study by T.C. Webb of limestone resources and assessment of the limestone industry in general, and (2) a geological and economic evaluaton of the Albert oil shale (Figure 1, K) and the Moncton subbasin.

Public Information, Evaluation And Administration program, directed by D.J.J. Carroll comprises: (1) public awareness, aimed at promoting the MDA agreement and the mineral industry in general, and publicizing the benefits derived from the programs; (2) advanced prospecting courses, and (3) editorial activities related in the publishing of project results. The latter is the responsibility of B.M.W. Carroll and S.A. Abbott.

PROVINCIALLY FUNDED PROGRAMS

In the Bathurst-Newcastle mining district, R.R. Irrinki continued his compilation of data on the larger, better grade massive zinc-lead-silver-copper sulphide deposits. This work will identify an inventory of potential Zn-Pb-Ag-Cu ore in the region. Data on the so-called Stratmat deposit (Figure 1, L), near the Heath Steele mine, and the Key Anacon deposit (Figure 1, M) have been compiled and synthesized. Work is now in progress on the Halfmile Lake deposit (Figure 1, N).

S.R. McCutcheon's study of the Mount Pleasant caldera, which hosts the Mount Pleasant tungsten-tin deposit, is nearing completion (Figure 1, O). One of the surprising recent discoveries is that of a diverse and well-preserved miospore assemblage indicating a Late Devonian age for the volcanic sequence. Isotopic data had previously suggested a much younger (Mississippian) age.

P.G. Chiswell mapped and sampled the tills of the Mascarene Peninsula to aid prospecting for new gold and base metal deposits in that area (Figure 1, P).

To spur gold exploration, several hundred stream silts collected many years ago in northern New Brunswick were analysed for gold and the pathfinder elements arsenic, antimony and barium. The results indicated several anomalies; these are currently under investigation.

L.R. Fyffe, S.R. McCutcheon and J.J. Thibault assisted in the preparation of the "Lexicon of Canadian Stratigraphy, Volume VI, the Atlantic Region". A.A. Ruitenberg completed a preliminary metallogenic map of New Brunswick, and prepared a more general version for inclusion in the metallogenic map of the Appalachian orogen.

Other Division activities include a study of the Stoney Creek gas and oil field, with a view to increasing hydrocarbon yields (Figure 1, Q); a use and market study for peat; the preparation of an eleven-hour video on New Brunswick's coastline; and the compilation of an aggregate resource atlas.

EXPLORATION ACTIVITY

Gold has been the object of most of the mineral exploration in the Province for the past several years. Many companies are involved, including: Lacana Mining Corporation and associated companies, Brunswick Mining and Smelting Corporation, Noranda Exploration, Granges Exploration, BP-Selco Resources, Lac Minerals Ltd., Rio Algom Exploration, Acadia Mineral Ventures, Seabright Resources, Gordex Minerals Ltd., Mispec Resources, Durham Resources Inc., Rex Silver Mines Ltd., and U.S. Borax Inc.

Numerous prospectors are working in the Province, including Merton Stewart, the Prospectors and Developers Association's "Prospector of the Year".

In northern New Brunswick, the important gold-bearing area lies just north of Bathurst. It extends 60 km, from the Baie des Chaleurs southwest to the headwaters of the Upsalquitch River. The interesting terrane is underlain mainly by highly deformed Ordovician and less deformed Silurian and Devonian volcanic and sedimentary rocks that are intruded by a variety of felsic and mafic plutons. The dominant structural feature is the northeasterly trending Rocky Brook-Millstream fault system that seems to have provided the plumbing system for hydrothermal solutions. The gold occurrences found so far are spatially related to large northeasterly trending faults; however, there may be some relationship to caldera development in the Silurian.

Several gold occurrences have been found in the belt so far but the only promising one is Lacana's Alcida prospect (Figure 1). In this deposit the gold, along with pyrite, arsenopyrite, and base metal sulphides, occurs in a highly fractured and altered mafic sill that intrudes deformed Ordovician sedimentary rocks, a dozen or so metres below a faulted contact with Silurian sedimentary rocks. Several drill holes indicate a steeply northeasterly plunging zone approximately 18 m wide and 260 m long at surface, which extends to a depth of 75 m. The grade ranges from 3.1 to 4.8 g/t (0.09-0.14 oz./ton) Au, with thinner, richer sections from 6.9 to 13.7 g/t (0.2-0.4 oz./ton) Au.

Although the Silurian-Devonian terrane is receiving the most attention, some companies are now returning to the deformed Ordovician (Miramichi Zone) that hosts the Bathurst massive sulphide deposit. The potential in this terrane is high, as attested to by the tenor of gold in the massive sulphide deposits. Three deposits have significant gold- and silver-bearing gossans. The gossans capping the Anaconda Caribou and Heath Steele deposits have been processed for their gold and silver content and the exploitation of the Murray Brook gossan is being considered by Northumberland Mines Limited. Exploration companies are also looking for post-Ordovician gold-bearing fracture zones within the Miramichi Zone. Lacana has found one such zone containing significant amounts of silver.

In southern New Brunswick, Gordex Minerals Ltd. successfully completed heap leaching tests at its Cape Spencer deposit (Figure 1). The first gold brick was poured in mid-1986. The published reserves are 500 000 t grading 2.4 g/t (0.07 oz/ton) Au.

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY
GEOSCIENCE ACTIVITIES

INTRODUCTION
The Nova Scotia Department of Mines and Energy has a broad mandate in minerals, mining and energy to develop each for the benefit of all Nova Scotians.

Organization of the Department
The Department is divided into two branches. The Mines and Minerals Branch is responsible for gathering geological information, promoting mineral development, regulating mineral claims, and reviewing mining leases and mine development. The search for energy resources, conservation of energy, and promotion of alternate energy sources is the mandate of the Energy Branch.

The Department employs more than fifty geologists in three divisions: Mineral Resources Division and Mineral Development Division in the Mines and Minerals Branch, and Energy Resources Division in the Energy Branch.

The summer of 1986 was the second full field season for geoscience work supported by the Canada-Nova Scotia Mineral Development Agreement (CNSMDA). Under the terms of the CNSMDA, the federal government, through Energy, Mines and Resources Canada (EMR), and the provincial government will spend $27 million between 1984 and 1989. Five programs — geoscience, minerals technology, mineral development, firm specific and public information — are designated to strengthen Nova Scotia's mineral industry through coordinated, parallel projects supported by both governments.

During 1986, thirty projects were underway. Their locations are shown on Figure 1 and are briefly described in the following text. Most of the projects are supported by the CNSMDA.

MINERAL RESOURCES DIVISION
The Mineral Resources Division undertakes long term, applied research to provide an understanding of the Province's geology and mineral resources. The research projects focus on mineral occurrences and their tectonic and stratigraphic frameworks. The Division provides staff and support for the Education and Public Awareness Program of the Mines and Minerals Branch.

Projects
Several projects that will provide more information about regional geochemistry of stream sediments are underway. In the Cobequid Highlands, a joint pilot project between the Geological Survey of Canada and the Department is examining the stream sediment geochemistry through catchment basin analysis. A better understanding of geochemical anomalies is achieved through computer manipulation of geochemical data from specific catchment areas and integration of

bedrock geological information. In other areas of northern Nova Scotia and large areas of Cape Breton Island, regional reconnaissance stream sediment sampling was completed. This project is a continuation of several years work in regional geochemistry sampling. Both projects will provide data for a geochemical atlas of the Province.

Another project that investigates geochemistry is the Surficial Geology and Geochemistry Project. This project is continuing from previous years and focuses attention on glacial deposits and till geochemistry. All of mainland Nova Scotia had been mapped and sampled by the end of the 1986 field season.

The South Mountain Batholith is an arcuate intrusive body stretching from Halifax to Yarmouth. It contains the only primary tin mine in North America. Under the CNSMDA, geologists from the Division are mapping the bedrock and surficial geology, and investigating the mineral occurrences within and at the contacts of the Batholith. Map coverage presently comprises half of the Batholith. Bedrock and surficial deposit geochemical sampling in this project is being used to locate specialized granites and to assess their mineral potential. Another granite-based mapping project is providing information about the Liscomb Complex, northeast of Halifax, and its mineral potential.

The tin deposit at East Kemptville was studied during 1986 to better understand granite and host rock alteration and its effect on mineralization. Other known deposits of gold and base metals in non-granitic rocks are being investigated and mapped. The areas around the former base metal mines at Walton, Stirling and Yava are being examined, along with drill core and archival data. The purpose of this project is to determine the extent of unmined mineralization and its potential for further development. With the increased of exploration work for gold in southern Nova Scotia, geologists from the division are studying some former gold districts in detail. This investigation will provide a better understanding of the factors required for localizing gold mineralization.

In northern Nova Scotia, a large area of Late Carboniferous strata is the subject of the Cumberland Basin Project. The work consists of sedimentological and stratigraphic studies to develop an understanding of basin formation and mineralization. With known reserves of coal and salt and occurrences of base metals, precious metals and uranium, the Cumberland Basin has mineral development potential. The Pugwash Salt Project is a study of a major salt deposit in the northern part of the Cumberland Basin. The mining operations have allowed geologists to obtain a better understanding of the salt diapir formation and emplacement. The purpose of the study is to provide more information about salt deposit formation and to explore for potash and other minerals.

Closely associated with all of the regional and mineral deposit studies is the Metallogenic and Tectonic Studies Project. This should provide a better understanding of the location and emplacement of mineral deposits, through the use of new geological data applied to plate tectonic models.

The Education and Public Awareness Program promotes an understanding of the minerals, geology and mineral industry of Nova Scotia, and the importance of the CNSMDA. Prospecting courses, displays, publications and educational material for schools were some of the projects completed under this Program.

MINERAL DEVELOPMENT DIVISION

The Mineral Development Division is concerned with the development of industrial mineral resources and the promotion of mineral development activities. This division administers the Mineral and Petroleum Rights Registry, monitors mineral exploration and development work, and maintains a drill core library at Stellarton.

Projects

Many projects undertaken by the Division are designed to strengthen the competitive position of Nova Scotia's mineral industry through specific site evaluation, regional studies and market studies. Geologists from the Division are continuing to describe and sample potential aggregate deposits in various parts of the Province. The Building Stone Project is locating former and potential building stone sites so that the occurrences may be sampled and drilled to test quality. In the same

way, the Gypsum and Anhydrite Project is developing an inventory of gypsum and anhydrite deposits in Nova Scotia. Additionally, the project will attempt to identify new markets and products for these commodities.

Three other projects — Diatomaceous Earth, Various Commodities, and Fillers — are examining the development potential for many new commodities. During 1986, lakes and bogs in different parts of Nova Scotia were sampled to assess the quality and quantity of diatomaceous earth. Some mineral commodities have improved economic potential because of changes in the market place, advances in technology and/or a high unit value in a restricted market. Some of the commodities being investigated are spodumene, silica, garnet, wollastonite, brucite, barite, beryllium, andalusite and high calcium limestone. Local users of filler materials (limestone, barite, etc.) were identified and their needs described. Potential deposits are being investigated for size and quality.

A comprehensive geological compilation and review of gold deposits and occurrences is the central part of the Gold Resource Project. During 1986, former gold mining areas in southern Nova Scotia were mapped and sampled, to assess the distribution and character of the gold mineralization.

An integral part of the Division's work is the promotion of potential and existing mineral commodities. Research, conducted for the Mineral Resource Promotion Project, is attempting to develop and promote new investment and trade opportunities and to compile technical information on particular mineral commodities.

Large databases are maintained by the Division in the Halifax office. Entries for GEOSCAN are continually made from journal literature and departmental publications. Two other databases, used extensively by exploration companies, provide locations of drillholes and logs and the location and description of mineral occurrences. Additionally, the Division provides a service to land use planners by publishing maps and handbooks that describe and locate lands with mineral potential. Through this project mineral lands are not entirely alienated by development and are conserved for potential future use.

The Division maintains an exploration monitoring office and a drill core library at the Stellarton regional office.

ENERGY RESOURCES DIVISION

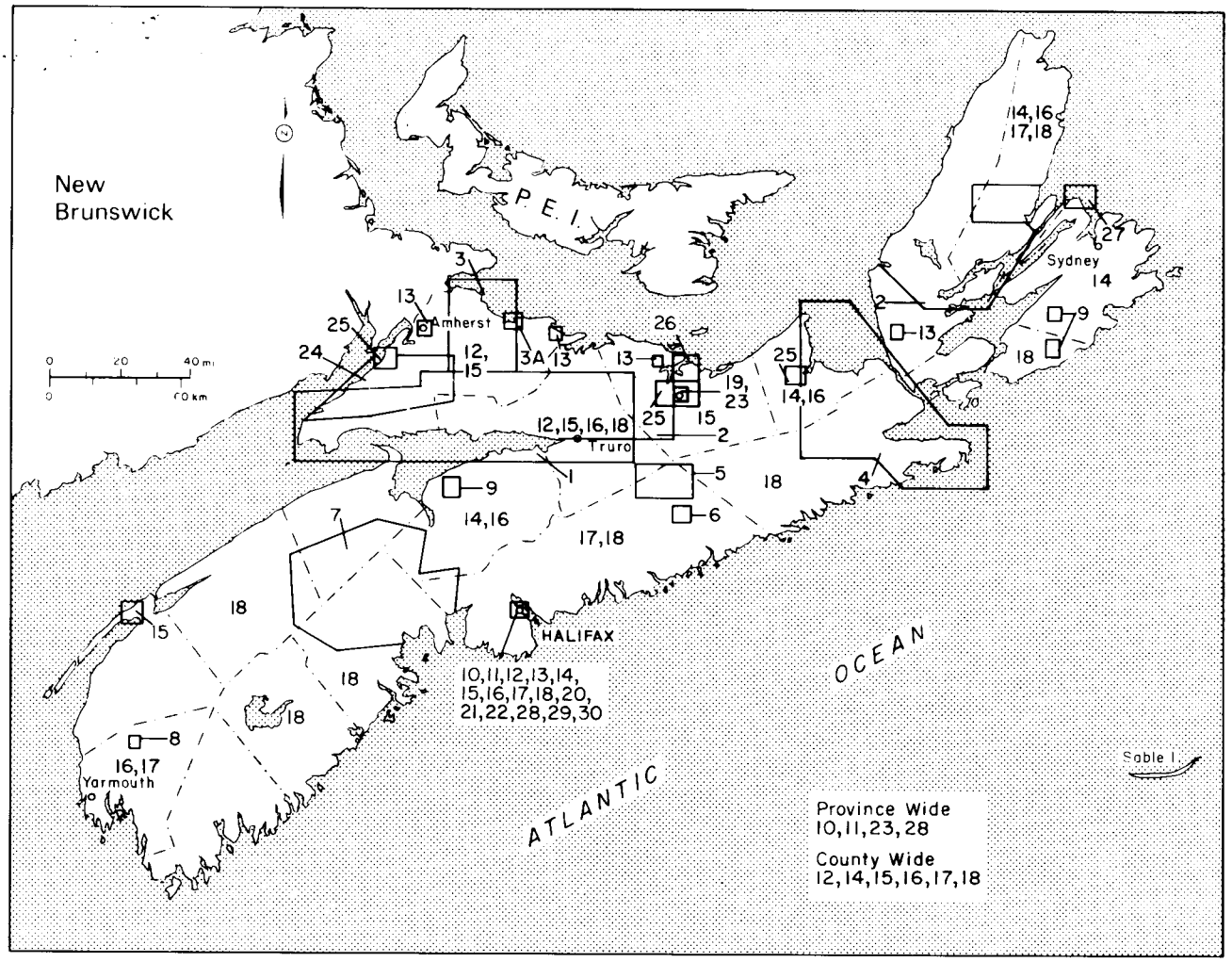
The Energy Resources Division is responsible for evaluating deposits of coal, peat, oil shale, natural gas and petroleum deposits and regulating their development. The geologists in the Division are investigating the broad aspects of the geological environment for these energy commodities so that future private and public development may proceed with an understanding of the quality and quantity of a deposit.

Projects

In the former coal-producing area around Springhill in northern Nova Scotia, a sedimentological study of the Late Carboniferous Cumberland Group will provide more information about the environments of deposition of these rocks and their included coal seams. Work on this project and the Oil Shale Project is coordinated with the overall study of Carboniferous rocks in the Cumberland Basin Project.

Oil shales are found in Carboniferous rocks at many locations in the Province. During 1986, three locations in northern Nova Scotia were mapped and sampled. North of the Stellarton area, the Division began a mapping project to define the coal and oil shale potential of the Late Carboniferous rocks. In the Sydney region a detailed sedimentological mapping project began on the roof strata of the Hub Seam (Late Carboniferous Morien Group).

Evaluation of Nova Scotia's enery resources includes geological projects for onshore and offshore oil and gas resources. The Division is responsible for monitoring all petroleum exploration and



GEOSCIENCE PROJECTS

MINERAL RESOURCES DIVISION

1. Catchment Basin Geochemical Study of the Cobequid Highlands*
2. Regional Reconnaissance Geochemical Project*
3. Cumberland Basin Project*
3a. Pugwash Salt Project*
4. Surficial Geology and Geochemistry Project*
5. Liscomb Complex Project*
6. Meguma Gold Project*
7. South Mountain Granite Project*
8. East Kemptville Tin Deposit Study*
9. Base Metal Deposits Study*
10. Metallogenic and Tectonic Studies*
11. Public Awareness and Education*

MINERAL DEVELOPMENT DIVISION

12. Aggregates Project*
13. Building Stone Project*
14. Gypsum and Anhydrite Project*
15. Diatomaceous Earth Project*
16. Various Commodities Project*
17. Fillers Project*
18. Gold Resource Project*
19. Core Library Project*
20. Drillholes and Mineral Occurrences Databases*
21. Mineral Land Use Policy Development Project
22. Mineral Resources Promotion Project*
23. Exploration Monitoring/Regional Office

ENERGY RESOURCES DIVISION

24. Sedimentological Study of the Springhill Coalfield Region
25. Oil Shale Project*
26. Coal and Oil Shale Exploration
27. Sedimentology of the Hub Seam
28. Petroleum Exploration Monitoring
29. Offshore Petroleum/Natural Gas Evaluation*
30. Onshore Petroleum/Natural Gas Evaluation

*Indicates partial or complete project funding from the Canada-Nova Scotia Mineral Development Agreement.

Figure 1. Locations and types of Geoscience projets undertaken by the Nova Scotia Department of Mines and Energy.

development activities onshore. It works in conjunction with the Nova Scotia office of the Canada Oil and Gas Lands Administration (COGLA) in administering offshore Nova Scotia.

For some offshore areas, Division staff are preparing evaluation reports which integrate well logs with geophysical and geological data from the surrounding areas, making structural maps of selected fields and evaluating geological models of oil and natural gas deposits. On shore in 1986, work was begun on evaluating the oil and natural gas potential of Carboniferous strata.

EXPLORATION ACTIVITY

With several major gold exploration programs initiated or continuing through 1986, mineral exploration has begun to grow rapidly in the Province. The total area held under exploration license increased from 521 619 ha (1 288 920 acres) in 1985 to 668 888 ha (1 652 800 acres) in 1986. More than $20 million was spent on exploration and development work in 1986 compared to only $8 million in 1985. The steady growth in production of industrial minerals, coal, aggregates and tin along with major gold development projects has encouraged the exploration and mining sectors. Nova Scotia looks forward to continued progress in the development of a stable and diversified mineral industry. The geoscience activities of the Department, with assistance from the CNSMDA, support this goal.

ENERGY AND MINERALS BRANCH, PRINCE EDWARD ISLAND

DEPARTMENT OF ENERGY AND FORESTRY

INTRODUCTION

The goal of the Prince Edward Island Minerals Branch is to develop the capability to respond effectively to public requests and needs relating to mineral, oil and gas administration. In addition, the branch is striving to become the centre of expertise on the geology of Prince Edward Island and is committed to carrying out essential geological survey activities.

The major focus of attention for the Minerals Branch during the 1986/87 fiscal year was a study designed to evaluate the Province's onshore mineral aggregate (sand and gravel) resources. The evaluation study is being conducted under the Canada-Prince Edward Island Mineral Development Subsidiary Agreement.

MINERAL DEVELOPMENT SUBSIDIARY AGREEMENT

On January 7, 1986, representatives from the federal and provincial governments signed a three-year, $300 000 Canada-Prince Edward Island Subsidiary Agreement. The Agreement became effective as of 2 January 1986 and will terminate 1 January 1989. It is being funded on an 80%-20% federal-provincial basis and will be delivered totally by the Province.

The purpose of the Agreement is to carry out programs with the objective of moving the Province closer to self-sufficiency in mineral aggregates. Program I, namely Onshore Aggregate Resources, will permit a comprehensive qualitative and, where possible, quantitative analysis of both surficial and bedrock mineral aggregate deposits within the Province. This program will involve the collection and assessment of existing information, air photo interpretation, ground investigation and mapping and the sampling and testing of selected sites. Program II, namely Public Information and Evaluation, will ensure that the results of Program I are transferred to potential developers. It is hoped that such an evaluation will provide potential developers with basic information on the nature, size, and potential for the development of the aggregate resources of the Province.

During the 1986/87 fiscal year, the initial phase of the inventory program was completed. Background information on aggregate occurrences was obtained from various sources and studies were undertaken to identify and catalogue known areas of aggregate production and development.

Reconnaissance geological mapping and site investigations were carried out across the Island. Preliminary geophysical testing was conducted in an attempt to find accurate methods of locating and outlining potential aggregate deposits for future development. Preliminary investigations of known deposits have broadly outlined areas of the Province where potential aggregate deposits are likely to occur and have provided greater information on the geological conditions under which these aggregate materials were deposited.

The next phase of the project will involve more detailed studies to better define potential areas for future aggregate development.

NEWFOUNDLAND DEPARTMENT OF MINES

MINERAL DEVELOPMENT DIVISION

INTRODUCTION

The Mineral Development Division of the Newfoundland Department of Mines is responsible for obtaining and disseminating information on the geology and mineral resources of the Province. The Division functions as a geological survey, providing the geoscientific database necessary for government planning and for effective mineral exploration by private industry. The Division carries out continuing programs of bedrock geological mapping, geochemical and geophysical surveys, mineral deposit studies, Quaternary mapping and information services. During 1986, many of these programs were funded under the five year (1984 — 1989) Canada — Newfoundland Mineral Development Agreement. The 1986 field program is summarized in Figure 1 and Table 1.

GEOLOGICAL MAPPING

The Division has carried out geological mapping programs, at the 1:500 000 scale on the island of Newfoundland and at the 1:100 000 scale in Labrador, since the mid-1970s. Maps at these scales are now available for about half the province and the program is continuing.

Six mapping projects were carried out in Newfoundland in 1986. Ian Knight continued his work on the Cambro-Ordovician carbonates along the west coast. Steve Colman-Sadd continued mapping in the central part of the island, north of Bay d'Espoir. New projects were initiated in the northeastern part of the Avalon Zone under S. O'Brien, in the northern Gander Zone, under P. O'Neill and in the Mount Sylvester area under L. Dickson. A new detailed mapping project was also initiated in the area of the Hope Brook gold deposit under B. O'Brien, aimed specifically at solving structural and stratigraphic problems identified by earlier 1:50 000 mapping. Mapping projects on the island were supported, where necessary, by biostratigraphic studies under the direction of Doug Boyce.

Six mapping projects were also active in Labrador last season: B. Ryan continued the Strange Lake project; R. Wardle, C. Gower and J. Connelly led the three projects in the Grenville Province; and A. Kerr worked on the lithogeochemical study of granitoid rocks in the Makkovik area. In addition, A. Thomas carried out some detailed mapping in the vicinity of lake sediment anomalies southwest of Schefferville.

Significant results from the 1986 mapping program include: the recognition of widespread Precambrian deformation and the identification of silicified zones with elevated gold values in the western part of the Avalon Zone; the discovery of anomalous gold values north of Gander; and delineation, in the Makkovik area, of a suite of syn-kinematic, circa 1810 Ma granites, distinct from the circa 1650 Ma granitoids of the trans-Labrador batholith.

GEOCHEMISTRY-GEOPHYSICS

The Division continued its program of regional geochemical and geophysical surveys under the Canada — Newfoundland Mineral Development Agreement. The Geological Survey of Canada carried out a reconnaissance stream sediment survey in the Torngat Mountains in northernmost

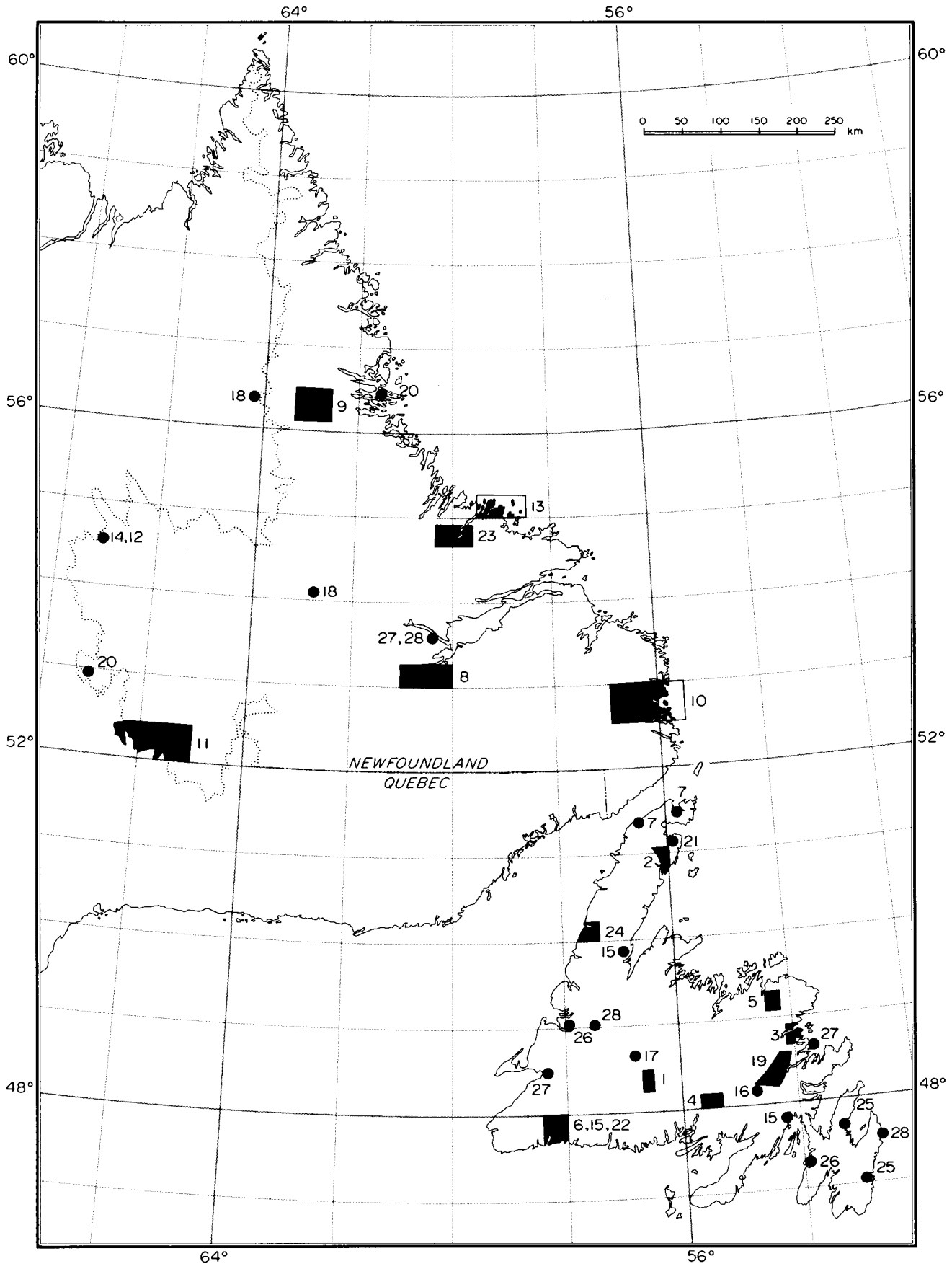


Figure 1. Distribution of field projects, 1986 (Numbers refer to Table 1).

Table 1: Summary of 1986 Field Program
Newfoundland Department of Mines
(Numbers refer to Fig. 1)

No.	Project Geologist	Project Name (and scale)	Area
A. Geological Mapping Sections			
1.	S. Colman-Sad	Bay d'Espoir Project (1:50K)	Snowshoe Pond
2.	I. Knight	Daniel's Harbour Project (1:50K)	Roddickton
3.	S. O'Brien	Avalon Zone Project (1:50K)	Eastport
4.	L. Dickson	Southern Gander Zone (1:50k)	Mount Sylvester
5.	P. O'Neill	Northern Gander Zone (1:50k)	Weirs Pond
6.	B. O'Brien	La Poile Project (1:20k)	Hope Brook
7.	D. Boyce	Biostratigraphic Studies	Pistolet Bay
8.	R. Wardle	Central Grenville Project (1:100k)	Traverspine River
9.	B. Ryan	Strange Lake Project (1:100k)	Cabot Lake
10.	C. Gower	Eastern Greenville Project (1:100k)	Port Hope Simpson
11.	J. Connelly	Western Greenville Project (1:100k)	Lac Fleur de Mai
12.	A. Thomas	Geochemical anomaly investigation	Schefferville
13.	A. Kerr	Lithogeochemistry of granitoid rocks	Makkovik
B. Geochemistry/Geophysics Section			
14.	J. Butler	Geochemical follower-up, Superior Province	Schefferville
15.	J. McConnell	Geochemical exploration methods for gold	White Bay, Burin
16.	H. Miller	Geophysical support — gravity	Ackley Granite
C. Mineral Deposits Section			
17.	B. Kean	Metallogeny of volcanogenic sulphide deposits, Victoria Lake area	Red Indian Lake
18.	R. Miller	Metallogeny of Labrador granitoids	Strange Lake
19.	D. Reusch	Metallogeny of Love Cove volcanic rocks	Clarenville
20.	J. Meyer	Assessment of silica and labradorite deposits, Labrador	Labrador City, Wabush, Nain
21.	A. Howse	Assessment of maarble deposits, western Newfoundland	Roddickton
D. Quarternary Geology Section			
22.	B. Sparkes	Quaternary mapping (1:50k) La Poile area	Hope Brook
23.	M. Batterson	Quaternary maapping (1:50k) Central Mineral Belt	Melody Lake
24.	D. Proudfoot	Quaternary mapping (1:50k) Daniel's Harbour area	Daniel's Harbour
25.	D. Bragg	Diatomaceous earth survey	Avalon Peninsula
26.	M. Ricketts	Aggregate assessment, development areas	Corner Brook

No.	Project Geologist	Project Name (and scale)	Area
27.	F. Kirby	Aggregate assessment, municipal areas	Stephenville, Eastport
E. Publications and Information Section			
28.	A. Harris	Drill core collection and storage	Pasadena, Goose Bay, St. John's

Labrador, from Saglek Fiord to Cape Chidely. This completed the reconnaissance geochemical database for the province. The GSC also carried out airborne gradiometer and gamma ray surveys over large areas on the island of Newfoundland.

The Division also continued its program of follow-up studies over anomalies revealed by regional geochemical surveys. J. Butler conducted follow-up investigations over base metal and precious metal anomalies in western Labrador. J. McConnell continued his investigation of geochemical methods for gold exploration, with particular emphasis on and encouraging results from, detailed lake sediment surveys.

The laboratory continued to meet the analytical requirements of the Division, with major assistance from the new sequential spectrometer installed in 1985. The computer unit, acting on a review of the Division's computer requirements, completed, in 1985, purchase and installation of a new computer system, consisting of a HP 9000 minicomputer and a number of microcomputers, plus associated peripherals and software packages. This new system, which is expected to be fully operational in late 1987, will allow the Division more autonomy in meeting its computer needs, in that it will no longer be dependent on larger government systems designed to meet financial and statistical objectives.

MINERAL DEPOSITS

The Mineral Deposits Section is responsible for metallogenic studies, industrial mineral surveys and mineral inventory. Work continued on four metallogenic studies : metallogeny of volcanogenic sulphide deposits in central Newfoundland, by B. Kean; geological setting and mineralogy of rare earth deposits at Strange Lake and Letitia Lake, by R. Miller; gold potential of the western Avalon Zone, under C. O'Driscoll and D. Reusch; and metallogeny of gold deposits associated with granitoid rocks, by J. Tuach.

A. Howse completed his assessment of marble occurrences in western Newfoundland, outlining major deposits in the Roddickton area, which have since attracted a great deal of interest from industry. J. Meyer continued his study of labradorite occurrences near Nain and completed his assessment of silica deposits in western Labrador. The silica project has outlined large deposits of very high grade silica in the Labrador City area.

C. O'Driscoll and his staff continued (work on) preparation of manual and computerized mineral occurrence files for Labrador (similar files for the island of Newfoundland were completed in 1985). Mineral occurrence maps have now been published for all of the island of Newfoundland, with the exception of two NTS 1:2 500 000 scale sheets for important mineral areas in Labrador.

QUATERNARY GEOLOGY

The Quaternary Geology Section carries out programs in surficial mapping and aggregate resource assessment. Three Quaternary mapping projects were carried out in 1986: B. Sparkes continued his long-term project in southwestern Newfoundland, mapping glacial flow features and glacial stratigraphy in the vicinity of the Hope Brook gold deposit; M. Batterson initiated a new 1:50 000 surficial mapping project in the Melody Lake area of east-central Labrador; D. Proudfoot, a new addition to the staff of the section, completed detailed surficial mapping begun in the Daniel's Harbour area by M. Mihychuk in 1985.

Assessment of aggregate resources continued in 1986, with M. Ricketts examining deposits in the Argentia area. F. Kirby conducted aggregate inventory in municipal areas, concentrating on Stephenville, Goose Bay and Eastport. The Quaternary Section also examined a number of other commodities in 1986, including: pottery clays, by M. Ricketts; diatomaceous earth, by D. Bragg; and high-silica sands, by M. Ricketts.

PUBLICATIONS AND INFORMATION SECTION

Results from the Division's field work were released informally at the annual Open House, and in a number of publications and open files. Some 12 000 m of drill core were added to the Division's drill core collection, under the supervision of Alvin Harris. New core storage facilities were acquired at Buchans with the cooperation of ASARCO and Abitibi-Price.

N. Mercer and his technical information management team had another record year, adding some 500 items to the geological and mineral resource assessment file system and handling some 1200 requests for information.

NORTHWEST TERRITORIES GEOLOGY DIVISION

NORTHERN AFFAIRS PROGRAM, INDIAN AND NORTHERN AFFAIRS CANADA

A major effort of the Northwest Territories (NWT) Geology Division, in 1987, was the planning and execution of the first ever Geological Association of Canada Summer Field Meeting. More than 100 geologists came to take part in 10 field trips to view unrivalled exposures in the Yellowknife Mining District, and 11 trips to mines and deposits in the Slave Structural Province. The Division also planned and hosted the 15th Annual Geoscience Forum, a meeting designed to bring industry, academic and government geo-explorationists together to exchange data on geology, mining and mineral exploration in the NWT.

The first NWT Mineral Development Agreement (MDA) was signed in July 1987 and the first 6 projects were begun, under contract to universities and consultants. Half of the total MDA Geoscience funds ($5.7 million) will be spent through the Geological Survey of Canada, the remainder through the Northwest Territories Government. The NWT Geology Division is providing technical direction, quality control and organizational advice to the (NWT) MDA program. Project officers are to be hired for one year terms.

Continued reduction of resources, mainly the shortfall in summer staff resources, reduced the Division's field program from 19 projects in 1986 to 13 projects in 1987. This decline was offset to some extent by work that was begun on 6 university contracts let under the Mineral Development Agreement. The following table lists the projects conducted in 1987. Most are multi-year studies.

GEOLOGY DIVISION 1987 PROJECTS

PROJECT	DESCRIPTION
PERMANENT STAFF PROJECTS	
1) JACKSON	Russel Lake supracrustal domain mapping (85 J/13, 14 and 0/3, 4), with detailed mapping of areas of volcanic rocks and iron formations.
2) JACKSON	Kathawachaga Lake (76/L) and adjacent areas at 1:50 000, with more detail in areas of supracrustal rocks.

PROJECT	DESCRIPTION
3) BROPHY	Continued work on gold deposits, particularly gold-quartz eins in Burwash Formation turbidites.

UNIVERSITY CONTRACT PROJECTS

PROFESSOR (STUDENT)	UNIVERSITY	1987-88 PROJECT
1) J.A. Donaldson (G. Potts, H. Falck)	Carleton B.Sc., M.Sc.	Volcanology & stratigraphy of the Yellowknife Bay Formation and its relationship to the gold deposits hosted therein.
2) W.S. Fyfe (D. Atkinson)	Western Ontario Ph.D	Continuing study of the Western Plutonic Complex to determine its relevance, if any, to the shear zone hosted gold deposits at Yellowknife.
3) D.W.G. Smith	Alberta	Mineralogy, petrology and genesis of the Lake Zone Cb-Ta deposit at Thor Lake.
4) W.K. Fyson (S. Templeton)	Ottawa B.Sc.	Detailed research on structures and their relationship to mineral deposits in the Slave Province; provide technical advice to staff and field crews of the NWT Geology Division.
5) N.W. Rutter (D. Kerr)	Alberta Ph.D.	Supervise studies of the Quaternary sediments along the Arctic Coast between Paulatuk and Cape Barron.
6) S.A. Bowring (C. Issachson)	Washington, St. Louis Ph.D.	Continue geochronological studies in the Slave Province; supervise mapping and geochronological sampling.
7) A.M. Goodwin	Toronto	Geochemical studies of samples of the High Lake volcanic belt.
8) P. Cerny	Manitoba	Studies of rare metal pegmatites in the Yellowknife Basin; provide a final report of that Basin.

MDA CONTRACTS

OBJECTIVES/DESCRIPTION	UNIVERSITY/ PROFESSOR/ STUDENT	BENEFIT
Study of the iron formation hosted gold deposits in the area of Russell Lake (NTS 850/4) and comparison to Lupintype deposits	Carleton University/Richard Taylor/Dan Bunner — Ph.D.	Develop a genetic model for Bugow type gold deposits and determine which criteria will assist in better understanding and developing exploration and development methodologies.
Detailed mapping and studies on quartz veins in granitoids, mainly in the Anialik River area NTS 76 M/11, 14.	U. of Toronto/Dr. E.T.C. Spooner/Andy Abraham — Ph.D.	Provide better understanding of the geology, genesis and controls on gold-quartz vein deposits along the north edge of the Slave province and possibly assist in their economic development.
Asses the placer gold potential of the Nonacho Group sediments testing for Witwatersrand type of gold deposit.	Carleton University/ Dr. L. Aspler	Assessment of gold potential of the Nonacho group.
Study of rare element pegmatites in Southern Slave Province, Chantrey Inlet and Eskimo Hill areaa of Baffin Island.	U. of Manitoba/ Professor P. Cerny & Dr. Wise	Develop a detailed picture of Slave Province rare metal pegmatites; relate them to other pegmatite deposits in the NWT. Evaluate rare metal pegmatites in NWT.
Mapping of the Beniah Lake straight zone to determine its relationship to the evolution of the Beaulieu River supracrustal belt and its potential as a locus for gold mineralization.	U. of Ottawa/Professor W.K. Fyson/ D. Roach — Ph.D.	Determine if the Beniah Lake straight zone is a locus of gold mineralization and relate the zone to development of the Slave Province and the Beaulieu River volcanic belt.
Study of Knight Bay type gold deposits in turbidites in the Gordon Lake area.	Dalhousie Univ./ Professsor Zentilli & Professor L. Culshaw/ Tim Stokes Ph.D.	Provide detailed information on turbidite hosted quartz stockwork gold deposits, in order to fit them into a regional context and develop criteria for prospecting for this type of deposit.

EXPLORATION AND GEOLOGICAL SERVICES DIVISION
YUKON DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

ACTIVITIES FALL 1986 TO SUMMER 1987

The Exploration and Geological Services Division (EGSD), Yukon, consists of five geologists, an office manager, a map sales person, and a secretary. The Division is part of the Mineral Resources Directorate of the Northern Affairs Program (NAP) in Yukon, as are the Mineral Rights and Mining Engineering Divisions. NAP is one of five programs of the Federal Department of Indian Affairs and Northern Development and has responsibilities in Yukon for mineral resource management, similar to those of a provincial department of mines. The projects described below were funded either by EGSD, or through the Mineral Resources Sub-Agreement of the Canada-Yukon Economic Development Agreement (EDA).

Staff projects included study of precious metal deposits by Jim Morin, mineral deposits in the Ogilvie Mountains by Grant Abbott, gold occurrences and their setting near Sekulmun Lake, west-central Yukon by Dave Downing, tin-tungsten occurrences in central Yukon by Diane Emond, and placer gold deposits by Steve Morison.

Projects sponsored by the Division included the Ketza River gold deposit by Mike Cathro, metamorphism and structure in the aureole of the Mt. Mye Batholith by Jennifer Smith, volcanic rocks in the Tintina Trench by Monica Pride, contact relationships of the Aishihik Batholith by Steve Johnson, the Keno Hill District by Greg Lynch, the Cement Creek subsidence structure by Mike Power, and the Wrangell Lavas by Tom Skulski.

Three 1:50 000 scale mapping projects funded through the Economic Development Agreement and managed by the Division included the Geology of Sab Lake (105 B 7); Meister Lake (115 I 3) and Stoddart Creek (115 I 6) map areas, Dawson Range, by G. Carlson; and Colorado Creek (115 J 10), Selwyn River (115 J 9), and Prospector Mountain (115 I 5) by J.G. Payne, R.A. Gonzales, K. Akhurst, and W.G. Sisson.

Studies of placer gold recovery and lode milling technology were also commissioned by the Mining Engineering Division and funded through the Economic Development Agreement. Placer studies included heap leaching research, wastewater treatment and materials handling research, flocculent research, fine gold recovery research, and pulsator jig field tests. The feasibility of small scale custom/portable milling in Yukon was also investigated.

The Division publishes two volumes annually. 1) "Yukon Exploration" summarizes the results of the previous year's exploration, and contains maps showing the location of and references for all known mineral occurrences in the Yukon; 2) "Yukon Geology" is a collection of reports on studies undertaken or sponsored by the department, as well as others about Yukon geology.

1986-1987

GEOLOGICAL PUBLICATIONS
PROVINCIAL AND TERRITORIAL GEOLOGICAL SURVEYS

BRITISH COLUMBIA

INFORMATION CIRCULARS

B.C. Mineral Exploration Review, 1986: Staff, Geological Survey Branch; Information Circular 1987-1.

B.C. Geological Survey Branch 1987-88 Project Inventory; Information Circular 1987-7.

PAPERS

Geological Fieldwork, 1986: Paper 1987-1, contained the following papers:

T.G. Schroeter: Brief Studies of Selected Gold Deposits inSouthern British Columbia.

B.N. Church: Geology and Mineralization of the Bridge River Mining Camp (92J/15, 92O/2, 92J/10).

B.N. Church: The Pacific Eastern Gold Prospect, Pioneer Extension Property, Lillooet Mining Division (92J/15).

C.H.B. Leitch and C.I. Godwin: The Bralorne Gold Vein Deposit: An Update (92J/15).

B.N. Church: The Bubble Hotspring Deposit, Black Dome Area (92O/8W).

D.G. Reddy, J.V. Ross and C.I. Godwin: Geology of the Hopkins Property, Indian River Area, Southwestern British Columbia (92G/11).

D.G. Reddy and C.I. Godwin: Geology of the Bend Zinc-Lead-Silver Massive Sulphide Prospect, Southeastern British Columbia (83D/1).

Kathryn P.E. Andrew and C.I. Godwin: Capoose Precious and Base Metal Prospect, Central British Columbia (93F/6E).

D.A. Sketchley and A.J. Sinclair: Multielement Lithogeochemistry of Alteration Associated With Gold-Quartz Veins of the Erickson Mine, Cassiar District (104P/4).

G.E. Ray, G.L. Dawson and R. Simpson: The Geology and Controls of Skarn Mineralization in the Hedley Gold Camp, Southern British Columbia (92H/8, 82E/5).

D.J. Alldrick, D.A. Brown, J.E. Harakal, J.K. Mortensen and R.L. Armstrong: Geochronology of the Stewart Mining Camp (104B/1).

D.J. Alldrick, J.E. Gabites and C.I. Godwin: Lead Isotope Data From the Stewart Mining Camp (104B/1).

T.G. Schroeter: Golden Bear Project (104K/1).

T.G. Schroeter and D.V. Lefebure: Toodoggone River Area (94E).

Andrejs Panteleyev: Quesnel Gold Belt — Alkalic Volcanic Terrane Between Horsefly and Quesnel Lakes (93A/6).

Mary Anne Bloodgood: Geology of the Triassic Black Phyllite in the Eureka Peak Area, Central British Columbia (93A/7).

G. Carter and T. Hoy: Geology of Skookumchuck Map Area, Southeastern British Columbia (82G/13W) , J.K. Glover and P. Schiarizza: Geology and Mineral Potential of the Warner Pass Map Sheet (92O/3).

L. Diakow and M. Mihalynuk: Geology of Whitesail Reach and Troitsa Lake Map Areas (93E/10W, 11E).

JoAnne Nelson and John Bradford: Geology of the Area Around the Midway Deposit, Northern British Columbia (104O/16).

K.R. McClay, M.W. Insley, N.A. Way and R. Anderton: Stratigraphy and Tectonics of the Gataga Area, Northeastern British Columbia (94E/16, 94F/14, 94K/4, 94L/1, 94L/7, 94L/8).

D.G. MacIntrye, D. Brown, P. Desjardins and P. Mallett: Babine Project (93L/10, 15).

N.W.D. Massey and S.J. Friday: Geology of the Cowichan Lake Area, Vancouver Island (92C/16).

G.P. McLaren: Geology and Mineral Potential of the Chilko Lake Area (92N/1, 8; 92O4).

P.B. Read: Industrial Minerals in Some Tertiary Basins, Southern British Columbia (92H, 92I).

Jennifer Pell and Z.D. Hora: Geology of the Rock Canyon Creek Fluorite/Rare Earth Element Showing, Southern Rocky Mountains (82J/3E).

J. Pell: Alkalic Utrabasic Diatremes in British Columbia: Petrology, Geochronology and Tectonic Significance (82G, J, N; 83C; 94B).

Olga J. Ijewliw: Comparative Mineralogy of Three Ultramafic Breccia Diatremes in Southeastern British Columbia, Cross, Blackfoot and HP (82J, 82G, 82N).

Urs K. Mader: The Aley Carbonatite Complex, Northern Rocky Mountains, British Columbia (94B/5).

S.B. Butrenchuk: Phosphate Inventory (82G and J).

G.V. White: Olivine Potential in the Tulameen Ultramafic Complex, Preliminary Report (92H/10).

G.V. White: Dimension Stone Quarries in British Columbia.

D.A. Grieve: Weary Ridge and Bleasdell Creek Areas, Elk Valley Coalfield (82J/7).

D.A. Grieve: Subsurface Coal Rank Profiles, Ewin Pass to Bare Mountain, Elk Valley Coalfield, Southeastern British Columbia (82G/15, 82J/2).

D.A. Grieve: Coal Rank Distribution, Flathead Coalfield, Southeastern British Columbia (82G/2, 82G/7).

A. Legun: A Geological Update of the Carbon Creek and Butler Ridge Areas (93O/15, 94B/1).

A. Legun: Relation of Gething Formation Coal Measures to Marine Paleoshorelines (93P, 93I).

W.E. Kilby and C.B. Wrightson: Bullmoose Mapping and Compilation Project (93P/3, 4).

Jane Broatch: Palynolgical Zonation and Correlation of the Peace River Coalfield, Northeastern British Columbia, An Update.

E.L. Faulkner: British Columbia Regional Geochemical Survey Release — An Assessment (93G, 93H and 93J).

P.F. Matysek: A New Look for Regional Geochemical Survey Data.

P.F. Matysek and D.W. Saxby: Comparative Study of Reconnaissance Stream Sediment Sampling Techniques for Gold: Fieldwork (93L).

S. Day and K. Fletcher: Seasonal Variation of Gold Content of Stream Sediments, Harris Creek, Near Vernon (82L/2).

S. Zastavnikovich: Geochemical Follow-up of RGS Data Orientation Report on the Field-Sieved Stream Sediment Sampling Method, Blackwater Mountain Area (93G/2).

S. Zastavnikovich and W.M. Johnson: Regional Geochemical Surveys RGS 16 — Whitesail 93E and RGS 17 — Smithers 93L, West-Central British Columbia.

D.A. Sketchley and A.J. Sinclair: Gains and Losses of Elements Resulting from Wallrock Alteration, a Quantitative Basis for Evaluating Lithogeochemical Samples.

Andree de Rosen-Spence and A.J. Sinclair: Classification of the Cretaceous Volcanic Sequences of British Columbia and Yukon.

Candace E. Kenyon: Coalfile.

A.F. Wilcox and C.B. Borsholm: Minfile — Redesign and Progress Report.

A. Bentzen: Report on the Establishment of a Computer File of Radiometric Dates.

C.I. Godwin and J.E. Gabites: Galena Lead Isotope Research on Mineral Deposits at The University of British Columbia.

V.A. Preto and P. Schiarizza: Geology of the Adams Plateau Clearwater -Vavenby Area, Paper 1987-2.

REGIONAL GEOCHEMICAL SURVEY

B.C. RGS 14 — 1986 (GSC Open File 1215) NTS 93H McBride.

B.C. RGS 15 — 1986 (GSC Open File 1216) NTS 93J McLeod Lake.

B.C. RGS 16 — 1987 93E Whitesail Lake.

B.C. RGS 17 — 1987 93L Smithers.

BULLETINS

Kwong, Y.T.J.: Evolution of the Iron Mask Batholith and its Associated Copper Mineralization; Bulletin 77.

OTHER GEOLOGICAL SURVEY BRANCH PUBLICATIONS

Matysek, P.F.: Regional Geochemical Survey Data Available on Floppy Diskettes (1:250 000 map sheet).

Coal in British Columbia 1986.

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PRELIMINARY MAPS AND NOTES

Grieve, D.A. and Price, R.A.: Geological Setting of the South Half of the Elk Valley Coalfield, Southeastern B.C.; Preliminary Map 63, Scale 1:50 000.

Schroeter, T.G. and Panteleyev, A.: Gold in British Columbia; Preliminary Map 64, Scale 1: 2 000 000.

1986 Producers and Potential Producers, Mineral and Coal; Preliminary Map 65, Scale 1: 2 000 000.

Schroeter, T.G., Crawford, S. and Drown, T.: Developing Properties and New Discoveries of Metallic Minerals in British Columbia: 1965-86; Preliminary Map 66, Scale 1:2 000 000.

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MacIntyre, D., Desjardins, P., Mallett, P. and Brown, D.: Geology of the Dome Mountain Area (93L/10, 15) (1: 20 000); Open File 1987-1.

Massey, N.W.D., Friday, S.T., Tercier, P., and Rublee, V.J.: Geology of the Cowichan Lake Area (92C/16) (1:50 000, 1:20 000); Open File 1987-2.

Glover, J.K., Schiarizza, P, Umhoefer, P.S. and Garver, J.: Geology and Mineral Potential of the Warner Pass Map Sheet (92O/3) (1:50 000); Open File 1987-3.

Diakow, L, and Mihalynuk, M.: Whitesail Lake Area; Geology and Epithermal Gold and Silver Prospects (93E/10W, 11E) (1:50 000); Open File 1987-4.

Nelson, J. and Bradford, J.: Geology of the Midway Area, Northern British Columbia (104O/16) (1:25 000); Open File 1987-5.

Kilby, W. and Wrightson, C.B.: Bullmoose Creek (93P/3) (1:50 000); Open File 1987-6.

Kilby, W. and Wrightson, C.B.: Sukunka River (93P/4) (1:50 000); Open File 1987-7.

Carter, G., and Hoy, T.: Geology of the Skookumchuk Map Area (West Half), Southwestern British Columbia (82G/13W) (1:50 000); Open File 1987-8.

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Ray, G.E., and Dawson, G.L.: Geology and Mineral Occurrences in the Hedley Gold Camp, Southern British Columbia (92H/8E) (1:20 000); Open File 1987-10a, 10b, 10c.

Church, B.N. and MacLean, M.E.: Geology of the Gold Bridge Area (92J/15W) (1:20 000); Open File 1987-11.

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Pell, J.: Alkaline Ultrabasic Rocks in British Columbia: Carbonatites, Nepheline Syenites, Kimberlites, Ultramafic Lamprophyres and Related Rocks; Open File 1987-17.

Mortimer, N.: Geological Map of Part of the Pavilion Map Area, B.C. (92I/13) (1:50 000); Open File 1987-18.

Read, P.B.: Tertiary Stratigraphy and Industrial Minerals, Princeton and Tulameen Basins, British Columbia (92H/2, 7, 8, 9, 10) (1:25 000); Open File 1987-19.

Bloodgood, M.A., Marks, K.E. and Panteleyev, A.: Near Shore Mineral Resources, Deep Sea Ridge Systems and Metal Deposits (1:2 000 000); Open File 1987-20.

Legun, A.: Carbon Creek Map Area (93O/15) (1:50 000); Open File 1987-21.

Alldrick, D.A.: Geology and Mineral Deposits of the Salmon River Valley, Stewart Area (104A, B) (1:50 000); Open File 1987-22.

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— and Kwong, Y.T.J. 1986: The Mount Grace Carbonatite — A Nb and light rare earth element enriched marble of probable pyroclastic origin in the Shuswap Complex, southeastern British Columbia; Economic Geology, Volume 81, p. 1347-86.

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—, Demant, A., Armstrong, R.L., and Harakal, J.E. 1987: K-Ar and geological data bearing on the age and evolution of the Trans-Mexican Volcanic Belt; Geofisica Internacional, Volume 26, p. 109-158.

— and Pearce, T.H. In Press: A laser interferometry study of oscillatory zoning in plagioclase: the record of magma mixing and phenocryst recycling in calc-alkaline magma chambers, Iztaccihuatl volcano, Mexico; American Mineralogist.

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Wilson, J.A. 1986: Geology of the basement beneath the Athabasca Basin in Alberta; Alberta Research Council Bulletin No. 55, 61 p.

OPEN FILE REPORTS

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MacGillivray, J.R. 1986: GEODIAL Users Guide; Alberta Research Council Open File Report 1986-17.

MAPS

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— 1986u: SONIC DRILLHOLE 85-24, ELLIOT TOWNSHIP, NTS 32D/5NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 865, SCALE 1:100 000

— 1986v: SONIC DRILLHOLE 85-25, THACKERAY TOWNSHIP, NTS 32D/5NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 866, SCALE 1:100 000

— 1986w: SONIC DRILLHOLES 85-26 AND 85-28, GARRISON TOWNSHIP, NTS 32D/5NW AND 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 867, SCALE 1:100 000

— 1986x: SONIC DRILLHOLE 85-27, GARRISON TOWNSHIP, NTS 32D/5NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 868, SCALE 1:100 000

— 1986y: SONIC DRILLHOLE 85-29, RAND TOWNSHIP, NTS 32D/12NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 869, SCALE 1:100 000

— 1986z: SONIC DRILLHOLE 85-30, RAND TONWHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 870, SCALE 1:100 000

— 1986A: SONIC DRILLHOLE 85-31, ABITIBI INDIAN RESERVE 70, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 871, SCALE 1:100 000

— 1986B: SONIC DRILLHOLE 85-32, RAND TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 872, SCALE 1:100 000

— 1986C: SONIC DRILLHOLE 85-33, ABITIBI INDIAN RESERVE 70, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 873, SCALE 1:100 000

— 1986D: SONIC DRILLHOLE 85-34, RAND TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 874, SCALE 1:100 000

— 1986E: SONIC DRILLHOLES 85-35 AND 85-36, GARRISON AND HARKER TOWNSHIPS, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 875, SCALE 1:100 000

— 1986F: SONIC DRILLHOLES 85-37 AND 85-38, HARKER TOWNSHIP, NTS 32D/5NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 876, SCALE 1:100 000

— 1986G: SONIC DRILLHOLE 85-39, HARKER TOWNSHIP, NTS 32D/5NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 877, SCALE 1:100 000

— 1986H: SONIC DRILLHOLE 85-40, HARKER TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 878, SCALE 1:100 000

— 1986I: SONIC DRILLHOLE 85-41, LAMPLUGH TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 879, SCALE 1:100 000

— 1986J: SONIC DRILLHOLE 85-42, LAMPLUGH TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 880, SCALE 1:100 000

— 1986K: SONIC DRILLHOLES 85-43 AND 85-44, LAMPLUGH TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 881, SCALE 1:100 000

— 1986L: SONIC DRILLHOLE 85-45, HOLLOWAY TOWNSHIP, NTS 32D/12SE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 882, SCALE 1:100 000

— 1986M: SONIC DRILLHOLE 85-46, HOLLOWAY TOWNSHIP, NTS 32D/12SE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 883, SCALE 1:100 000

— 1986N: SONIC DRILLHOLES 85-47 AND 85-48, STOUGHTON TOWNSHIP, NTS 32D/12SE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 884, SCALE 1:100 000

— 1986O: SONIC DRILLHOLES 85-49 AND 85-50, HOLLOWAY AND HARKER TOWNSHIPS, NTS 32D/5NW AND 32D/12SE, COCHRANE DSITRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 885, SCALE 1:100 000

— 1986P: SONIC DRILLHOLE 85-51, GARRISON TOWNSHIP, NTS 32D/12SW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 886, SCALE 1:100 000

— 1986Q: SONIC DRILLHOLE 85-52, MCCOOL TOWNSHIP, NTS 42A/9SE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 887, SCALE 1:100 000

— 1986R: SONIC DRILLHOLE 85-53, THOMAS TOWNSHIP, NTS 42A/7NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 888, SCALE 1:100 000

— 1986S: SONIC DRILLHOLE 85-54, SHERATON TOWNSHIP, NTS 42A/7NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 889, SCALE 1:100 000

— 1986T: SONIC DRILLHOLES 85-55 AND 85-56, SHERATON AND EGAN TOWNSHIPS, NTS 42A/7N, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 890, SCALE 1:100 000

— 1986U: SONIC DRILLHOLE 85-57, EGAN TOWNSHIP, NTS 42A/7NE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 891, SCALE 1:100 000

— 1986V: SONIC DRILLHOLE 85-58, BOND TOWNSHIP, NTS 42A/10SE, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 892, SCALE 1:100 000

— 1986W SONIC DRILLHOLES 85-59 AND 85-60, TAYLOR TOWNSHIP, NTS 42A/10SE AND COOK TOWNSHIP, NTS 42A/8NW, COCHRANE DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 893, SCALE 1:100 000

Airborne electromagnetic survey maps

GEOTERREX LIMITED 1986a: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/5NE, 52O/6NW, 52O/11SW AND 52O/12SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 894, SCALE 1:20 000

— 1986b: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/6NW AND 52O/11SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 895, SCALE 1:20 000

— 1986c: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/5E AND 52O/6W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 896, SCALE 1:20 000

— 1986d: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/6W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 897, SCALE 1:20 000

— 1986e: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 052O/6, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 898, SCALE 1:20 000

— 1986f: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/6E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 899, SCALE 1:20 000

— 1986g: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/6S, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 900, SCALE 1:20 000

— 1986h: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/6SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 901, SCALE 1:20 000

— 1986i: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 902, SCALE 1:20 000

— 1986j: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3N, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 903, SCALE 1:20 000

— 1986k: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3NE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 904, SCALE 1:20 000

— 1986l: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 905, SCALE 1:20 000

— 1986m: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3NW AND 52O/4NE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 906, SCALE 1:20 000

— 1986n: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3NW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 907, SCALE 1:20 000

— 1986o: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/3W AND 52O/4E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 908, SCALE 1:20 000

— 1986p: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7E AND 52O/8W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 909, SCALE 1:20 000

— 1986q: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7SE AND 52O/8SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 910, SCALE 1:20 000

— 1986r: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 911, SCALE 1:20 000

— 1986s: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 912, SCALE 1:20 000

— 1986t: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7S, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 913, SCALE 1:20 000

— 1986u: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 914, SCALE 1:20 000

— 1986v: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7SE AND 52O/8SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 915, SCALE 1:20 000

— 1986w: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1NW AND 52O/8SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 916, SCALE 1:20 000

— 1986x: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8S, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 917, SCALE 1:20 000

— 1986y: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8S, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 918, SCALE 1:20 000

— 1986z: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/2NW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 919, SCALE 1:20 000

— 1986A: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/2N, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 920, SCALE 1:20 000

— 1986B: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/2NE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 921, SCALE 1:20 000

— 1986C: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1NW AND 52O/2NE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 922, SCALE 1:20 000

— 1986D: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/12NW AND 52P/13SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 923, SCALE 1:20 000

— 1986E: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/9E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 924, SCALE 1:20 000

— 1986F: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/12W, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 925, SCALE 1:20 000

— 1986G: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/9SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 926, SCALE 1:20 000

— 1986H: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/9SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 927, SCALE 1:20 000

— 1986I: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/12SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 928, SCALE 1:20 000

— 1986J: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/7NE, 52O/8NW, 52O/9SW AND 52O/10SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 929, SCALE 1:20 000

— 1986K: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8NW AND 052O/09SW, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 930, SCALE 1:20 000

— 1986L: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8NE AND 52O/9SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 931, SCALE 1:20 000

— 1986M: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8NE AND 52O/9SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 932, SCALE 1:20 000

— 1986N: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/5NE AND 52P/12SE, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 933, SCALE 1:20 000

— 1986O: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/8E, PATRICIA KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 934, SCALE 1:20 000

— 1986P: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1NE, PATRICIA KENROA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 935, SCALE 1:20 000

— 1986Q: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1W, THUNDER BAY AND PATRICIA KENORA DISTRICTS; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 936, SCALE 1:20 000

— 1986R: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1, THUNDER BAY AND PATRICIA KENORA DISTRICTS; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 937, SCALE 1:20 000

— 1986S: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52O/1E, THUNDER BAY AND PATRICIA KENORA DISTRICTS; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 938, SCALE 1:20 000

— 1986T: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/4W, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 939, SCALE 1:20 000

— 1986U: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/4, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 940, SCALE 1:20 000

— 1986V: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/4E, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 941, SCALE 1:20 000

— 1986W: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/3NW AND 52P/4NE, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 942, SCALE 1:20 000

— 1986X: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/16NW AND 52O/1SW, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 943, SCALE 1:20 000

— 1986Y: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/16N AND 52O/1S, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 944, SCALE 1:20 000

— 1986Z: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/16NE AND 52O/1SE, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 945, SCALE 1:20 000

— 1986aa: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52I/13NW AND 52P/4SW, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 946, SCALE 1:20 000

— 1986bb: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52I/13N AND 52P/4S, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 947, SCALE 1:20 000

— 1986cc: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/4SE, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 948, SCALE 1:20 000

— 1986dd: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52P/3W AND 52P/4E, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 949, SCALE 1:20 000

— 1986ee: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/13NW, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 950, SCALE 1:20 000

— 1986ff: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/13N, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 951, SCALE 1:20 000

— 1986gg: AIRBORNE ELECTROMAGNETIC SURVEY AND TOTAL INTENSITY MAGNETIC SURVEY, PICKLE LAKE AREA, NTS 52J/13NE, THUNDER BAY DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 952, SCALE 1:20 000

ONTARIO GEOLOGICAL SURVEY 1987a: AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, DRYDEN AREA, NTS 52K/1SW AND 52K/2SE, KENORA; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 953, SCALE 1:20 000

— 1987b: AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, DRYDEN AREA, NTS 52K/1SW, KENORA DISTRICT; ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 80 954, SCALE 1:20 000

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PRELIMINARY MAPS

Sand and gravel assessment maps

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— 1987c: SAND AND GRAVEL ASSESSMENT OF FRONTENAC COUNTY, NORTH SHEET, NTS 31C/N AND 31F/S, MILLER, N. CANONTO, S. CANONTO, BARRIE, CLARENDON, PALMERSTON TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2693, SCALE 1:50 000

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— 1987g: SAND AND GRAVEL ASSESSMENT OF HASTINGS COUNTY, SOUTH SHEET, NTS 31C/W, ROWDON, HUNTINGDON, HUNGERFORD, SIDNEY, THURLOW, TYENDINAGA TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2977, SCALE 1:50 000

— 1987h: SAND AND GRAVEL ASSESSMENT HASTINGS COUNTY, SOUTH-CENTRAL SHEET, NTS 31C/NW, LAKE, TUDOR, GRIMSTHORPE, MARMORA, MADOC, ELZEVIR TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2978, SCALE 1:50 000

— 1987i: SAND AND GRAVEL ASSESSMENT OF HASTINGS COUNTY, NTS 31C/NW AND 31F/SW, FARADAY, DUNGANNON, MAYO, WOLLASTON, LIMERICK, CASHEL TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2979, SCALE 1:50 000

— 1987j: SAND AND GRAVEL ASSESSMENT OF HASTINGS COUNTY, NORTH SHEET, NTS 31E/SE AND 31F/SW, MCCLURE, WICKLOW, BANGOR, HERSCHEL, MONTEAGLE, CARLOW TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2980, SCALE 1:50 000

Bedrock aggregate assessment maps

— 1987k: BEDROCK AGGREGATE ASSESSMENT OF FRONTENAC COUNTY, SOUTH SHEET, NTS 31C/E, PORTLAND, LOUGHBOROUGH, STORRINGTON, KINGSTON, PITTSBURGH, HOWE ISLAND, WOLFE ISLAND TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2694, SCALE 1:50 000

— 1987l: BEDROCK AGGREGATE ASSESSMENT OF LENNOX AND ADDINGTON COUNTY, SOUTH SHEET, NTS 31C/S, RICHMOND, CAMDEN EAST, N. FREDERICKSBURGH, ERNESTOWN, ADOLPHUSTOWN, S. FREDERICKSBURGH, AMHERST ISLAND TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2976, SCALE 1:50 000

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— 1987n: BEDROCK AGGREGATE ASSESSMENT OF HASTINGS COUNTY, SOUTH-CENTRAL SHEET, NTS 31C/W, LAKE, TUDOR, GRIMSTHORPE, MARMORA, MADOC, ELZEVIR TOWNSHIPS; ONTARIO GEOLOGICAL SURVEY, MAP P-2982, SCALE 1:50 000

Petroleum resources maps

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— 1986b: SILURIAN SANDSTONE OIL AND GAS POOLS, LAKE ERIE (MAP B), NTS 30L/5NW, 30L/12 AND 30L/13, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2863, SCALE 1:100 000

— 1986c: SILURIAN SANDSTONE OIL AND GAS POOLS, LAKE ERIE (MAP C), NTS 40I/8, 40I/9 AND 40I/16S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2864, SCALE 1:100 000

— 1986d: SILURIAN SANDSTONE OIL AND GAS POOLS, LAKE ERIE (MAP D), NTS 40I/7 AND 40I/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2865, SCALE 1:100 000

— 1986e: SILURIAN SANDSTONE OIL AND GAS POOLS, LAKE ERIE (MAP E), NTS 40I/3N, 40I/6 AND 40I/11; ONTARIO GEOLOGICAL SURVEY, MAP P-2866, SCALE 1:100 000

— 1986f: SILURIAN SANDSTONE OIL AND GAS POOLS, LAKE ERIE (MAP F), NTS 40I/4 AND 40I/5, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2867, SCALE 1:100 000

— 1986g: SILURIAN SANDSTONE OIL AND GAS POOLS, ELGIN COUNTY, NTS 40I/5NE, 40I/NW, 40I/10N AND 40I/15, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2868, SCALE 1:100 000

— 1986h: SILURIAN SANDSTONE OIL AND GAS POOLS, OXFORD COUNTY, NTS 40I/15, 40P/1NW, 40P/2, 40P/3E, 40P/6SE, 40P/7S AND 40P/8SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2869, SCALE 1:100 000

— 1986i: SILURIAN SANDSTONE OIL AND GAS POOLS, REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK, NTS 30L/13, 30L/14, 30M/4, 40I/NE AND 40P/1, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2870, SCALE 1:100 000

— 1986j: SILURIAN SANDSTONE OIL AND GAS POOLS, BRANT COUNTY, NTS 40I/16NE AND 40P/SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2871, SCALE 1:100 000

— 1986k: SILURIAN SANDSTONE OIL AND GAS POOLS, REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH, NTS 30M/4, 30M/5, 40P/1N AND 40P/8, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2872, SCALE 1:100 000

— 1986l: SILURIAN SANDSTONE OIL AND GAS POOLS, REGIONAL MUNICIPALITY OF NIAGARA, NTS 30L/14N, 30L/15NW, 30M/3 AND 30M/4, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2873, SCALE 1:100 000

— 1986A: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP A), NTS 30L/11NW, 30L/14 AND 30L/15W, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2874, SCALE 1:100 000

— 1986B: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP B), NTS 30L/5NW, 30L/12 AND 30L/13S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2875, SCALE 1:100 000

— 1986C: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP C), NTS 40I/8, 40I/9 AND 40I/16S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2876, SCALE 1:100 000

— 1986D: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP D), NTS 40I/7 AND 40I/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2877, SCALE 1:100 000

— 1986E: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP E), NTS 40I/3, 40I/6 AND 40I/11, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2878, SCALE 1:100 000

— 1986F: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP F), NTS 40H/13N, 40I/4, 40I/5 AND 40I/12SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2879, SCALE 1:100 000

— 1986G: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP G), NTS 40G/9N, 40G/16, 40J/1 AND 40J/8SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2880, SCALE 1:100 000

— 1986H: STRUCTURE TOP ROCHESTER FORMATION, LAKE ERIE (MAP H), NTS 40G/10N, 40G/14, 40G/15, 40J/2S AND 40J/3S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2881, SCALE 1:100 000

— 1986I: STRUCTURE TOP ROCHESTER FORMATION, ESSEX COUNTY, NTS 40G/15N, 40G/16NW, 40J/SE, 40J/3E AND 40J/6SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2882, SCALE 1:100 000

— 1986J: STRUCTURE TOP ROCHESTER FORMATION, KENT COUNTY, NTS 40I/5, 40I/12, 40J/SE, 40J/9 AND 40J/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2883, SCALE 1:100 000

— 1986K: STRUCTURE TOP ROCHESTER FORMATION, LAMBTON COUNTY, NTS 40I/12NW, 40I/13W, 40J/7NE, 40J/8NW, 40J/NE, 40O/1, 40P/4W AND 40P/5SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2884, SCALE 1:100 000

— 1986L: STRUCTURE TOP ROCHESTER FORMATION, MIDDLESEX COUNTY, NTS 40I/NW, 40I/15NW, 40O/2SW AND 40O/SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2885, SCALE 1:100 000

— 1986M: STRUCTURE TOP ROCHESTER FORMATION, ELGIN COUNTY, NTS 40I/5N, 40I/10N, 40I/NW AND 40I/15, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2886, SCALE 1:100 000

— 1986N: STRUCTURE TOP ROCHESTER FORMATION, OXFORD COUNTY, NTS 40I/15N, 40P/SE, 40P/3E AND 40P/6SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2887, SCALE 1:100 000

— 1986O: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK, NTS 30L/13N, 30L/14NW, 30M/4, 40I/NE AND 40P/1SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2888, SCALE 1:100 000

— 1986P: STRUCTURE TOP ROCHESTER FORMATION, BRANT COUNTY, NTS 30M/4NW, 40I/15NW, 40I/16NE, 40P/SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2889, SCALE 1:100 000

— 1986Q: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF NIAGARA, NTS 30L/14N, 30L/15NW AND 30M/SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2890, SCALE 1:100 000

— 1986R: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH, NTS 30M/4, 30M/5, 40P/1NE AND 40P/8, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2891, SCALE 1:100 000

— 1986S: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF HALTON, NTS 30M/5, 30M/12, 40P/8NE AND 40P/9E, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2892, SCALE 1:100 000

— 1986T: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF WATERLOO, NTS 40P/7, 40P/8, 40P/9 AND 40P/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2893, SCALE 1:100 000

— 1986U: STRUCTURE TOP ROCHESTER FORMATION, PERTH COUNTY, NTS 40P/03NE, 40P/6, 40P/7, 40P/10, 40P/11, 40P/14SE AND 40P/15SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2894, SCALE 1:100 000

— 1986V: STRUCTURE TOP ROCHESTER FORMATION, HURON COUNTY, NTS 40P/5, 40P/6, 40P/NW, 40P/15W AND 41A/4SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2895, SCALE 1:100 000

— 1986W: STRUCTURE TOP ROCHESTER FORMATION, WELLINGTON COUNTY, NTS 30M/12SW, 40P/8, 40P/NE AND 41A/2SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2896, SCALE 1:100 000

— 1986X: STRUCTURE TOP ROCHESTER FORMATION, REGIONAL MUNICIPALITY OF PEEL, NTS 30M/12, 30M/13 AND 40P/16E, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2897, SCALE 1:100 000

— 1986Y: STRUCTURE TOP ROCHESTER FORMATION, DUFFERIN COUNTY, NTS 30M/13NW, 31D/4SW, 40P/16, 41A/1 AND 41A/8SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2898, SCALE 1:100 000

— 1986Z: STRUCTURE TOP ROCHESTER FORMATION, SIMCOE COUNTY, NTS 30M/13NW, 31D/4, 31D/5, 31D/NW AND 41A/8, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2899, SCALE 1:100 000

— 1986aA: STRUCTURE TOP ROCHESTER FORMATION, BRUCE COUNTY, NTS 40P/13N, 40P/14N, 41A/SW, 41A/11, 41A/14, 41H/3 AND 41H/4, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2900, SCALE 1:100 000

— 1986aB: STRUCTURE TOP ROCHESTER FORMATION, GREY COUNTY, NTS 40P/15N AND 41A, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2901, SCALE 1:100 000

— 1986aa: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP A), NTS 30L/11, 30L/14S AND 30L/15SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2902, SCALE 1:100 000

— 1986bb: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP B), NTS 30L/5NW, 30L/12 AND 30L/13S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2903, SCALE 1:100 000

— 1986cc: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP C), NTS 40I/8, 40I/9 AND 40I/16S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2904, SCALE 1:100 000

— 1986dd: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP D), NTS 40I/7 AND 40I/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2905, SCALE 1:100 000

— 1986ee: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP E), NTS 40I/3NW, 40I/6 AND 40I/11, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2906, SCALE 1:100 000

— 1986ff: ISOPACH SILURIAN THOROLD SANDSTONE, LAKE ERIE (MAP F), NTS 40H/13N, 40I/4 AND 40I/5, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2907, SCALE 1:100 000

— 1986gg: ISOPACH SILURIAN THOROLD SANDSTONE, ELGIN COUNTY, NTS 40I/5NE, 40I/10NW, 40I/11N, 40I/12, 40I/14 AND 40I/15SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2908, SCALE 1:100 000

— 1986hh: ISOPACH SILURIAN THOROLD SANDSTONE, MIDDLESEX COUNTY, NTS 40I/NW, 40I/15NW, 40P/2SW AND 40P/SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2909, SCALE 1:100 000

— 1986ii: ISOPACH SILURIAN THOROLD SANDSTONE, REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK, NTS 30L/13, 30L/14NW, 30M/4S,

— 1986jj: ISOPACH SILURIAN THOROLD SANDSTONE, OXFORD COUNTY, NTS 40I/15, 40P/2, 40P/3E, 40P/6SE, 40P/7S AND 40P/8SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2911, SCALE 1:100 000

— 1986kk: ISOPACH SILURIAN THOROLD SANDSTONE, BRANT COUNTY, NTS 30M/4NW, 40I/15NW, 40I/16NE AND 40P/SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2912, SCALE 1:100 000

— 1986ll: ISOPACH SILURIAN THOROLD SANDSTONE, REGIONAL MUNICIPALITY OF NIAGARA, NTS 30L/14, 30L/15NW AND 30M/SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2913, SCALE 1:100 000

— 1986mm: ISOPACH SILURIAN THOROLD SANDSTONE, REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH, NTS 30M/4, 30M/5, 40P/1 AND 40P/8, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2914, SCALE 1:100 000

— 1986nn: ISOPACH SILURIAN THOROLD SANDSTONE, WELLINGTON COUNTY, NTS 30M/12NW, 40P/8, 40P/NE AND 41A/01SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2915, SCALE 1:100 000

— 1986AA: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP A), NTS 30L/11, 30L/14N AND 30L/15NW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2916, SCALE 1:100 000

— 1986BB: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP B), NTS 30L/5NW, 30L/12 AND 30L/13S, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2917, SCALE 1:100 000

— 1986CC: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP C), NTS 40I/8N, 40I/9 AND 40I/16SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2918, SCALE 1:100 000

— 1986DD: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP D), NTS 40I/7 AND 40I/10, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2919, SCALE 1:100 000

— 1986EE: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP E), NTS 40I/3, 40I/6 AND 40I/11, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2920, SCALE 1:100 000

— 1986FF: ISOPACH SILURIAN GRIMSBY SANDSTONE, LAKE ERIE (MAP F), NTS 40H/13NW, 40I/4, 40I/5 AND 40I/12SE, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2921, SCALE 1:100 000

— 1986GG: ISOPACH SILURIAN GRIMSBY SANDSTONE, ELGIN COUNTY, NTS 40I/5NE, 40I/NW, 40I/10NW AND 40I/15, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2922, SCALE 1:100 000

— 1986HH: ISOPACH SILURIAN GRIMSBY SANDSTONE, MIDDLESEX COUNTY, NTS 40I/NW, 40I/15NW, 40P/2SW AND 40P/SW, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MAP P-2923, SCALE 1:100 000

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INAC — Indian and Northern Affairs Canada
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Brophy, J.A. 1986: Geology of the Lower Crestaurum Formation in the Fred Henne Park Area (NTS 85 J/8); INAC, NAP, Geology Division, EGS 1986-13, 1 map, scale 1:2 000.

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Clark, A.: A Mineral Development Agreement for the NWT.

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Nikhanj, J.: Gold Showings in the Archean Rankin-Ennadai Greenstone Belt, NWT.

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Sawiuk, M.: Sediment-hosted Stratabound Copper and Uranium Mineralization in the Bear Province.

Smith, D.G.W.: Economic Geology and Mineralogy, Lake-Zone, Thor Lake Rare Metal Deposits: Report on 1986 Field Work.

Swatton, S.: The Structure and Mineralogy of the Bullmoose Lake Gold Deposit.

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YUKON (INFORMATON CIRCULARS 1986/87)

REPORTS

Economic Development Agreement (EDA) placer research program:

Fine gold recovery of selected sluicebox configuratons; University of British Columbia

Materials handling technology; Wright engineers

Wastewater treatment technology; Sigma Resource Consultants

Flocculant test program; Stanley and Associates

PAPERS

YUKON GEOLOGY VOLUME 1 contained the following papers.

B.W.R. MCDONALD and C.I. GODWIN: Geology of the Main Zone at Mt. Skukum, Wheaton River area, southern Yukon.

L.D. MEINERT: Gold in skarns of the Whitehorse Copper Belt.

M.B. DUFRESNE, S.R. MORISON and B.E.NESBITT: Evidence of hydrothermal alteration in White Channel sediments and bedrock of the Klondike area, west-central Yukon.

R.L. HUGHES and S.R. MORISON: Placer gravels of Miller Creek, Sixtymile River area, 116 B-C, Yukon.

J.G. ABBOTT: Epigenetic mineral deposits of the Ketza-Seagull District, Yukon.

L. WALTON: Textural characteristics of the Venus vein and implicatons for ore shoot distribution.

J.L. DUKE and C.I. GODWIN: Geology and alteration of the Grew Creek epithermal gold-silver prospect, south-central Yukon.

K.W. WATSON: Silver-lead-zinc deposits of the Keno Hill-Galena Hill area, central Yukon.

G. LYNCH: Mineral zoning in the Keno Hill Ag-Pb-Zn mining district, Yukon.

J.P. FRANZEN: Metal-ratio zonation in the Keno Hill Disrict, central Yukon.

J.G. ABBOTT: Geology of the PLATA-INCA property, Yukon.

D.S. EMOND: Tin and tungsten veins and skarns in the McQuesten River area, central Yukon.

V.L. HANSEN: Preliminary structural and kinematic analysis of mylonitic rocks of the Teslin Suture zone, 105 E, Yukon.

V.L. HANSEN: Petrotectonic study of the Teslin Suture Zone, Yukon: a progress report.

D.T. OSBORNE, G.M. NARBONNE and J. CARRICK: Stratigraphy and economic potential of Precambrian-Cambrian boundary strata, Wernecke Mountains, east-central Yukon.

L.E. JACKSON, S.P. GORDEY, R.L. ARMSTRONG and J.E. HARAKAL: Bimodal Paleogene volcanics near Tintina Fault, east-central Yukon and their possilbe relationship to placer gold.

M.J. PRIDE: Description of the Mount Skukum Volcanic Complex, southern Yukon.

T. SKULSKI and D. FRANCIS: On the geology of the Tertiary Lavas in the St. Clare Province, St. Elias Mountains, Yukon.

M.D. ALBANESE, T.E. SMITH, M.S. ROBINSON and T.K. BUNDTZEN: Summary of DGGS investigations at Livengood, Alaska: Geology, mineral potential and regional correlation with east- central Yukon.

REGIONAL GEOCHEMICAL SURVEYS (EDA funded, EMR managed).

GSC OPEN FILE 1217 (105 C): Regional Stream Sediment and Water Geochemical Reconnaissance Data.

GSC OPEN FILE 1218 (105 d): Regional Stream Sediment and Water Geochemical Reconnaissance Data.

GSC OPEN FILE 1219 (115 H): Regional Stream Sediment and Water Geochemical Reconnaissance Data.

GSC OPEN FILE 1220 (115 I): Regional Stream Sediment and Water Geochemical Reconnaissance Data.

GSC OPEN FILE 1289 (105 B): Regional Stream Sediment and Water Geochemical Reconnaissance Data (Au only).

GSC OPEN FILE 1290 (105 F): Regional Stream Sediment and Water Geochemical Reconnaissance Data (Au only).

OPEN FILES

Lowey, G.W. and Lowey, J.F., Geology of the Spencer Creek (105 B 1) and Daughney Lake (105 B 2) map areas, Rancheria District, Southeast Yukon; Open File 1986-1, text with two 1:50 000 scale maps).

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Abbott, J.G., Gordey, S.P. and Tempelman-Kluit, D.J. 1987: Setting of stratiform, sediment-hosted lead-zinc deposits in Yukon and northeastern British Columbia; p. 1-18 in Mineral Deposits of Northern Cordillera, J.A. Morin ed., CIM Special Volume 37.

Gordey, S.P., Abbott, J.G., Tempelman-Kluit, D.J. and H. Gabrielse 1987: "Antler" clastics in the Canadian Cordillera; Geology, Volume 15, p. 103-107.

Morison, S.R. and Hein, Frances J. 1987: Sedimentology of the White Channel Gravels, Klondike area, Yukon Territory: fluvial deposits of a confined valley; p. 206-216 in Recent Developments in Fluvial Sedimentology, F.G. Ethrudge, R.M. Flores, and M.D. Harvey, eds., S.E.P.M., Special Publication 39.

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Presented at the Cordilleran Geology and Exploration Round-Up in Vancouver January 1987:

Abbott, J.G. Mineral deposits of the Ogilvy Mountains.

Carlson, G. Bedrock geology and mineralization of the Mount Nansen — Big Creek Areas, 115 I 3 and 6.

Morin, J.A. 1986 Mining, mineral exploration, and government geoscience activities in Yukon.

Morision, S.R. The future of Yukon placer mining: reserves, exploration targets.

Payne, J. Bedrock geology and mineralization of the central Dawson Range, 115 J 9, 10 and 115 I 3 and 6.

Pride, M.S. Cenozoic volcanic rocks in central Tintina Trench.

Skulski, T. Stratigraphy, structure and alteration of Wrangell volcanic rocks in the St. Clare Creek area of the Kluane Ranges.

Morin, J.A. and R. Stroshein 1987: Disseminated precious metal exploration targets in Yukon; abstract, Bulk Mineable precious metal deposits of the western United States, Geological Society of Nevada Symposium.

ARTICLES

REPORTS ON TECHNICAL LIAISON COMMITTEES

Technical Liaison Committees have been formed in each province and territory to act as advisory bodies to government sponsored geoscience programs. The introduction of such committess was formally endorsed by Provincial and Terrotirial Mines Ministers at their 40th Annual Meeting held in Regina in 1983.

THE YUKON MINERAL EXPLORATION LIAISON COMMITTEE

The Yukon Mineral Exploration Liaison Committee (YMELC) was formed in the spring of 1984. The Chairman is the Chief Geologist of Exploration and Geological Services Division (EGSD) of the DIAND Northern Affairs Program in the Yukon. The YMELC meets semi-annually in the spring and fall and is used as a consultative group to advise on the merits of projects currently being undertaken, finished and being considered for the future of EGSD. Minutes of the meetings (including YMELC recommendations and comments) are directed to the Director of Mineral Resources of the Northern Affairs Program in the Yukon.

Membership is as follows:

President of the Yukon Chamber of Mines

President of the Yukon Prospectors Association

Representative of the executive of the Whitehorse Branch of the Canadian Institute of Mining and Metallurgy

Representative of a major private sector mineral concern in the Yukon (currently Aurum Geological Consultants Inc.)

Representative of the Klondike Placer Miners Association

Representative of the Government of Yukon, Department of Mines and Small Business

The committee ensures that communication is maintained between the mineral exploration industry and the Exploration and Geological Services Division. Results include de following:

— discussion of government projects to ensure maximum usefulness to the mineral exploration industry.

— establishment of a committee to arrange the Whitehorse Geoscience Forum and also to advise on its scheduling.

— priorizing of areas to be geologically mapped in detail.

Recently, the committee decided to review its internal structure. It was felt that industry should improve the overall effectiveness of the committee as a review body concerned with the progress of government geoscience programs in the Yukon. An expanded membership was also suggested to include additional industry representatives as well as a university representative. Further meetings will be held at the Geoscience Forum in Whitehorse and the Cordilleran Round-Up in Vancouver to review and assess changes to the internal structure of the committee.

THE NORTHWEST TERRITORIES MINERAL EXPLORATION LIAISON COMMITTEE

The Northwest Territories Mineral Exploration Liaison Committee met twice during 1986-87. One meeting was held in conjunction with the 14th Annual Geoscience Forum. At that meeting the Northwest Terrotiries Mineral Exploration Liaison Committee agreed to assume the role of mineral Industry Review Committee for the MDA Geoscience programs. At the December meeting representatives from industry were elected to all executive positions relegating Northwest Territories Geology Division staff to the role of observers and resource-members.

A second meeting of the Mineral Exploration Liaison Committee was held in April to review the Northweat Territories' portion of the MDA Geoscience program. The Mineral Exploration Liaison Committee representatives also took part in meetings to review the whole Northwest Territories' MDA Geoscience Program.

In the future, the Mineral Exploration Liaison Committee is expected to take a more active role in reviewing and advising on all government sponsored geoscience programs conducted in the Northwest Territories.

BRITISH COLUMBIA GEOLOGICAL SURVEY TECHNICAL LIAISON COMMITTEE

The Techinical Liaison Committee was formed in 1984 at the request of the Minister of Energy, Mines and Petroleum Resources to support the Geological Survey Branch, recommend and criticize Branch projects, document industry comments and reactions to programs, and give assistance and support to Geological Survey Branch presentations to Treasury Board.

In 1986 the Committed was expanded to nine members when an invitation was extended to the Association of Exploration Geochemists to nominate a member.

Current members are:

W.R. Smyth; Chief Geologist, Geological Survey Branch

O.E. Owens (Chairman); Cominco; Mining Association of British Columbia

D.L. McElvie; Denison Mines Limited; Coal Association of Canada

C.A. Aird; Esso Minerals Canada; British Columbia & Yukon Chamber of Mines

H.D. Meade; Wesmin Resources Ltd.; Canadian Institute of Mining and Metallurgy

R.S. Hewton; Western Canadian Mining Corporation; Geological Association of Canada

A.J. Sinclair; Department of Geological Sciences; University of British Columbia

D. Templeman-Kluit; Geological Survey of Canada

I. Thompson; Orvana Resources Inc.; Association of Exploration Geochemists

The Committee held two meetings in 1987. The first meeting, in the spring, reviewed and set priorities for proposed new projects that were funded from the enhanced 1987 budget of the Geological Survey Branch, and also reviewed ongoing projects under the Canada-B.C. Mineral Development Agreement. The second meeting was held after the field season to review the progress of individual projects.

In addition to regular comments on specific programs, the Technical Liaison Committee provided comments to the Minister on:

1) The longer term budget requirements of the Branch.

2) The question of contracting out geological mapping.

ALBERTA GEOLOGY SURVEY ADVISORY COMMITTEE

The program of the Alberta Geological Survey is reviewed annually by this Advisory Committee.

The Committee meets at least once a year to review all projects. It provides advice on research methods and approches being used and on the direction of effort; and comments on the quality or research results.

The committee consists of at least nine external members and includes representatives from the energy, minerals and consulting industries.

Alberta Government departments, an Alberta university, the Energy Resources Conservation Board, the Geological Survey of Canada and the Canadian Society of Petroleum Geologists. Membership term on the committee is three years, with turnover dates staggered.

SASKATCHEWAN GEOLOGICAL LIAISON COMMITTEE

The Geological Liaison Committee was formed in 1984 to assist the Geological Survey in planning its geoscientific programs and in evaluating their effectiveness particularly from the perspective of industry. Accordingly the committee met in November 1986 to review the results of the 1986 field program and again in February 1987 to participate in the planning for 1987 field activities.

During the year under review the first chairman of the committed, G.L. Colborne, completed his term of office and was succeeded by R.T. Lainé. The current composition of the committee is:

R.T. Lainé, Chairman; Amk Ltée.

R.A. Arnold, Saskatchewan Research Council

P. Cooper; Saskatchewan Mining Association

D.M. Kent, University of Regina

H. Hendry/E.G. Nisbet*; University of Saskatchewan

P. Gummer/A.L. Parres*; Independent Mineral Developers Association

L.S. Beck, Saskatchewan Energy and Mines

* Alternates

Continuing concerns by the committee regarding the restricted size of the Survey's budget and, as a result, the narrow scope of its program, were expressed in a letter from the Chairman of the committee, Dr. R. T. Lainé to the Hon. Pat Smith, Minister of Energy and Mines.

A number of recommendations regarding the Survey's geoscientific program were made during the year, including a strengthening of the industrial minerals group and re-activation of uranium deposit studies.

MANITOBA MINERAL EXPLORATION LIAISON COMMITTEE

The Manitoba Mineral Exploration Liaison Committee was expanded to include representatives from all three major northern mining districts, Winipeg-based exploration companies, the Winnipeg section of the Prospectors and Developers Association, and Manitoba-Saskatchewan Prospector Association.

Industry representation is currently as follows:

J. Chornoby; Lynn Lake-Ruttan District

B. Burbidge; Flin Flon-Snow Lake District

M. Toderian: Thompson District

T. Pryslak; Winnipeg-based Companies

B. Dunlop; Prospectors and Developers Association

M. Kreczmer; Manitoba/Saskatchewan PDA

The Committee met November 19, 1986 to review the previous summer's field work and to discuss the outline of programs to be delivered in 1987. Several of the industry recommandations were subsequently incorporated into the Workplan for 1987-88.

ONTARIO GEOLOGICAL SURVEY TECHNICAL LIAISON COMMITTEE

The Ontario Geological Survey Technical Liaison Committee is now in its third year and represents a cross section of geoscience, industry and university associations views. The Committee acts in an advisory capacity to the Assistant Deputy Minister, Mines and Minerals Division, Ministry of Northern Development and Mines with regard to the Survey's geoscience programs. In 1987 there were eight committee members:

J. Chivers; W.T. Chatham Associates Ltd.; Ontario Petroleum Institute

J.F. Church; INCO Limited; Ontario Mining Association

R.P. Cook; Aggregate Producers Association of Ontario

C.J. Hodgson; Queen's University; Council University Departments-Geology

R.H. McMillan; Westmin Resources; Canadian Institute Mining & Metallurgy

V.G. Milne; Ontario Geological Survey

R.E. Van Tassell; Dickenson Mines Ltd.; Prospectors and Developers Association

R. Wallis; Billiton Canada Ltd.; Geological Association of Canada

The Committee meets twice a year and, in the short time it has existed, has been instrumental in improving communication and program awareness over a period of major organizational and program adjustment. The committee also contributed to the recommendations of the E.G. Thompson report on mining and exploration to the Ontario government. Recommendations in this report supporting geophysical programs and computerization of geoscience data are being acted upon. A new program of airborne geophysical surveys is already in place and geoscience database development projects are being developed. The committee has provide valuable feedback on the perceived relevance of program components by the industry and has helped stimulate coopreative research initiatives with universities.

COMITÉ CONSULTATIF DE LA DGEGM

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES QUÉBEC

Historique et rôle

En 1983, la DGEGM s'est doté d'un Comité consultatif. Son rôle est de faire, au sous-ministre associé, les recommandations utiles pour l'élaboration de la politique d'exploration minérale de la DGEGM et de conseiller la DGEGM sur l'élaboration de ses programmes de recherche géologique et minérale au Québec. Le Comité consultatif agit comme liaison entre l'industrie, les universités et la DGEGM de façon à promouvoir des actions prioritaires.

Sa composition

Le Comité consultatif se compose d'au plus dix (10) personnes nommées pour un mandat n'excédant pas deux (2) ans par le ministre de l'Energie et des Ressources. Le mandat est renouvelable. Ces personnes, dont deux (2) proviennent de la DGEGM, six (6) de l'industrie et deux (2) du milieu universitaire, sont reconnues pour leur compétence dans tous les domaines de l'exploration minière au Québec.

Le comité actuel 1985-1986/1986-1987 est composé de:

M. André F. Laurin	Sous-ministre adjoint (MER)	Président
M. Jean-Louis Caty	Directeur, Rech. géol. (MER)	Secrétaire
M. Jean Boissonnault	Cambior	Val-d'Or
M. Guy Perrault	Ecole Polytechnique	Montréal
M. Michel Gauthier	Université du Québec	Montréal
M. Denis Simoneau	Soquem	Québec

M. Denis Francoeur	Explorations Noranda	Noranda
M. Roger Doucet	Minerais Lac Ltée	Malartic
M. T. Flanagan	Flanagan, McAdam Ltée	Toronto
M. Bernard Coulombe	J.M. Asbestos	Asbestos

Son fonctionnement
Le président et le secrétaire proviennent de la DGEGM.

Le Comité consultatif tient au moins deux réunions par année à Québec: l'une au printemps et l'autre à l'automne.

NEW BRUNSWICK ADVISORY COMMITTEE
One meeting was held in 1986 between the New Brunswick Industrial Advisory Committee and members of the New Brunswick Geological Surveys Branch and the Geological Survey of Canada. The purpose of the meeting was to review the projects carried out under the New Brunswick-Canada Mineral Development Agreement. There was general satisfaction with projects and their aims, but there was some concern regarding perceived lack of cooperation between provincial and federal project leaders. The committee was also concerned that "academically oriented" project managers were neglecting the economic aspects of geological mapping projects.

This year's committee consists of:

W. Lockhard; Consulting Geologist

B. Bourgoin; Durham Resources

O. Bonham; Rio Algom Exploration Inc.

K.D. Whaley; New Brunswick Prospectors and Developers Association

P. Dimmell; New Brunswick Prospectors and Developers Association

P. Fenety; New Brunswick Prospectors and Developers Association

NOVA SCOTIA ADVISORY COMMITTEE ON GEOSCIENCE PROJECTS
In 1985, an Advisory Committee on Geoscience Projects was established in Nova Scotia to represent the collective viewpoints of the local academic community and of the mineral industry in reviewing programs undertaken and/or planned by the Nova Scotia Department of Mines and Energy. Representation on the committee is split equally between these two sectors of the geoscientific community, with a total committee membership of four, two of whom are replaced annually.

Members for 1986-87 included:

Dr. S.M. Barr; Acadia University;

Dr. M.R. Gibling; Dalhousie University;

Mr. J. Amiriault; Nova Scotia Chamber of Mineral Resources

Mr. D. Duncan; Nova Scotia Chamber of Mineral Resources

Meetings of the committee, normally one per year, are chaired by the Director of the Mineral Resources Division, with less formal participation by other staff members of the Department so as to provide the best possible program overview to the committee. Discussions are generally program specific but range widely and include frank appraisal of the Department's role and strategic priorities in geoscience in both the short and long term.

The report of the Advisory Committee is considered carefully by senior Departmental management, and program adjustments are made wherever possible. Concerns expressed in the most recent

report have helped the Department to move more rapidly towards computer-assisted publication procedures in an effort to provide more timely release of information. The Department of Mines and Energy looks forward to continued, useful dialogue with the industry and with the academic community through this committee.

NEWFOUNDLAND AND LABRADOR TECHNICAL LIAISON COMMITTEE

The Technical Liaison Committee was formed in 1984, at the request of the Mineral Development Division of the Newfoundland Department of Mines, to assist the Division in planning its geoscientific programs. The committee meets informally at the Division's Review of Activities in November, to review projects carried out during the previous field season, and formally later in the year to discuss projects proposed for the next season. The committee reports to the Minister of Mines.

The terms of reference establisshed for the committee are:

1) to review the geoscientific programs of Mineral Development Division and recommend changes or additions which will maximize the usefulness of these programs to the exploration industry;
2) to provide the Division with a continuing evaluation of its geoscientific programs, and to participate in formal evaluations which may be required for specific programs from time to time.

Committee membership consists for four representatives of the exploration industry and one from Memorial University. Current members are:

G. Thurlow; B.P. Selco Ltd.

J. Robertson; Falconbridge

L. Murphy; Murphy Corporation Ltd.

D. MacInnes; Noranda Exploration

T. Rivers; Memorial University

The committee met on November 24 and 25, 1986, with V. French of Shear Exploration substituting for D. MacInnes, and D. Wilton acting as Memorial University's representative. The committee reviewed the proposed 1987 program of the Mineral Development Division as well as work to be carried out by the Geological Survey of Canada under the Canada-Newfoundland Mineral Development Agreement. A number of recommendations covering specific projects were made. General recommendations included the following:

1) Serious consideration should be given to providing new office space for the Division, to promote more integration among the staff and restore a sense of cohesiveness and team spirit in the Division.
2) The committee congratulated the Divison on its prompt release of preliminary maps and reports, but felt that more attention should be given to preparation and publication of final reports.
3) Core storage facilities at Pasadena and St. John's should be expanded.
4) The need for systematic Quaternary mapping of the Province was recognized; priority ares for such mapping should be chosen in areas of current exploration activity and in consultation with industry.
5) The Committee stressed the importance of Mineral Development Agreements in the Division's geoscientific program and the need for their continuation beyond the end of the current 1984-89 Agreement.

SURVEY OF FEDERAL–PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS

Province or Territory	Total $ Value of Agreement ($ million)	Cost Sharing Formula	Time Period	Delivery % Canada % Province	Major Components/Projects			Contact Person & Tel. No.
					Project Name	Budget ($,000's)	Delivery (Prov. or Canada)	
British Columbia	$10	50/50	1985-1990	96% B.C. 4% Can.	Geoscientific Surveys	6 650	90% B.C.	G. McKillop (604) 356-2854
					Geoscience Data Systems	450	94% B.C.	
					Market, Technical & Feasibility Studies	750	100% B.C.	
					Financial Assist. for Mine Development	1 620		
					Management, Public Info., Evaluation	530		
Saskatchewan	$6 380	N/A	1984-1989	50 Can. 50 Sask. Parallel Work Delivery	**Geoscience**	5 340	41.2 Can. 51.8 Sask.	R. Macdonald (306) 787-2568
					Minerals Technology	400	100 Can.	
					Mineral Development	400	100 Can.	
					Public Information	240	79.2 Can. 20.8 Sask.	
Manitoba	$24.7	60% Fed. 40% Prov.	1984-89	60% Can. 40% Man.	Sector A Geoscientific Activities	13 000	38.5% Man.	W.D. McRitchie (204) 945-6559
					Sector B Research & Technology	7 430	37.2% Man.	
					Sector C Development Studies	1 770	50% Man.	
					Sector D Public Information, Evaluation and Administration	2 500	50% Man.	
Ontario	$30	50/50	1985-1990	63% Ont. 37% Can.	Geoscience Program Information Exchange	18 350	64% Ont. 100% Ont.	R. Watson (416) 965-1546
					Productivity & Technology	3 550	100% Ont.	
					Economic Development	4 500	96% Ont.	
					Public Information, Evaluation and Administration			
Québec	$100	50/50	1985-1990	96% Qué. 4% Can.	5 Volets			
					1. Activités géoscientifiques	34 750	Québec	J.L. Caty 643-1803
					2. Rechereche et développement sur l'amiante	8 000	Québec-Canada	à determiner
					3. Infrastructure de développement minéral	42 000	Québec	A. Jean 643-4896
					4. Désenclàvement de l'industrie québécoise du mineral de fer	15 000	Québec	G. Richard 643-4410
					5. Information au public	250	Québec	M. Lecours 643-1803

SURVEY OF FEDERAL–PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS

Province or Territory	Total $ Value of Agreement ($ million)	Cost Sharing Formula	Time Period	Delivery % Canada % Province	Major Components/Projects			Contact Person & Tel. No.
					Project Name	Budget ($,000's)	Delivery (Prov. or Canada)	
New Brunswick	$22.3	—	1984-1989	30% N.B. 60% Can.	GEOSCIENCE	12 373	31% N.B.	ADM - R.R. Potter North - J.J. Davis Central - L.R. Fyffe South - A.A. Ruitenberg GSC - F.D. Anderson W.H. Poole
					MINING & MINERALS TECH.	3 275	8% N.B.	G. Greer or D. Barnett (506) 453-2206
					ECONOMIC DEVELOPMENT	4 861	57% N.B.	G. Greer or D. Barnett
					PUBLIC INFORMATION, EVALUATION, ADMIN.	1 798	16.6% N.B.	D. Carroll (506) 453-2206
Nova Scotia	$26.945	60/40	1984-89	60% Can. 40% N.S.	GEOSCIENCE	14 507	62% Can. 38% N.S.	J.D. Keppie MDA Coord. (902) 424-4700
					MINERAL TECHNOLOGY	4 982	66% Can. 33% N.S.	
					DEVELOPMENT STUDIES	1 841	48% Can. 52% N.S.	
					MINERAL INVESTMENT STIMULATION PROGRAM (MISP)	1 600	80% Can. 20% N.S.	
					PUBLIC INFORMATION	1 215	37% Can. 63% N.S.	
					ADMINISTRATION	2 800	47% Can. 53% N.S.	
Newfoundland	$22	50/50	1984-1989	45% Nfld. 55% Can.	Geoscientific Surveys	16 400	52% Nfld.	B. Greene (709) 576-2763
					Mining & Mineral Tech.	2 100	29% Nfld.	
					Economic Develop. Studies	1 500	17% Nfld.	
					Public Information, Evaluation and Administration	2 000	30% Nfld.	
Prince Edward Island	$0.3	80/20	1986-1989	100% P.E.I.	GEOSCIENCE — Onshore Aggregate Resources	290.6	100% P.E.I.	W. MacQuarrie (902) 368-5011
					— Public Information and Evaluation	9.4	100% P.E.I.	
Yukon Mineral Resources Subagreement	$3.9	90/10 Can./Yukon	1985-1990	100% Can.	1. Geological Mapping	1 100	100% Can. (DIAND)	J.A. Morin (DIAND) (403) 667-3200
					2. Geochemistry	2 200	100% Can. (G.S.C.)	A. Clark (EMR) (613) 995-9466
					3. Placer Mining	600	100% Can. (DIAND)	C.H. MacDonald (DIAND) (403) 667-3160
Yukon Mining Industry Recovery Subagreement	$3	100% Can.	1986-1989	100% Yukon	Mining Industry Recovery	3 000	100% Yukon	J. Maissan (Government of Yukon) (403) 667-5462

1987/88 ANNUAL REVIEWS OF ACTIVITIES
PROVINCIAL AND FEDERAL GEOSCIENTIFIC ORGANIZATIONS

Province or Territory Location	Date(s) (No. of Days)	Time for Talks	Universities Involved?	Industry Involved?	Poster Session	Universities Involved?	Industry Involved?	Publication	[1]Energy Matters	[2]Other Topics	Comments
British Columbia Vancouver	3 Feb. 88 (1 of 3)	1 day	Yes	Yes B.C. & Yukon Chamber Annual Meeting	Yes	Yes	Yes	– Geological Fieldwork – B.C. Mineral Exploration Review, 1987	Yes Coal	Yes	Part of "Cordilleran Geology and Exploration Roundup" 2 Feb. – GSC 3 Feb. – BCEMPR 4 Feb. – BC-YCM; DIAND-Yukon
Yukon Territory Whitehorse (DIAND)	30 Nov., 1 Dec. 87 Whitehorse (2)	2 days	Yes	Yes	Yes	Yes	Yes	No	No	No	Contributions from DIAND, GSC and industry, Review of current projects
	2 Feb. 88 Vancouver (1 of 3)	one 2-hour session	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Part of "Cordilleran Geology and Exploration Round-Up" with BCEMPR BC-YCM and GSC
Northwest Territories Yellowknife (DIAND)	1-3 Dec. 87 (3)	3 days	Yes	Yes	Concurrent Dec. 1-3	Yes	Yes	Exploration, Mining and geology overview	Coal only	as required	Organized with NWT Chamber of Mines GSC involved. Also take part in "Cordilleran Geology and Exploration Round-Up", Vancouver
Alberta Edmonton	OPEN HOUSE TENTATIVELY SCHEDULED FOR FALL OF 1988										
Saskatchewan Regina	23 Nov. 87 (1)	0.5 day	Yes	No	0.5 day	Yes	Yes	Summary of Investigations	Yes	Yes	Sask. Research Council involved, talks and poster displays
Manitoba Winnipeg	23, 24 Nov. 87 (1.5)	1 day	Yes	No	1-2 days	Yes	No	Rept. of Field Activities	No	No	Contributions from GSC and University of Manitoba and other universities
Ontario Toronto	15, 16 Dec. 87 (2)	2 days	Yes	No	Concurrent	Yes	No	2 Repts. of Activities	Yes	Yes	Research oriented; special symposium
Quebec Quebec City	1, 2 Dec. 87 (2)	2 days	Yes	Yes	2 days	Yes	No	Rept. of Activities	No	No	Special publication platinum mineralization
New Brunswick Fredericton	23, 24 Nov. 87 (1.5)	1.5 days	No	No	1 day	Yes	No	1987 Project Resumes	No	Yes	GSC involved
Nova Scotia Halifax	25, 26 Nov. 87 (1.5)	1 day	No	No	1 day	Yes	No	Program and Summaries	Yes	Yes	GSC involved
Newfoundland St. John's	5 Nov. 87 (1)	0.5 day	Yes	No	0.5 day	Yes	No	Yes	No	Yes	GSC involved
Prince Edward Island Charlottetown	4 May 88 (1)	No	No	No	1 day	No	No	No	Yes	Yes	Mineral, Forestry and Energy matters
Geological Surv. Can. Ottawa	18 to 20 Jan. 88 (3)	2 days	Yes	No	Concurrent	Yes	Yes	Current Research	Yes	Yes	Provincial agencies involved

[1]Energy Matters: (e.g. oil, gas, coal, oil shales, peat)

[2]Other Topics: (e.g. administration, engineering, regulations, legislation, etc.)

NSDME Oct. 87

SURVEY OF HARD ROCK DRILL CORE PROGRAMS IN CANADA, FISCAL YEAR 1986-87

PROVINCE	B.C.** (1986)	ALBERTA	SASK.	MAN.	ONT.	QUE.	N.B.	N.S.	NFLD & LAB	PEI	YUKON	N.W.T.
No. of Facilities	1	1	1	4	7	4	3	4	3	1	1	1
Staff Man-Days Work 1986-87	½ yr	25	115	1030	3532	NIL	420	1060	685	—	182	53
Capital Cost 1986-87	NIL	$12.0	13.6	25.0	NIL	NIL	21.0	20.5	NIL	—	33.0	8.7
Operating Cost 1986-87	$11.1	$5.5	17.5	167.0	256.5	NIL	6.0	123.5	125.7	—	12.0	16.3
Core Collected or Delivered 1986-87	2083 m	600	4302	8126	154 634	11 925	31 933	18 667	19 347	—	4660	1556
Core Reduction*	12%	NIL	NIL	22%	8%	50% approx.	NIL	NIL	NIL	—	NIL	NIL
Use of Facilities (visits or persons) 1986-87	4v	20v	29v	17v	1447v	n.d.	60v	855 userdays	91v	—	25v	39v
Total Core in Storage (from all years)	150 680 m	19 859	89 807	172 584	573 932	230 409	227 933	372 167	192 989	1298	109 660	29 118
Total Exploration Drilling 1986-87	8 662 m	3000 approx.	173 291	175 583	464 093	1 136 760 approx.	42 000 approx.	57 800	44 362	—	30 000 approx.	162 811

* Over last year

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

SUMMARY OF PROVINCIAL GEOLOGICAL SURVEYS ANALYTICAL LABORATORIES

BRITISH COLUMBIA

The B.C. Geological Survey's Analytical Sciences Section is a dedicated in-house facility yith a staff of 7 full time employees and occasional contract help. It is a section of the Geological Survey Branch within the Mineral Resources Division of the Ministry. Its major responsibility is to provide analytical data to Branch geologists. It also is responsible for licensing assayers in the province and meets numerous requests for advice from other government offices on matters of a chemical nature.

ALBERTA

The analytical services used by the Alberta Geological Survey are supplied by the Alberta Research Council's analytical and testing services. These service laboratories consist of the following:

Soils Analytical Laboratory

Analytical Chemistry Laboratory

Coal Analytical Laboratory

Gasoline and Oil Testing Laboratory

Geological Survey Laboratories

Oil Sands Analytical Laboratory

Industrial Services Laboratory

Forest Products Laboratory

These laboratories support in-house programs and their services are also available to government departments and to the private sector provided the special sevices required are not available from commercial laboratories.

SASKATCHEWAN

Saskatchewan Geological Survey does not have a laboratory as such. The only facility is has is a "core storage and study building". About 80% of its analytical work is done by the Saskatchewan Research Council Laboratories and the rest by commercial laboratories.

MANITOBA

The Geological Services Branch Laboratory is an in-house facility with a technical staff of 7 wich supports the department's geologists by providing silicate, base and precious metal analyses on samples collected as part of their mapping and mineral investigations. The laboratory also provides precious and base metal assays to holders in good standing of mineral properties to enable them to evaluate the mineral potential of their claims. Non-routine analytical work is also performed for other government departments and the general public.

ONTARIO

The Geoscience Laboratories Section is a part of the Ontario Geological Survey within the Mines and Minerals division of the Ontario Ministry of Northern Development and Mines. The laboratory employs 30 scientific and technical staff in support of in-house projects of the Survey. It also provides a service to prospectors and developers using a free assay — coupon scheme as provided for in the Ontario Mining Act.

The Temiskaming Testing Laboratory (TTL) is an ancillary facility within the Mines and Minerals Division located in Cobalt. The TTL has a bulk — sampling facility and an assay laboratory suited to the analysis of material from mines in the Cobalt silver camp.

Relocation of the Survey to Sudbury, planned for 1990, will see the Laboratories move into new, custom — designed facilities. They will be capable of providing the environment needed for geoanalytical work on samples for element concentrations ranging from the sub-ppb range to the percent range as well as an expended role in research and development. It is the Government's intention that this will be a centre of exellence in geoanalysis.

QUÉBEC

The Centre de recherches minérales (CRM) is a general directorate of the Mines sector under the jurisdiction of the Ministère de l'Energie et des Ressources du Québec (MER). It has a technical staff of 43 and is an agency of applied research wich provides scientific and technical support to the mining and metallurgical industries with the aim of promoting the growth and economic development of these sectors in Québec.

The CRM is divided into two directorates [Analyse minérale (DAM) and Recherche métallurgique (DRM)] and two branches [Technologie minière (STM) and Secrétariat général et commercialisation (SSGC)].

The DAM provides routine and research analyses as a priority to the DRM and the Geological and Mineral Exploration Directorate of the Mines sector. It also provides mineral analysis and analytical research services to various groups within the mining industry whose activities centre on the exploration, extraction and transformation of mineral resources in Québec.

NEWFOUNDLAND

The Minerals Laboratory of the Newfoundland Department of Mines has a full time staff of 12 scientific and technical people. It is an integral part of the Department of Mines, supporting mainly geological staff of the Mineral development Division, and to a minor extent the Mineral Lands Division. The laboratory director reports to the Senior Geochemist who, in turn, reports to the Director of the Mineral Development Division.

NOVA SCOTIA

The Nova Scotia Department of Mines and Energy has no laboratory. Most of its major projects are carried out in collaboration with scientists from other institutes. The in-house laboratories of these institutes perform any large analytical programs for the collaborative studies. Routine geochemical analyses and small whole rock and other specialty analytical requirements are contracted out to commercial laboratories.

NEW BRUNSWICK

The New Brunswick Geological Survey has a small laboratory which carries out a limited suite of base element determinations on sediment samples collected for geochemical purposes. Other analytical work is contracted to commercial laboratories.

Provincial geological analytical laboratories

	SERVICES OFFERED							
PROV	ANALYSIS MAJOR	ANALYSIS TRACE	MINERAL SEP	OUTSIDE WORK DONE	MATERIALS TESTING	MINERAL IDENT	MANAGER	PHONE NO
B.C.	Y	Y	Y	N	N	Y	Wes Johnson	(604) 387-6249
ALTA	Y	Y	Y	ALL	Y	Y	Michael Gray	(403) 450-5414
SASK	NO LABORATORY							
MAN	Y	Y	N	Y	N	N	John Gregorchuk	(204) 945-3786
ONT	Y	Y	Y	Y	Y	Y	Chris Riddle	(416) 965-1337
QUE	Y	Y	Y	Y	N	Y	Marc Pichette	(418) 643-4540
NFLD	Y	Y	N	N	N	N	Hank Wagenbauer	(709) 576-3312
N.S.	NO LABORATORY							
N.B.	N	Y	N	N	N	N	Les Fyffe	(506) 453-2206

EQUIPMENT USED

PROV	SAMPLE PREP	XRF	XRD	AAS	ICP/OES SEQ	ICP/OES SIM	FIRE ASSAY	OTHER
B.C.	Y	Y	Y	Y,3	N	N	Y	OES
ALTA	Y	Y	Y,2	Y,2	N	Y	N	GC/MS IR NMR ION CR
SASK	NO LABORATORY							
MAN	Y	N	N	Y,2	N	N	Y	OES
ONT	Y	Y,2	Y	Y	Y	Y	Y	ICP/MS
QUE	Y	Y	Y	Y,4	Y	Y	Y	INAA ELE MIC ION CR IR
NFLD	Y	N	N	Y,2	Y	N	N	IR
N.B.	N	N	N	Y	N	N	N	COLOUR'C
N.S.	NO LABORATORY							

XRF: X-ray fluoresence;
XRD: X-ray diffraction;
IR: infrared;
OES: D.C. arc emission spec;
ICP/OES: plasma emission spec;
GC/MS: gas chromatography mass spec;
ION CR: ion chromatography;
ICP/MS: plasma mass spec;
NMR: nuclear mag. resonance.

MINERAL DEVELOPMENT AGREEMENT SUPPORT FOR REGIONAL ECONOMIC DEVELOPMENT; THE IMPORTANCE OF GOVERNEMENT GEOSCIENTIFIC ACTIVITIES

INTRODUCTION

Canada is one of the most advanced and competitive mineral and metal producers in the world.

For more than 150 years, the mining industry has been directly responsible for opening up many of the frontiers within the Dominion*, and continues to be one of the principle engines driving regional economic development and prosperity.

Many parts of the country owe much of their current economic activity to mining and mineral processing. Indeed, throughout much of Canada, mineral production constitutes the only viable economic activity capable of sustaining the current infrastructure and affirming a territorial presence.

Regional disparity in mineral endowment is a reality. Nevertheless, all Provinces have the potential to benefit from mineral exploration and the development of new mines and quarrying operations, whether it be short term benefits related to exploration activities, or the longer term rewards accruing from firmly established industrial centres and their attendant transportation/processing/manufacturing appendages.

Currently, the Canadian mineral and metals industry is faced with strongly competitive challenges as a result of the introduction of substitute materials, and a fall off in the level of demand for metals stemming from the introduction of new and more effective production technologies.

In addition to a slowdown in the rate of world economic growth, rapid growth in resource extraction in Australia, Brazil and other developing countries has dramatically decreased Canada's share of world mineral and metal production and increased price competition on world mineral markets.

Despite substantial cost-cutting, productivity gains and corporate restructuring, the minerals industry is still faced with low profitability and must continue to be resourceful and innovative in order to raise its productivity and lower production costs.

Under these circumstances it is essential that Governments at both Federal and Provincial levels work cooperatively with the private sector to see that maximum benefit is derived from the resources and expertise resident in their respective organizations in pursuing the goal of regional resource development.

Governments have made a major contribution by providing a reliable geoscientific data base that can be used by industry to guide and focus its exploration for new mineral deposits. The value of such data bases has been acknowledged repeatedly by industry and was recently summarized by J. Alan Coope in a presentation to the 42nd Provincial Mines Ministers' at Charlottetown, P.E.I., September, 1985.

PREVIOUS GOVERNMENT INITIATIVES (First Generation)

Since the early seventies the Government of Canada, together with the Provinces, has utilized various mechanisms for combining the expertise of the Federal and Provincial Geological Surveys in support of mineral developments.

Substantial advances in documenting Canada's mineral endowment were made as a result of cooperative agreements mounted between 1970 and 1982 with Federal funding allocated through the Department of Regional Economic Expansion (DREE). Other agreements (NORTHLANDS,

*see: W.A. Padgham's presentation a "Transportation and Its Effect on Mineral Exploration" given at the 43rd Provincial Ministers of Mines meeting in Banff, September 1986.

KIRKLAND LAKE INITIATIVES PROGRAM, NORTHERN ONTARIO RURAL DEVELOPMENT COMMUNITY BASED GEOLOGICAL SURVEYS, URANIUM RECONNAISSANCE PROGRAM, NEW BRUNSWICK SUBSIDIARY MINERALS AND FUEL DEVELOPMENT AGREEMENT, and the MANITOBA INTERIM MINERAL AGREEMENT, to name a few, and programs such as the NON-RENEWABLE RESOURCE EVALUATION PROGRAM (NREP) experimented with a variety of approaches, most facilitated by a transfer of funding to the Provinces who then undertook the task of autonomous program implentation with Federal contributions constrained to a management or technical advisory function.

Throughout this period the Federal Government negotiated minerals agreements with all provinces excepting Alberta, Quebec, B.C. and P.E.I. with joint expenditures totalling close to 84 million dollars.

MINERAL DEVELOPMENT AGREEMENTS (1984-1990) (Second Generation)

In 1984 Manitoba and Canada signed the first of a new generation of cooperative Mineral Development Agreements (MDAs). Responsibility for program implementation was shared (parallel delivery) between the provincial Department of Energy and Mines, and Energy, Mines and Resources Canada.

In addition to the traditional commitment to geoscientific surveys (Sector A) which was the mainstay of the earlier agreements, the range of activities conducted under the MDA was expanded significantly to include R & D into mining and mineral processing technology (Sector B), marketing and economic studies (Sector C), and communications and public information (Sector D).

In the following years (1984-86) similar multi-year agreements were signed between Canada and eight other Provinces and the Yukon, committing joint expenditures of close to 250 million dollars.**

Federal/Provincial cost-sharing ratios ranged from 50:50 (B.C., Quebec, Saskatchewan and Ontario), 60:40 (Manitoba), 65:35 (New Brunswick, Nova Scotia), 70:30 (Newfoundland), 80:20 (P.E.I.) to 90% Federal in the Yukon. Federal involvement in program delivery varied substantially from 0% in P.E.I. to over 60% in Newfoundland.

INDUSTRY INVOLVEMENT

In this review of Federal minerals-related programming, the Nielsen task force concluded that the MDAs are a potentially powerful and flexible instrument for the coordination of Federal-Provincial activities, provided "activities were directed toward economic potential in the private sector and mechanisms were emplaced to provide for appropriate industry involvement in the setting of priorities and selection of projects".

Within the current generation of MDAs a system of industry advisory forums has evolved in each of the Provinces to assist the selection, priorization, planning and execution of MDA projects by Federal/Provincial Management Committees and Technical Sub-committees.

Furthermore, in order to implement new directions and strong links between CANMET and the minerals and metals sector, the Government of Canada has already strengthened the National Advisory Committee on Mining and Metallurgical research (NAC MMR) to give it a more direct role in the planning and execution of CANMET's R&D programs. The newly named National Advisory Council on CANMET is expected to play a key role in charting the future course of the government's minerals and metals related R & D.

A July 1987 Interim Evaluation of the Manitoba MDA by Price Waterhouse concludes that the Agreement and industry liaison committees, now in their 3rd year, are working well and ensuring timely and appropriate project implementation in response to specific initiatives within that Province.

**see: Summary of Federal Provincial Mineral Development Agreements in Provincial Geologists Journal 1986, p. 121-123.

Where appropriate there is also a trend toward industry cost-sharing some joint projects that would not have been implemented without MDA leverage. In several instances industry representatives have commented on their ability, through the MDA's, to access superior expertise and facilities which might not otherwise have been available to them.

NATIONAL MINERAL POLICY

In its Mineral Policy Paper (May 1987) the Government of Canada outlined six national objectives aimed at promoting the exploration, development and utilization of Canada's mineral and metal wealth.

The sixth objective, directed at Economic and Scientific Information expressly states:

> "the Government of Canada will ensure that its role of providing timely and economic technical and scientific information required by the minerals and metals sector, labor organizations, federal and provincial agencies and the general public is developed to the maximum."

Furthermore, a commitment is made to continue Government support of basic geoscientific mapping,

"as a means of reducing exploration risks and avoiding costly duplication of efforts by the private sector," and for the GSC to work closely with Provincial agencies and to complement their activities in the minerals and metals field "particularly under the MDAs."

At present, these objectives are being met successfully under the MDAs, as well as programs designed to provide the economic information basic to marketing strategies, studies aimed at ameliorating the impact of implementing costly environmental controls, and a broad range of multi-agency projects investigating ways of increasing the effectiveness of mineral extraction and production.

IMPACTS

Cooperation between industry and both levels of government is producing constructive task-oriented results.

New mineral discoveries at Hope Brook (Newfoundland) and Strange Lake (Quebec/Labrador) have been attributed in part to the data bases generated by cooperative Federal/Provincial government geoscientific surveys.

In other regions of Canada the MDAs have done much to strengthen the liaison and close cooperative working relationships between industry and government. MDA outputs are being used extensively by industry and in many instances have led to staking rushes, new ground acquisition and follow-up assessment work.

MDA funding has also been a boon to universities which have benefitted from an attendant increase in the number of contracted applied geoscience research agreements, as well as elevated levels of seasonal student employment and training.

Numerous graduate theses have been supervised/sponsored/cosponsored by government scientific authorities, with many of the topics being tailored to address industry needs in exploration or mining technology research.

Furthermore, a national awareness of MDA momentum and potential has established, in the geoscientific community, a spirit of cooperative research that facilitates interprovincial exchanges of expertise and a joint commitment by researchers in many agencies to resolving problems peculiar to each of the regions.

Government departments themselves have benefitted from an elevated level of information flow, and through socioeconomic and marketing studies have been able to respond constructively with industry-supportive policies and considerations.

Mining technology R & D is helping to increase productivity and safety in operating mines as well as generating a better understanding of new products and new markets for certain commodities.

SUCCESSOR MDAs (Third Generation)

Much as been achieved through the current generation of MDAs, however, much still needs to be done.

In some parts of the country, such as Alberta, the understanding of industrial and metallic mineral deposits is less advanced than in other provinces, and relative to energy resources, these commodities truly constitute a frontier resource. Development of this potential would make a strong contribution to a much-needed diversification of this Province's economy.

The Canadian minerals and metals industry is likely to be faced with strong competitive challenges for the balance of this century.

Accordingly, continued effort must be directed toward finding new mineral deposits, developing new exploration techniques and technologies, and conducting research into new uses for minerals and metals.

The MDAs have proven to be a highly effective mechanism for assembling and catalytically unifying the complementary skills and technologies in industry, universities and both levels of government.

RECOMMENDATIONS

Recognizing that the MDA mechanism has proven successful in delivering government-sponsored industry-supportive minerals programming, the Committee of Provincial Geologists hereby recommends that:

> **Both levels of Government initiate action to ensure new MDAs are implemented at the conclusion of the current agreements so as "to assist the mining industry locate, mine and produce minerals and metals at the lowest possible cost for expanding world markets and for expanding the related manufacturing sectors across Canada".**

The aims and objectives of the successor agreement will be to:

foster continued liaison with and involvement by industry in setting goals and priorities for timely and appropriate MDA projects.

encourage sharing of costs by industry where this is appropriate.

complete basic 1:50,000 mapping in prospective regions.

sustain and intensify detailed 1:20,000 mapping efforts in regions of existing mining activity.

broaden and diversity the focus of field activities to include "greenfields" mapping in more remote as yet undeveloped areas with geologic potential for new discoveries (onshore and offshore).

initiate/expand systematic computerization of minerals oriented data bases to permit integration and analysis.

upgrade mineral inventories to include recent/new developments.

continue and intensify application of proven prospecting and exploration methodologies to upgrade geochemical definition of potential ore zones.

encourage increased participation by university research workers in minerals and economically oriented applied geoscience research.

complete coverage of government funded regional airborne magnetic surveys and continue implementation of electromagnetic surveys in regions with favourable potential for base and precious metal mineralization.

facilitate increased involvement by university graduates or under-graduate students in minerals developments, through institution of co-op education programs with the mineral industry; establishing chairs of Economic Geology; enlarging seasonal employment opportunities.

extending shield-marginal documentation of the Precambrian basement as a means to locating sub-Phanerozoic ore deposits.

increase the level of research and development into cost effective mineral exploration technologies, geophysical instrumentation and drilling techniques.

increase the level of research and development into minerals extraction and processing technologies (institute suitably equipped analytical laboratories in research centres across the country where these do not currently exist).

increase the number of prospectors and improve their skills by holding prospecting schools in mining districts; encouraging native participation and providing prospectors assistance programs.

conduct research and development into preventing and correcting environmental damage caused by acid mine drainage.

conduct research and development into SO2 emission reduction and new smelting techniques to ameliorate the costs of imposing environmental controls.

and as part of a national mineral products strategy;

continue evaluation of industrial mineral potential and potential for new industrial meneral commodities.

evaluate potential for new commodities with high tech applications as well as by-product applications from existing operations.

initiate infrastructure provisions (e.g. Ontario, Quebec)

initiate drill core storage and retrieval programs.

modify the existing parallel delivery approach
i.e. federal contributions to provincial delivery (e.g. Ontario, B.C., Quebec).

improve mineral title systems.

ALBERTA GEOLOGICAL SURVEY WELL DATA BASE

Andre Lytviak, Alberta Geological Survey

INTRODUCTION

The Alberta Geological Survey Well Data Base (AGSWDB) is a computer data base implementing a number of elements of a vast array of data from wells drilled for hydrocarbon exploration or exploitation. It provides the Alberta Geological Survey with easy and quick access to these elements and with an infrastructure useful in computer-based management and manipulation of data not formally included in AGSWDB.

PURPOSE

The many projects and programs within the Alberta Geological Survey use generally available well data, at least during their initial phase. The Energy Resources conservation Board (ERCB), in pursuing its own mandate, maintains a large computer data base of information on wells within Alberta. A subset of these data is publicly available in machine-readable form. AGSWDB was designed and implemented as a common database to reduce duplication of effort in implementing these data for each individual program and project, to facilitate the development of a standard set of data manipulation and display utilities, and to make a subset of ERCB data readily available within the Alberta Geological Survey.

HISTORY

Since the early 70's, first the Groundwater Department and then the Geology Department of the Alberta Research Council have been using computers to manipulate, synthesize and display geographically located data. Though the Groundwater Department did implement a province-wide computer data base of shothole information for bedrock surface mapping, initially most of the data treated were entered from hardcopy into the computer for each project and program separately.

The Alberta Research Council acquired a VAX 11/780 during the late 70's. Shortly thereafter, the Alberta Geological Survey made arrangements with the ERCB to acquire machine-readable Alberta well data on an ad hoc basis. This information was implemented using the Datatrieve* data base managment system. However, because of the volume of data involved, only project-specific subsets resided on disk and the data base as a whole existed only on magnetic tape. It was updated from ERCB data whenever it was felt that some new project warranted current data.

In 1983, as part of a multidisciplinary project to study the deep basin hydrogeology in the Cold Lake area of Alberta, the desing and implementation of an integrated set of data manipulation, synthesis, and display tools was undertaken. As the Datatreive DBMS was judged to be inappropriate for the implementation of a complex data base with one-to-many, many-to-many, variable occurrence and variable length records, a custom data base, General Well Data Base (GWDB) (S. Bachu *et al.*, 1987), was designed and written in FORTRAN and implemented under VMS**. GWDB utilized both magnetic tape and disk to implement a subset of the ERCB well records as well as data entered from hardcopy sources and data derived by the synthesis and interpretation of both.

GWDB and the associated tools were used to support projects in all areas of the Alberta, parts of Saskatchewan as well as in the Beaufort Sea — Mackenzie Delta area. Thus, at one point, in excess of 150 000 wells were being managed within GWDB. The data base and software were developed, supported ans primarily used by the Basin Analysis Group, of the Alberta Geological Survey.

In addition to the suppor of the data base itself, the suport and development of the GWDB software became sufficiently onerous that in 1985, the data base was re-implemented on the commercial INGRES data base management system (RTI, 1985). This implementation was designed to support a common subset of Alberta Geological Survey needs in addition to those specific to the

*Datatreive is a data base management system written and sold by Digital Equipment Corporation (DEC).
**VMS is an operating system written by DEC to run on DEC's VAX computers.

Basin Analysis Group. A set of basic applications was written, using FORTRAN and the INGRES EQUEL high-level language interface to duplicate most of the functions previously provided by GWDB. In addition to the explicitly designed and written applications, AGSWDB users can use a large suite of application-independent tools which are part of the INGRES system.

Currentley work is in progress to add more record types to AGSWDB as well as to provide more tools to manipulate these data.

DESIGN

Data base management systems implement one of three basic data models, commonly called the hierarchical model, the network model, and the relational model. There are a number of hybrids available as well. INGRES directly implements the relational model. In this model, data records (tuples) are stored in a set of files (tables) with no explicit structural links between the contents of one table and those of another (Stevens, 1987). These links are implied by relations between data elements of one thable and those of another. The main advantage of the relational model over the hierarchical and network models is that it is easier to build. The main disadvantages are that it doesn't enforce relationships, and that many-to-many relationships are awkward to implement.

The records and elements in well data tend to have complex many-to-many relationships with one another intuitively best described in network terms (e.g. the case where there are many chemistries from a well battery). A requirements analysis was undertaken to determine the commonly used data elements and access paths. This analysis showed that some basic normalization could simplify the interrelationships. It was then possible to reduce these to a form which could be implemented in a relational model in a relatively straightforward manner.

The fact that the relational model does not enforce relationships between tables is a mixed blessing in an environment such as the Alberta Geological Survey. The onus is on the database implementers to ensure that integrity of relationships is maintained along defined access paths. However, the user is not constrained by any fixed set. Thus, anyone conversant with the retrieval languages, QUEL, SQL, or INGRES-menue is free to explore the data base along other lines and to display or seek additional relationships between AGSWDB data elements or records.

The main link in AGSWDB is a record element called sitid, whick uniquely defines a single well throughout the data base. All well-specific tables include it in their records. In the cases in which multiple occurrences are possible within a well, such as picks, chemistries, cored intervals, etc., sitid is supplemented with an additional identifier. This identifier is specific to each record type. For example, intervals are numbered in the cores cut and core analysis tables. A record which was specific to a well and a cored or analysed interval would contain both the sitid and the interval number. It is through careful management of these links that main relationships are retained within AGSWDB.

IMPLEMENTATION

The data base contains one common MASTER table. The MASTER record type constitutes the primary index and main linking mechanism within AGSWDB. This record type contains three identifier elements. The first, sitid, is unique within AGSWDB and is also contained by any other AGSWDB record specific to this particular well. The sitid element provides the main inter-table link within AGSWDB. The second element, called srcid, is the unique identifier given to the well by the agency from which the record was acquired. This allows AGSWDB to be related to the data base of the source agency for purposes of update, verification and reference. The last element, called wname, is the well name given by the company hardcopy well records. It also serves as a verification mechanism for record correspondences established using other data elements. The MASTER record type also contains an element identifying the source of the well information and the date of its acquisition.

AGSWDB contains one common LOCATION table. The LOCATION record type provides the ability to locate the well in geographic coordinates. The ability to locate quickly and positively identify the wells in a given area is the single most commonly used function of AGSWDB. In addition to the sitid

element, LOCATION records contain the latitude and longitude of the well surface location, its ground and kelly elevations, its total depth and true vertical depth. Each set of values also has an associated data element which indicates the precision of the given location and depth values.

Horizons are implemented as a single dictionary table, HORDIC, together with a separate table, HORIZON, for each horizon picked. These are implemented to allow the storage and retrieval of pick records such as those available from the ERCB. The HORDIC record type provides the link between horizon names, identifies the source of the horizon picks, as well as the date the horizon was implemented in the data base. The HORIZON record type contains the sitid element as a link to the well, the depth of the pick, a quality code and an element describing the part of the horizon picked. The fact that picks for each horizon are implemented in separate tables makes the manipulations of horizons as entities straightforward at considerable detriment to the ability to deal with the down-hole relationships of horizon sequences.

An inventory of the cored intervals is implemented as a single table, CORES CUT. The CORES CUT records are linked to the other tables via the sitid data element and differentiated by a core no element. The top and bottom of the cored interval as well as the length of core recovered constitute the main elements in this record type. Several other elements such as date of coring and fluid used are also retained.

The results of core analyses are also implemented as a single table, CORE ANAL, and implemented much the same as the CORE CUT record type. The core anal records have, in addition to elements used for linking and differentiating records, a subset of possible determinations. This subset consists of maximum, perpendicular and vertical permeabilities, porosity, grain density, etc.

Drillstem tests (DST) and formation fluid chemistries have been implemented in AGSWDB. These are both complex implementations of one-to-many and many-to-many relationships. They differ from the previous data types in that, though their indices are based on machine-readable files from the ERCB and other agencies, the bulk of the data was entered by hand from hard-copy originals or through interactive interpretations of such base data.

CURRENT STATUS

The Alberta Geological Survey Well Data Base currently contains records on approximately 170 000 wells. About 130,000 of these are in Alberta, 30 000 in Saskatchewan, and the remainder are in B.C. and N.W.T. (Figure 1).

The ERCB releases an updated version of its data base four times a year. To take advantage of ERCB's update flags and, thereby, decreasing the number of records to be processed, the Alberta subset of AGSWDB is also updated four times a year. The Saskatchewan, British Columbia, and North West Territories subsets are updated only when project requirements indicate this to be necessary.

Currently one main users utility, GEOCRT (GEOgraphy CaRTography) (A. Lytviak, 1986), has been written to allow users transparent access to AGSWDB. GEOCRT allows users to define a project with any number of associated study areas. These can be disjoint or subsets of other study areas. Within each study area users can extract, edit, and print the pertinent subset of wells from AGSWDB's total holdings. These subsets constitute a custom database accessible only to the user. Changes to this subset do not affect the common tables and are not available to other users without explicit arrangements being made by the data base administrator. GEOCRT also allows users to extract, edit, and print custom horizon tables. The extraction process allows one to equate any combination of the generally available horizons with user-defined horizons. These, as well, are specific to the user unless explicit arrangements are made with the data base administrator.

Though some custom reports have been predefined and can be run by inexpert users, access to AGSWDB holdings other than well distribution and horizon picks currently requires knowledge of the INGRES retrieval and report languages.

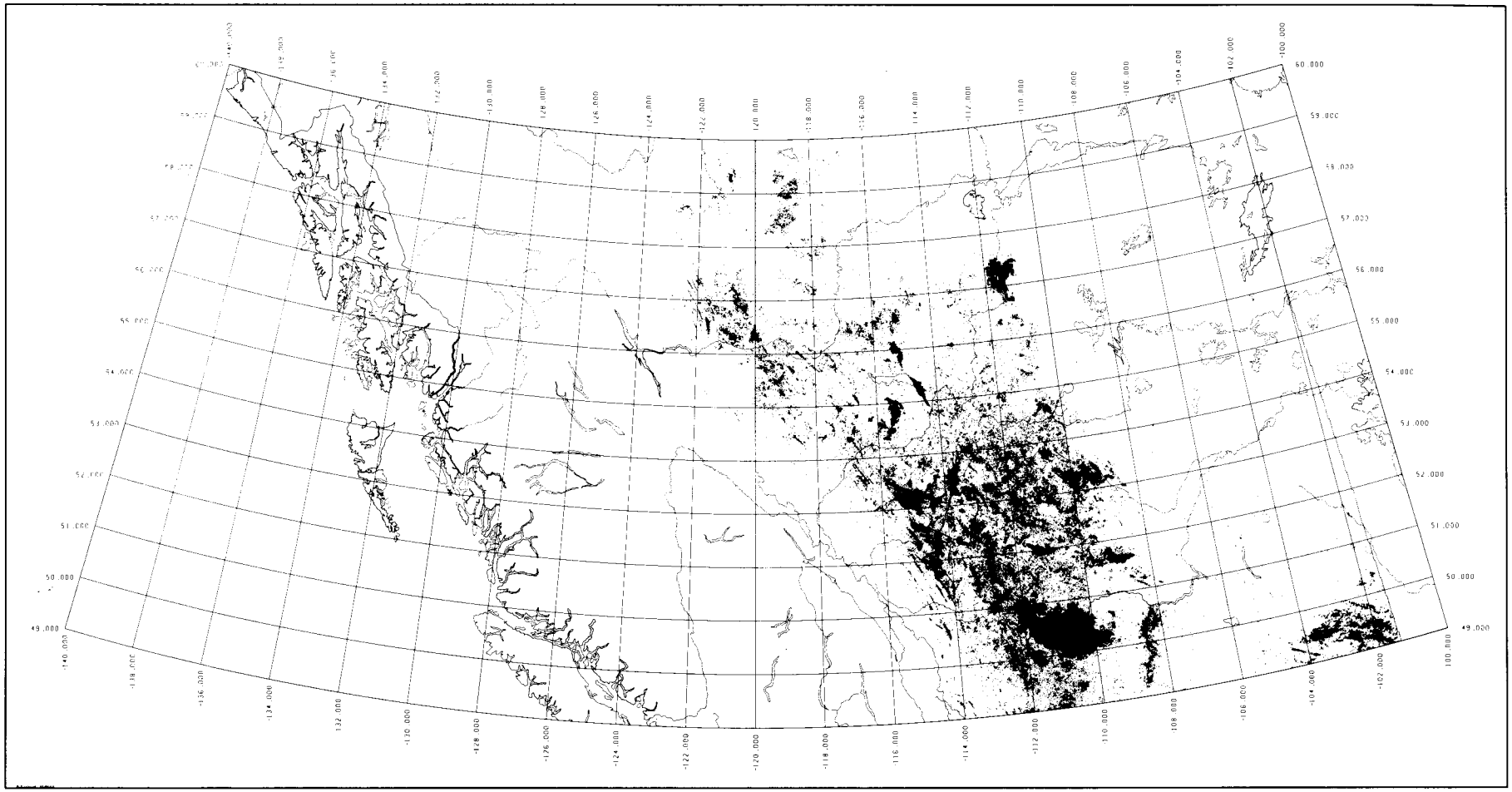

Figure 1. Distribution of wells in Alberta, Saskatchewan, B.C. an N.W.T.

Cartographic representation (plotting) of these data is performed by applying a custom cartographic package, GEOPLTR (A. Lytviak, 1983), to reports generated from AGSWDB, or acquired otherwise. Structure contour maps and other data generalizations are produced by using GEOPLTR in conjunction with the commercial surface manipulation and display package, SURFACE II (R. Sampson, 1975).

FUTURE DIRECTIONS

AGSWDB's emphasis on the horizon relationships will be supplemented by a stronger set of down-hole capabilities. This requires that the multiple tables for horizons be reimplemented as a single, multiple horizon table. This will allow simplification of the currently complex procedure to subset data based on vertical relationships such as "above", "below" and "between".

The logged intervals description data will be implemented in AGSWDB in the near future. The current horizon and area capabilities of GEOCRT will be extended to allow transparent access to the core cut, core analysis data and logged interval data.

The GEOPLTR cartographic package will be rewritten and integrated with the database software to make the plotting and data retrieval system interface more transparent to the user.

The intention is to implement Radian Corporation's CPS-3 subroutine library (K. Graf, 1986), as the basis for surface manipulation and display. This, too, will be integrated with the data base and cartographic packages. The ability to use SURFACE II will be retained, but will not be integrated.

CONCLUSION

At this time it appears that the AGS efforts in adoption and development of a department-wide data base has the following actual and potential consequences.

1) Reduce the duplication of data acquisition and data support effort.
2) Increase the currency, availability, and integrity of many commonly accessed data.
3) Allow the desing and implementation of a common set of data manipulation and display tools for a wider range of projects and programs.
4) Increase the access to data and data manipulation capabilities to the geologist.
5) Increase the amount of departmental resources required for overall computer support, both in terms of computers and computer support personnel.

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INFORMATION ON LEGISLATION SURROUNDING MANDATES OF PROVINCIAL GEOLOGICAL SURVEYS IN CANADA

BRITISH COLOMBIA

LEGISLATION

Ministry of Energy, Mines & Petroleum Resources Act.

Purpose and functions of ministry:

(a) initiate and carry out any investigation, research, study or inventory respecting mineral and petroleum resources, and on energy facilities and future requirements for the Province;

(b) collect and circulate the information acquired;

(c) establish energy services for ministries of the Province, and for that purpose to obtain from them information about their projects, programs and requirements involving energy.

GEOLOGICAL RESPONSIBILITIES

GEOLOGICAL SURVEY BRANCH 87/88 PLAN

MISSION STATEMENT

The mission of the Geological Survey Branch is:

> To aid, stimulate and promote the growth of the mining industry for the social and economic benefit of the people of British Colombia by conducting geoscientific surveys, by inventorying and analysing the geology and mineral depostis of the Province and by disseminating this information in a timely manner.

SUPERORDINATE GOALS

The work of the Geological Survey Branch contributes to five main, inter-related goals that contribute to the over-all mission of the Mineral Resources Division — "stimulate, facilitate and guide mineral exploration development and production for the overall benefit of the Province."

These goals are:

1. To develop and advance the basic geoscientific knowledge of B.C., by undertaking and supporting geoscientific surveys and related research, to enhance the discovery and development of the Province's mineral resources.

2. To analyse and interpret information on the distribution, nature and magnitude of the Province's mineral, coal and industrial mineral resources.

3. To collect, compile and collate all information relating to the geology, mineral resources, and exploration activites in B.C. in order to provide a comprehensive database for government, industry and public use.

4. To develop and communicate the geoscientific information needed by Governments for effective land use and mineral policy decision.

5. To disseminate the information collected in a timely manner through publications, scientific meetings, trade shows, and an annual open house.

ALBERTA

LEGISLATION	GEOLOGICAL RESPONSIBILITIES
ALBERTA RESEARCH COUNCIL ACT	The Alberta Research Council may conduct, on a scientific or engineering basis: (a) research related to the utilization and upgrading of the natural resources of Alberta; (b) research on new and improved technical processes and methods that are of might be used in Alberta industries; (c) research on behalf of or pursuant to agreements with persons, firms or organizations that wish to avail themselves of the expertise and facilities of the Alberta Research Council; (d) basic and applied research in the natural sciences with the objective of improving the welfare and progress of urban and rural life in Alberta; (e) research to ensure the effective application of technology developed by the Alberta Research Council in both the public and private sectors of Alberta. The Alberta Research Council (a) shall, at the request of the Executive Council, advise it on questions of scientific and technological methods affecting the expansion of industries or the utilization of the natural resources of Alberta, and (b) shall supervise matters affecting scientific and industrial research assigned to it by the Lieutenant Governor in Council.
ENERGY RESOURCES CONSERVATION ACT	(a) to provide for the appraisal of the reserves and productive capacity of energy resources and energy in Alberta; (b) to provide for the appraisal of the requirements for energy resources and energy in Alberta and of markets outside Alberta for Alberta energy resources or energy; (c) to effect the conservaton of, and to prevent the waste of, the energy resources of Alberta; (d) to control pollution and ensure environment conservation in the exploration for, processing, development and transportation of energy resources and energy; (e) to secure the observance of safe and efficient practices in the exploration for, processing, development and transportation of the energy resources of Alberta; (f) to provide for the recording and timely and useful dissemination of information regarding the energy resources of Alberta;

(g) to provide agencies from which the Lieutnant Governor in Council may receive information, advice and recommendations regarding energy resources and energy.

OIL SANDS TECHNOLOGY AND RESEARCH AUTHORITY ACT

The compilation, assessment and dissemination of present and future technological information relating to:

(a) exploration for oil sands deposits and the recovery and processing of oil sands products,

(b) the recovery and processing of crude oil and products derived from crude oil,

(c) environmental conservation in connection with those exploration, recovery and processing operations, and

(d) the production and transportation of synthetic crude oil and other oil sands products and of crude oil and products derived from crude oil.

OIL & GAS CONSERVATION ACT

(a) to effect the conservation of, and to prevent the waste of, the oil and gas resources of Alberta;

(b) to secure the observance of safe and efficient practices in the locating, spacing, drilling, equipping, completing, reworking, testing, operating and abandonment of wells and in operations for the production of oil and gas;

(c) to provide for the economic, orderly and efficient development in the public interest of the oil and gas resources of Alberta;

(d) to afford each owner the opportunity of obtaining his share of the production of oil or gas from any pool;

(e) to provide for the recording and the timely and useful dissemination of information regarding the oil and gas resources of Alberta;

(f) to control pollution above, at or below the surface in the drilling of wells and in operations for the production of oil and gas and in other operations over which the board has jurisdiction.

SASKATCHEWAN

LEGISLATION

THE MINERAL RESOURCES ACT 1985.

NOTE: "Section 10 of *The Mineral Resources Act, 1985* empowers the Minister to carry out various geological and mineral-related activities".

POWERS OF MINISTER

10 The minister may do those things that he considers necessary respecting the exploration for and the development, management and conservaton of the mineral resources of Saskatchewan and, without limiting the generality of the foregoing, the minister may;

(a) provide for the carrying out of surveys of any or all minerals or mineral resources in Saskatchewan;

(b) provide for the collection, arrangement and systematization of information respecting minerals and mineral resources and the operation of mines or wells for the production of any minerals in Saskatchewan and the preparation and publication of such reports in connection therewith as he deems necessary;

(c) make and carry out investigations, examinations, experiments, tests and analyses of or pertaining to minerals for the purpose of determining their scientific and economic value.

"This is from the *departmental* "Mandate, Aims and Objectives". The document does not contain a specific mandate or mission statement for the Geological Survey but states major aimns of the Geology and Mines Division (1-7 below) of which the Survey is a part." (Dr. Les Beck 11/6/87).

GEOLOGICAL RESPONSIBILITIES

Geology and Mines Division

(1) Perform geological and mineralogical studies in order to assess the mineral potential of the province and to provide a framework for mineral exploration programs by industry.

(2) Maintain an up-to-date and relevant geoscientific library (maps, reports, data files, inventories and core collections).

(3) Promote resources and exploration opportunities in the province through publication, technical meetings, open house displays and individual consultations.

(4) Assess the results of petroleum and mineral exploration submitted by industry for technical validity and conformity to the regulations.

(5) Monitor mining operations to ascertain that good conservation practices are in place and that mine development correlates with royalty returns.

(6) Regulate and administer the disposition of crown lands relating to potash, uranium, hard rock minerals, sodium sulphate, coal and quarriable commodities such as limestone and aggregate.

(7) Maintain up-to-date and accurate records of mining and exploration activites, mineral production and the value of mineral sales in the province.

MANITOBA

LEGISLATION

An act to create a Department of Mines and Natural Resources.

Appointment of staff

A deputy minister, an assistant deputy minister, a Director of Mines, a provincial geologist, a provincial assayer, a chief inspector, inspectors, and such other officers and employees as may be required to carry on the business of the department, may be appointed as provided in The Civil Service Act.

Duties of Director of Mines

The Director of Mines, under the direction and control of the minister, shall carry out the provisions of The Mines Act and the regulations or ordors.

Administration

The minister shall administer The Mines Act and the regulations, and the Director of Mines, the provincial geologist, the chief inspector and inspectors appointed under this Act are, and have the powers of, inspectors under that Act and the regulations.

ONTARIO

LEGISLATION

"In 1891, an Act of Legislature created the Ontario Bureau of Mines, its purpose being "to aid in promoting the mineral interests of the Province". It is here that the present Ontario Geological Survey originated and staff were appointed.

The need for geological mapping to encourage exploration for minerals was recognised. Over the years, the role of the Survey was modified from time to time, until the formulation of the current goal statement, of which a copy is attached. This statement, and the eight objectives, were approved in 1978 by the Deputy Minister of Natural Resources. We are now in a new Ministry and the Survey's role is under review" (from Dr. Milne, June, 1987).

GEOLOGICAL RESPONSIBILITIES

PROPOSED GOAL AND ABJECTIVE STATEMENTS

GEOLOGICAL PROGRAM

Goal: To stimulate exploration for, and facilitate sound planning in all matters related to, mineral and all other earth resources by providing an inventory and analysis of the geology and mineral deposits of Ontario.

Objectives:

1. To interpret the geology and mineral deposits of Ontario by undertaking geological, geochemical and geophysical surveys of the bedrock and surficial deposits.

2. To locate areas of high mineral resource potential by analyzing and evaluationg geoscience data in order to determine the characteristics of geological environments favourable for mineralization.

3. To provide expertise and information for the identification and evaluation of earth resources to facilitate integrated planning in the context of MNR's corporate program objectives, putting particular emphasis on the program interaction relative to urban, engineering, recreational and environmental concerns by locating terrain most suitable for construction and development, identifying potential natural hazards and assisting in the siting and potential utility corridors.

4. To evaluate the mineral development capabilities of the province by undertaking inventories of the reserves and potential resources of Ontario's mineral deposits.

5. To achieve wide effective circulation of technically current geological and geotechnical information on the Ontario land mass and its mineral resources, and to develop and maintain a readily accessible modern data storage and retrieval system on the geology and mineral deposits of the province.

6. To stimulate exploration by the private sector and aid regional development by providing financial incentives and assistance programs to the exploration industry.

7. To stimulate and encourage new technology and new concepts in mineral exploration by funding applied geoscience research on the nature and origin of mineral deposits, geological processes, engineering and environmental geology, exploration technology, and data processing.

8. To provide analytical and mineralogical expertise in aid of Ministry Mineral Resource Inventory and Management Activities.

QUEBEC

LEGISLATION

Political Statement relating to Geological Exploration and assistance to exploration of Mineral Deposits.

GEOLOGICAL

OBJECTIVES OF THE DEPARTMENT OF ENERGY & MINES FOR GEOLOGICAL RESEARCH

— To augment all exploration efforts in Quebec.
— To ameliorate its efficacy.
— To diversify mineral production in its territory.

The means for realizing these objectives are based on four activity levels:

Activity 1: Geological mapping over the entire Quebec territory. This is at a reconnaissance level using aeromagnetic and/or gravimetric mapping at a small scale (i.e. of large areas), combined with geological mapping also at a small scale (1:250 000).

Activity 2: Geological mapping of metallogenic provinces (in Quebec) at 1:50 000 scale. Regional geochemical and spectromagnetic survey is based roughly on 1 sample /15 km^2 depending on type of terrain.

Activity 3: Detailed geological mapping in potential or existing mineral districts at 1:20 000 and 1:10 000 scale. Aerial geophysical study, detailed geochemical and geological work help identify complexes, units or structures most favorable for mineral exploration.

Activity 4: Specific studies of mineral districts, helps to finalize the local geological modelling, characterize and locate deposits in the model in order to predict and locate other deposits. This may include various studies such as structural, stratigraphic, sedimentologic, geophysical, geochemical, petrologic, volcanologic, geochronologic, etc.

NEW BRUNSWICK

LEGISLATION

There is no specific Act governing the survey, but there are guidelines setting out the geological responsibilities of the Geology Branch.

GEOLOGICAL RESPONSIBILITIES

GEOLOGICAL SURVEYS BRANCH

The Geological Surveys Branch is responsible for the collection and dissemination of information pertaining to the geology and mineral deposits of New Brunswick. Closely associated activites include the encouragement of mineral exploration, the promotion of the mining industry, and helping those who formulate resource and land use policies. The principal objective of the Branch is to provide a complete and up-to-date inventory of geological data to stimulate and guide mineral exploration, and to allow sound resource planning.

A large part of the Branch's activities in 1985 were carried out under Canada-New Brunswick Mineral Development Agreement (MDA). This accord entails an expenditure of $22.3 million over a five year period on geoscience, mineral technology, and public awareness programs.

NOVA SCOTIA

LEGISLATION

The Department traces its history back to the 1840s when the Inspector of Mines made regular reports. In 1862 an act was passed to establish a Gold Commissioner with power to survey gold mining districts and appoint assistant commissioners and bailiffs in each district as needed.

Not until 1939 did the Department gain a separate identity. In that year the Public Service Act was passed which separated Mines from Public Works and established a department with a deputy minister. The Mines Act, passed during the same period of time, provided for the regulatory functions of the Department.

An amendment to the Public Service Act in 1978 changed the name of the Department from Mines to Mines and Energy. It added responsibility for promoting mineral and energy use and allowed for the regulation of these sectors.

The geological investigations that our Department undertakes are not spelled out in legislation but are encouraged by the various acts through reference to "promotion of our mineral resources," etc.

NEWFOUNDLAND

LEGISLATION

DEPARTMENT OF MINES & ENERGY ACT.

POWERS, FUNCTIONS AND DUTIES OF MINISTER.

7. The powers, functions and duties of the Minister extend to and include

   (a) the supervision, control and direction of all matters relating
   (i) to mines, minerals, coal, oil, natural gas, salt, quarries, quarry materials and beaches.

   (b) the collection, compilation, analyzing and recording of such statistical and other information relating to any of the matters referred to in paragraph (a) as may be useful.

   (c) the preparation and publication of statistics, reports, records, bulletins, pamphlets, circulars and other means of disseminating information in relation to any of the matters referred to in paragraph (a) as may be useful.

GEOLOGICAL RESPONSIBILITIES

OBJECTIVES AND GOALS OF MINERAL DEVELOPMENT DIVISION

The Mineral Development Division is responsible for obtaining and disseminating information on the geology and mineral resources of Newfoundland. The division functions as a geological survey with two major objectives:

1. to promote exploration and development of the province's mineral resources by providing basic geoscientific data indicating areas where mineral deposits may be found, and

2. to provide the geoscientific data necessary for proper management of the province's mineral resources.

In fulfilling its role, the division carries out field and office programs in a number of disciplines related to mineral resource development. These include geological, geophysical and geochemical surveys, evaluation of mineral deposits and resource development potential, and development and maintenance of mineral resource information systems for government, the mineral exploration industry and the general public.

FUNDING

Mineral Development Division's budget for the 1984-85 fiscal year was $4.1 million (net), allocated as outlined below.

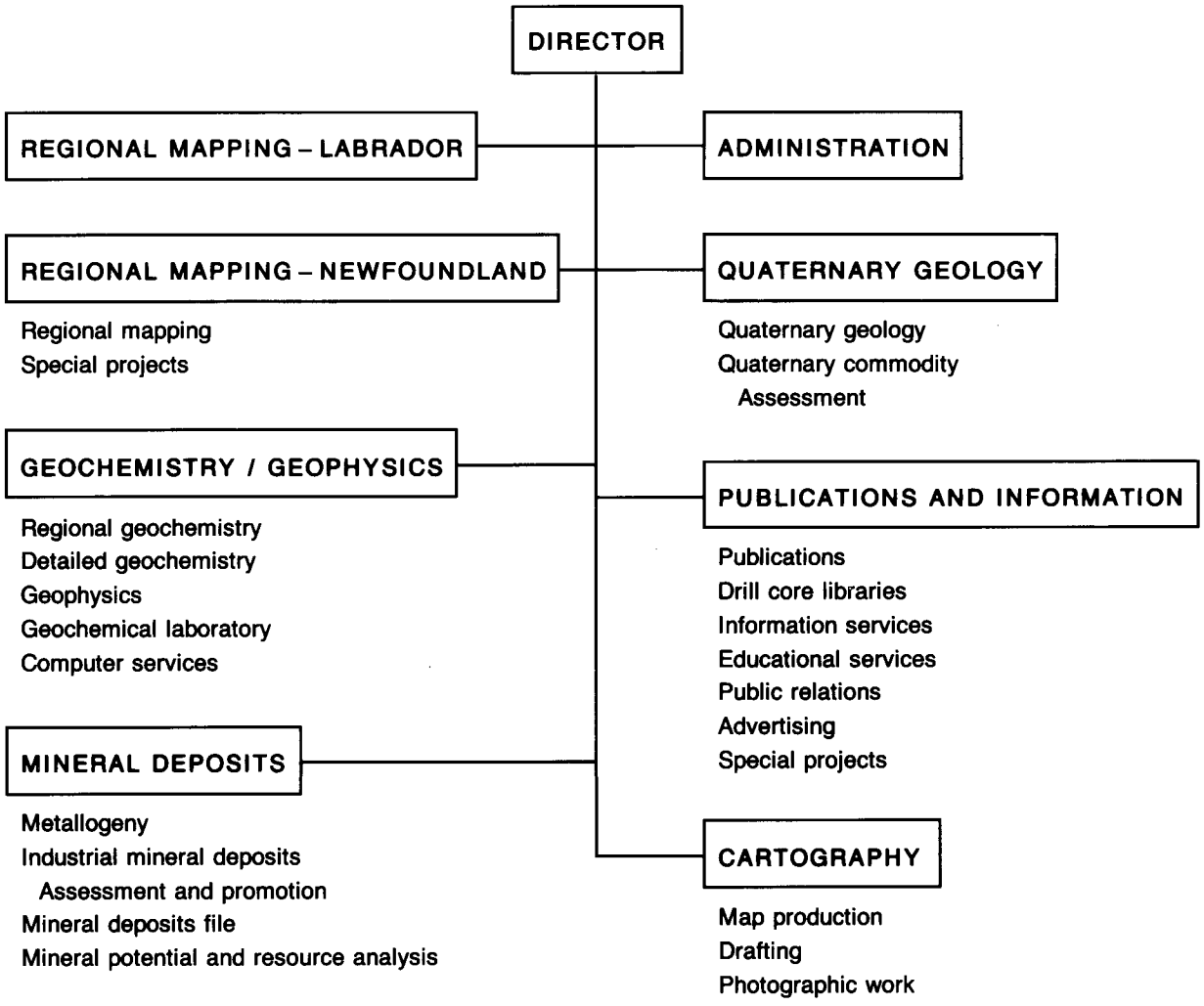
Major increases in funding over 1983 levels were due entirely to the initiation of new projects under the Canada-Newfoundland Subsidiary Agreement on Mineral Development, wich was signed in May, 1984. This agreement is for a five-year term (1984-89) and will

involve the expenditure of $22 million. This amount is subdivided as follows:

	Total*	1984-1985
1. Federally funded and delivered projects	$12.1	$2.0
2. Provincially funded and delivered projects	3.4	0.5
3. Provincially delivered, cost-shared (50 percent federal, 50 percent provincial) projects	6.5	1.3
TOTAL	$22.0	$3.8

* Totals in millions

MINERAL DEVELOPMENT DIVISION
ORGANIZATION AND RESPONSIBILITIES



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