



Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

ANNUAL REPORT 1980

**MINERAL RESOURCES BRANCH
GEOLOGICAL DIVISION**

May 1981

GEOLOGICAL DIVISION

Annual Report - 1980

OBJECTIVES AND ORGANIZATIONS

Metals, non-metallic minerals, and coal are non-renewable judged by the scale of man's lifetime. The Province's needs for these commodities for our own use and for export are fulfilled only by continuous exploration and discovery. The fundamental role of the Geological Division is to facilitate the renewal process. To do this the detailed objectives of the Geological Division are to provide accurate and current information on the quantity and distribution of mineral and coal deposits of the Province for government and industry, to provide geological, geochemical, and geophysical maps and other data, ideas, interpretations, and training useful in the search for these deposits, and to assist in the orderly exploration, development, and use of these resources. To carry out these objectives, the Division is organized into four sections: Project Geology, Applied Geology, Resource Data and Analysis, and Analytical Laboratory, the work of which is described subsequently.

STAFF

The staff on December 31, 1980, included 52 permanent positions, 10 full-time auxiliary positions. The permanent positions consisted of 28 geoscientists, 6 chemists, 10 technicians and technical assistants, and 8 secretaries, clerks, and office assistants. The auxiliary positions included two geoscientists, 5 technicians, and 3 office assistants. At the end of the year 6 permanent positions were vacant and three resignations were in hand.

A. Sutherland Brown, Ph.D., P. Eng. Chief Geologist

Project Geology

| | |
|--|---------------------------|
| W. J. McMillan, Ph.D., P. Eng. | Senior Geologist |
| P. A. Christopher, Ph.D., P. Eng. | Geologist |
| B. N. Church, Ph.D., P. Eng. | Geologist |
| G. E. P. Eastwood, Ph.D., P. Eng. | Geologist |
| R. D. Gilchrist, B.Sc. | Geologist |
| T. Høy, Ph.D., P. Eng. | Geologist |
| D. G. MacIntyre, Ph.D., P. Eng. | Geologist |
| A. Panteleyev, Ph.D., P. Eng. | Geologist |
| D. E. Pearson, Ph.D., P. Eng. | Geologist |
| V. A. Preto, Ph.D., P. Eng. | Geologist |
| Vacant | Geologist |
| Vacant | Geologist |
| J. L. Armitage | Chief Draughtsman |
| R. E. Player | Lapidary and Photographer |

Applied Geology

E. W. Grove, Ph.D., P. Eng.Senior Geologist
Vacant Geologist
G. G. Addie, M.Sc., P. Eng.District Geologist
G. H. Klein, B.A.Sc., P. Eng.District Geologist
T. G. Schroeter, M.Sc., P. Eng.District Geologist
G.P.E. White, B.Sc., P. Eng.District Geologist
R. H. Karst, B.Sc.District Geologist
D. A. Grieve, M.Sc.District Geologist
G. V. White, B.A.Engineering Assistant

Resource Data and Analysis

J. G. McArthur, M.Sc. Senior Geologist
Z. D. Hora, M.Sc. Industrial Minerals Geologist
Vacant Land Use Evaluation Geologist
Vacant Resource Analyst Geologist
T. E. Kalnins, B.A.Sc., P. Eng. Geologist
VacantResearch Officer
J. E. Forester, M.A.Research Officer
A. Matheson, B.ScResearch Officer

Analytical Laboratory

W. M. Johnson, Ph.D. Chief Analyst
P. F. Ralph, L.R.I.C. Deputy Chief Analyst
B. Bhagwanani, B.Sc. Laboratory Scientist
R. J. Hibberson, B.Sc. Laboratory Scientist
Y.T.J. Kwong, M.Sc. Laboratory Scientist
V.V.B. Vilkos, Ph.D. Laboratory Scientist
M. A. Chaudhry Laboratory Technician
F. F. Karpick Laboratory Technician
L. E. Sheppard Laboratory Technician

STAFF CHANGES

During 1980, the Division experienced a major staff turnover that seriously affected its capability to carry out its program. Dr. N. C. Carter, Senior Project Geologist, resigned to become Vice President of Great Western Petroleum Corporation. Dr. E. W. Grove resigned during December 1980 effective in January 1981, to start his own consulting service. Mr. A. F. Shepherd, Deputy Director of Prospectors Assistance, retired after 36 years of service with the Ministry. Dr. K. E. Northcote, Mineral Land Use Specialist, resigned to join consulting and management firm, Bema Industries Ltd.; Dr. P. A. Christopher, uranium project geologist, resigned to work for Utah International. Mr. G. L. James was

transferred to Finance and Administration to become Co-ordinator for Data Processing. In addition, two other resignations were made at the end of the year to be effective early in 1981; Dr. D. E. Pearson to set up his own coal consulting firm, and Mr. R. H. Karst to become Chief Mine Geologist at Hinton, Alberta.

In contrast during the year, the only positions filled by competition were Dr. W. J. McMillan who became Senior Project Geologist and Mr. J. G. McArthur, formerly with the Newfoundland Dept. of Mines and Energy, became Senior Geologist, Resource Data & Analysis.

THE WORK OF THE DIVISION

The distribution of major projects in 1980 and of district offices, regional geochemical surveys, map areas are shown on Figure 1.

PROJECT GEOLOGY

The work of this section is devoted principally to geological mapping of areas important for mineral resources and to related research leading to better understanding of the origin and distribution of mineral deposits. It also conducts, with the help of the Analytical Laboratory, the regional geochemical reconnaissance surveys that are useful for both exploration and environmental base line studies. The section, under N. C. Carter until June and later in the year W. J. McMillan, mounted 10 main field projects listed below. Field costs for the geological surveys were about \$300,000 and a geochemical reconnaissance survey cost about \$205,000. Salaries and other costs of the section totalled about \$600,000.

Major Projects mounted by the Section in 1980 included:

| <u>Project & Commodity</u> | <u>NTS Areas</u> | <u>Map Publication Scale</u> | <u>Principal Investigators</u> |
|---|----------------------------------|----------------------------------|------------------------------------|
| (a) N. Okanagan Tertiary Stratigraphy and Paleomagnetism (U,Au,Ag) | 82E & parts of 82L | 1:50,000 | B.N. Church |
| (b) S.E. B.C. Lead & Zinc Resources, Moyie Lake & Revelstoke area | 82G,L,M | 1:50,000 and 1:10,000 | T. Höy |
| (c) Barriere Lakes/Adams Plateau (Cu/Zn) | 82M/3,4,5 92/1,8 | 1:25,000 | V.A. Preto |
| (d) Clearwater Area (Cu,Zn,U) | 82M/12W 92P/8E,9W | 1:25,000 | P.A. Schiarizza |
| (e) Sicker Group (Cu,Zn,Au,Ag) | 92B/13 | 1:25,000 | G.E.P. Eastwood |
| (f) N.E. B.C. Lead & Zinc Resources, Akie River Area | 94F/2,3,6,11 12,13 94L/1,8 | 1:50,000 | D.G. MacIntyre |
| (g) Cassiar Area (Mo,W,Au) | 104P/4,5 | 1:25,000 | A. Panteleyev & L.J. Diakow |
| (h) Crowsnest Coalfield | 82G/14,15 | 1:10,000 | D.A. Grieve & D.E. Pearson |
| (i) Peace River Coalfield Correlation Studies | parts of 93I,D | 1:25,000 | R.D. Gilchrist & P.McL.D. Duff |
| (j) Correlation of Lower Cretaceous Stratigraphy from Peace River Foothills to Plains | 93P; 94A | - | R.H. Karst |

The Regional Geochemical Survey in 1980 of Quesnel (93B) and Quesnel Lakes (93A) areas was done by a series of separate contracts with planning, supervision, and control provided by the Division. Considerable help in data handling was received from the Geological Survey of Canada.

The geological studies conducted principally by project geologists were augmented by similar work by district geologists and laboratory scientists. Cooperative studies included sampling of the Blizzard deposit by P. A. Christopher and J. Kwong for the latter to conduct detailed mineralogical work; mapping coal quality and correlation studies at both major coalfields and also a study of lead zinc deposits in the southern Rocky Mountains by D. A. Grieve and T. Höy.

Valuable additional work was also conducted by professors and graduate students at the University of British Columbia with the aid of grants from the Ministry. Many of these studies were directly relevant to Division projects and some were cooperative. The university studies included:

- . Effect of Shear on Coal Quality by R.M. Bustin.
- . Pacific Ocean Minerals Project, by R.L. Chase, E.V. Grill, and J.W. Murray.
- . A Preliminary Evaluation of Categorical Field Observations for Regional Stream Sediment Samples, by P. Matysek, W.K. Fletcher, A. J. Sinclair, and A. Bentzen.
- . Lead isotope-oriented Metallogenic Study of Mineral Deposits in B.C.; C.I. Godwin, and A.J. Sinclair.
- . Bowron Coalfield Study by G.E. Rouse and W.H. Mathews.
- . MINDEP - Editing and Evaluation of Producer File by A.J. Sinclair.
- . Isotopic Analysis by R.L. Armstrong.

At Western Ontario University the following project was sponsored:

- . Gold Mineralization at Big Missouri Property by A.G. Galley and R.W. Hodder.

Progress in fieldwork of the Division and related university projects is described yearly in Geological Fieldwork, published early in the year following the work, and in a series of preliminary maps, papers, and authoritative bulletins, issued irregularly.

APPLIED GEOLOGY

The work of the Applied Geology section, under E. W. Grove, includes aid in the field to exploration personnel and prospectors, monitoring of exploration and geological developments at producing mines, coal core storage and studies, prospector training, and control of incentive grants to exploration. District geologists conduct visits to mineral and coal properties and mapping as well as other duties related to prospectors, public information, and integrated resource management. The geological studies are described in Geological Fieldwork and Geology.

A considerable part of the effort of the section is devoted to prospectors and small developers. Over 550 students were enrolled in basic prospecting courses in 1980 and 32 prospectors graduated from the two-week long Fourth Annual Mineral Exploration course held at David Thompson University Centre, Nelson. One hundred and fifty prospectors received grants under the Mineral Prospectors Act. The Mineral Exploration Incentive Program, started in 1978 with a yearly budget of \$500,000, concluded in March 1980. It was designed to stimulate the industry by acting as a fiscal bridge between prospecting and preliminary development. The MEIP provided grants up to one-third of the receipted cost of approved programs to a maximum of \$50,000. Forty-six contracts were let in 1979-80 under the supervision of J. Bristow. Payments totalling \$290,077 were responsible for initiating \$3,655,298 worth of mineral exploration, including more than \$700,000 in diamond drilling. Ongoing projects funded in 1979/80 include Banwan Gold Mines; Consolidated Cinola Mines; Dimac Resource Corp.; Granges Exploration (Capoose L.); Hallmac Mines Ltd. (Sandon), Penresh Exploration; and Scottie Gold Mines Ltd.

The approximate operating costs of Applied Geology programs other than the MEIP were as follows: core repository and recovery, \$80,000; prospector training, \$40,000; Prospectors' Assistance grants, \$240,000; field programs of district geologists, \$100,000; permanent salaries \$320,000.

RESOURCE DATA AND ANALYSIS

This section, under J. G. McArthur, is responsible for the collection, compilation, interpretation, distribution and approval of exploration and development data gathered from various sources. Most of the information is made generally available after requisite confidential periods, normally one to three years.

The major files are:

Mineral Assessment Reports - over 7,000 microfilmed reports available at reader/printers in Vancouver and Victoria.

Mineral Assessment Report Index - a computerized bibliographic index updated annually.

MINFILE, a shallow level computerized information system with data on over 8,000 mineral occurrences. Statistical data on mineral production and reserves.

Property Files - open files containing published and unpublished reports and maps (historical) on producers and prospects and filed by N.T.S.

Coal Assessment Reports - nearly 500 reports on coal exploration. Non-confidential are available in Victoria.

Coal Data File - a computerized coal data is being constructed.

The annual volume, Exploration in British Columbia, is produced by the section coincident with its update of MINFILE.

In addition, the section administers the Portable Assessment Credit account, produces map compilations and mineral potential evaluation studies related to land use conflicts, and advises on regulations. Field-oriented studies related to industrial minerals and structural materials are also handled by this section.

A major field study of aggregate materials of the lower mainland and Vancouver Island was completed under the direction of Z. D. Hora with the cooperation of the Mineral Economics Division.

Specific site investigations in regard to land use assessments were carried out largely by District Geologists.

The budget of this section was approximately as follows: non-metallic field studies, \$26,500; MINFILE and Land Use, \$42,000; coal file construction, \$72,000; permanent salaries, \$340,000.

ANALYTICAL LABORATORY

The laboratory, under W. M. Johnson, is responsible for a complete range of analytical services for the Division geologists and prospector grantees as well as some services to other government agencies. The laboratory also runs control samples and handles the chemical data for the British Columbia regional geochemical surveys. The Chief Analyst is also responsible for assayer examinations for the Province, and assists in the organization, administration and control of the regional geochemical reconnaissance.

The facilities include X-ray fluorescence, atomic absorption and emission spectrography, X-ray diffraction, gamma-ray spectrometry and mineral separation. Capability in traditional fire assay and wet analytical chemistry still exists.

Method Development and research in the laboratory concentrated in 1980 on the following subjects: mineralogy of the Afton ore body, coal oxidation and liquefaction, measurement of low levels of gold in silts, monitoring of uranium in natural waters, trace elements in molybdenum concentrates, geochemical standards and new methods of determination of gold in copper concentrates. Many of these studies cooperated with Project Geology or with other agencies. These studies were as follows:

The distribution of the minerals in the Afton ore body by J. Kwong as his thesis work for his Ph.D. from UBC.

Investigation of the oxidation of coals and coal liquefaction, Dr. Paul West of the University of Victoria with W.M. Johnson and D. E. Pearson. There is also close liaison with B.C. Research in their coal liquefaction work.

Development and coordination by W. M. Johnson of a domestic water monitoring program with the Ministry of Health.

Development of a new method of determining gold in both exploration samples and copper concentrates by M. A. Chaudhry.

Development of trace element analysis by X-ray fluorescence by P. F. Ralph and V. Vilkos.

Participation in interlaboratory standards program, particularly by P. F. Ralph, M. A. Chaudhry and B. Bhagwanani in determination of seventeen major and trace elements in two standard reference materials put out by the National Research Council and also the determination of uranium and thorium in the CANMET standard DL-2.

Establishment of reference geochemical silt materials containing cobalt, nickel, silver, uranium, tungsten and tin in cooperation with the Geological Survey of Canada.

Cooperative program between W. M. Johnson and Dr. Ian Jonasson of the Geological Survey of Canada in regard to rhenium, lanthanum and gold in molybdenum concentrates from Canadian mines.

Certification

Two Certification of Efficiency in Assaying examinations were held with a total of twelve examinees writing. Ten Certificates of Efficiency were awarded.

Output

Wet Chemical and X-ray Fluorescence Laboratory: There were 2,033 determinations on 912 samples submitted by prospectors and prospector grantees, and 8,270 determinations on 1,119 samples submitted by Ministry personnel.

Emission Spectrographic Laboratory: There were 46,950 semi-quantitative determinations on 1,565 samples. In addition, there were 1,407 quantitative results on 219 samples.

X-ray Diffraction Laboratory: There were 515 mineral identifications made, determination of mineral matter in ash of coals on 40 samples, and 16 determinations on quartz and 311 semi-quantitative results obtained.

Sample Comminution: There was a total of 2,754 samples received and prepared for analytical work, 1,842 from geologists and 912 from prospector grantees and general prospectors.

Mineral Separation: There were 14 mineral separations done.

Budget

The Laboratory's budget was \$274,000 for salaries, \$51,000 for supplies and equipment, \$13,000 for travel and miscellaneous.

PROFESSIONAL ACTIVITIES

The staff of the Division was active in professional activities related to their work during 1980 including organizing and attending meetings, visits, and executive activities in societies.

Two meetings and a major field excursion were organized by the Division during the year:

- (1) A Review of Activities of the Division for the exploration industry and other interested public took place at the Newcombe Auditorium of the Museum in February. This is expected to be a two-yearly event. All geoscientists gave talks on their work and most displayed maps of recent projects. A tour of the laboratory was an integral part of the day.
- (2) A three-day colloquium on the geology of the Peace River coalfield was organized by R. D. Gilchrist and took place in Qualicum Beach in February. Forty-five geologists working on Peace River coal geology from industry, government and university participated in the work-shop.

- (3) A field excursion to porphyry copper deposits of the Southern Intermontane Belt was lead by W. J. McMillan and V. A. Preto. The trip, sponsored by the Mineral Deposit Division of the Geological Association of Canada, visited Afton, the Highland Valley mines, and Ingerbelle. Forty-six geologists attended.

The staff were involved in much foreign travel for educational, scientific, and trade mission purposes, some at their own expense.

D. G. MacIntyre and T. Höy visited classic shale-hosted lead-zinc deposits in Germany as an aid to their studies of similar deposits in B.C.

D. E. Pearson visited SASOL I and II plants in South Africa and similar facilities in West Germany in regard to coal liquefaction and quality of feedstocks.

W. J. McMillan and A. Sutherland Brown attended the International Geological Congress in Paris, both gave talks and chaired sessions. McMillan's was the culmination of a joint study with the BRGM of France. Sutherland Brown was a delegate for Canada to the IGC and the International Union of Geological Sciences general meetings.

N. C. Carter was part of a British Columbia trade mission on base metals that visited Japan and Korea.

Executive Activities by staff included:

Canadian Institute of Mining and Metallurgy - D. E. Pearson was elected councillor of the Institute, A. Panteleyev was Victoria Branch Chairman.

Geological Association of Canada - Dr. A. Sutherland Brown was Past President of the Association. A. Panteleyev was a councillor of the Cordilleran Section and W. J. McMillan was secretary of the local section.

W. M. Johnson was Past President of the Spectroscopy Society of Canada and Chairman of Analytical Chemistry Division of the Chemical Institute of Canada.

N. C. Carter was a councillor of the British Columbia Association of Professional Engineers.

A. Sutherland Brown also served on the Advisory Committee to the Geological Survey of Canada, the Committee of Provincial Geologists, and the Canadian Geoscience Council.

In addition a large number of talks were given on their work by staff at a variety of scientific and exploration meetings, the subjects of which will be published later.

PUBLICATIONS

The work of the Division is presented to the interested public by a series of formal publications and maps as well as by technical talks, consultations, and informal discussions.

Formal publications prepared by the Division in 1980 include the following:

Prepared yearly:

Geological Fieldwork - a preliminary account of work of the Division as soon as possible after completion. Now published as part of the paper series of the Ministry.

Exploration in British Columbia - a report that summarizes and collates all known exploration in Province based on reports filled out jointly by the Division and industry personnel.

At irregular intervals:

Bulletins - these are generally the result of three or four years' work and commonly of areas of significant mineral potential. In 1980 one was published:

Bulletin 73 - Geology of the Riondel Area, Central Kootenay Arc by Trygve Höy

Preliminary Maps, usually white prints issued as soon as compilations are complete with brief accompanying notes. In 1980, the following five were issued.

36 - Geology of Estella-Kootenay King Area, Hughes Range by Trygve Höy. Parts of 82G/11, 12, 13, 14 (scale 1:50,000)

37 - Geology of the Terrace Mountain Tertiary Outlier by B. N. Church. Parts of 82L/4E, 5E (scale 1:50,000).

38 - Geological Compilation and Mineral Occurrence Map, Driftpile Creek - Akie River Ba-Pb-Zn Mineral District by D. G. MacIntyre. Parts of 92F and 94K (scale 1:250,000).

39 - Geology of Kelowna Tertiary Outlier (West Half) by B. N. Church. Part of 82E/13 (scale 1:50,000).

40 - Geology of Mount Richards Area, Vancouver Island by G.E.P. Eastwood. Part of 92B (scale 1:15,840).

Other maps and data issued included:

Regional Geochemical Surveys #5 and #6

RGS 5 NTS 920 - Taseko Lakes

RGS 6 NTS 92P - Bonaparte River

Scale 1:250,000 - 13 elements in silts, 2 + pH in water

No aeromagnetic maps were issued in 1980.

No new or revised Mineral Deposit/Land Use maps were issued in 1980.

Regularly updated maps in the following series are available:

Mineral Inventory Maps, issued as ozalid prints, show location and commodities of all known mineral deposits.

Assessment Report Index Maps show the location and number of reports accepted for assessment credit by the Ministry. A new Assessment Report Index to accompany the map series was issued in a ring binder for regular update.

Works published in external refereed and technical journals in 1980 included the following:

Church, B.N. and Johnson, W.M., Calculation of the Refractive Index of Silicate Glasses from Chemical Composition; Geol. Soc. Am. Bull. Part I, pp. 619-625.

Creaney, S., Pearson, D. E., and Marconi, L. G., Anomalous Coking Properties of the Wolgan Seam, NSW Australia; Fuel Vol. 59, No. 6 June 1980.

Johan, Z., Le Bel, L., and McMillan, W. J., Minéralization Liées aux Granitoïdes, Bureau de Recherches Géologiques et Minières, Memoir No. 99, Chapter 3 and 4, pp. 21-94.

McMechan, M. and Höy, T., Bull. Can. Petrol. Geol.

McMillan, W.J. and Panteleyev, A., Ore Deposit Models - 1 Porphyry Copper Deposits, Geoscience Canada, Vol. 7, No. 2, pp. 52-63.

Painter, P.C., Snyder, R.W., Pearson, D.E., and Kwong, J., Fourier Transform Infrared Study of the variation in the Oxidation of a Coking Coal, Fuel Vol. 59, No. 5, May 1980 pp. 282-286.

- Pearson, David E., The Quality of Western Canadian Coking Coal, CIM Bulletin, Vol. 73, No. 813, pp. 70-84, Jan. 1980.
- Pearson, David E. and Creaney, S., Spontaneous Carbonization of Oxidized High-volatile Coal by a Lightning Strike, CJES 1980 Vol. 17, pp. 36-42, Jan. 1980.
- Sutherland Brown, A. and Matheson, A., The Next Decade: Major Mineral Resource Expansion in B.C., Western Miner, Vol. 53, pp. 48-54, No. 2, Feb. 1980.
- Sutherland Brown, A., Metallogeny by Numbers, Geoscience Canada, Vol. 7, No. 3, pp. 95-102.

MINERAL RESOURCES
GEOLOGICAL DIVISION MANAGEMENT & ORGANIZATION MATRIX

ORGANIZATION & PROGRAM RESPONSIBILITY

DISCIPLINES & FIELDS OF INTEREST

| | <u>PROJECT</u> | <u>APPLIED</u> | <u>RESOURCE DATA</u> | <u>LAB</u> |
|--------------------------------|----------------|----------------|----------------------|------------|
| RESOURCE TYPE | | | | |
| METALLIC | * | * | * | + |
| NON-METALLIC | - | - | * | + |
| COAL | * | * | * | + |
| GEO THERMAL | - | | | |
| RESEARCH & DEVELOPMENT | | | | |
| GEO SCIENCE RESEARCH | * | + | - | - |
| GEOLOGICAL SURVEYS | * | + | - | |
| GEOCHEM SURVEYS & CONTROL | * | - | - | * |
| ANALYTICAL METHOD DEVELOPMENT | - | | | * |
| FUNCTIONS | | | | |
| LAND USE ANALYSIS & MANAGEMENT | - | + | * | |
| RESOURCE ANALYSIS & MANAGEMENT | - | + | * | |
| INDUSTRY INTELLIGENCE | + | * | * | |
| CONSULTATION SERVICE | * | * | * | + |
| DATA PROCESSING | - | | * | - |
| CORE STORAGE | | * | | |
| PROSPECTOR TRAINING | + | * | - | - |
| GEOLOGIST TRAINING | * | - | - | |
| ASSAYER CERTIFICATION | | | | * |

* MAJOR ROLE
+ IMPORTANT ROLE
- MINOR ROLE
NIL

GEOLOGICAL DIVISION

| | | | | | |
|--------------|---|--|--|---|---------------|
| | <div style="border: 1px solid black; padding: 2px; display: inline-block;">CHIEF GEOLOGIST</div> | | | | |
| | <div style="border: 1px solid black; padding: 2px; display: inline-block;">SECRETARY</div> | | | | |
| EMPLOYEES | <div style="border: 1px solid black; padding: 2px; display: inline-block;">RESOURCE DATA & ANALYSIS</div> | <div style="border: 1px solid black; padding: 2px; display: inline-block;">PROJECT GEOLOGY</div> | <div style="border: 1px solid black; padding: 2px; display: inline-block;">APPLIED GEOLOGY</div> | <div style="border: 1px solid black; padding: 2px; display: inline-block;">LABORATORY</div> | DIV. TOTAL |
| PERMANENT | 10 | 19 | 12 | 10 | 53 |
| AUXILLIARY | 6 | 6 | 6 | 2 | 20 |
| 80/81 BUDGET | 420.8 | 894.7 | 498.6 | 344.7 | 2229.8 |

SUPPLEMENTARY PROGRAMS

| | | | |
|------------------------------------|--|---------------------------|--------|
| COMPUTERIZING COAL INVENTORY | REGIONAL GEOCHEM, RELATED RESEARCH | PROSPECTORS ASSISTANCE | |
| 61.5 | 410.0 | 283.2 | 754.7 |
| | | GRAND TOTAL | 2984.5 |

