FRONTIER GEOSCIENCE PROGRAM

ANNUAL REPORT

1985-86

Energy, Mines and Resources Canada

Énergie, Mines et Ressources Canada

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Prepared by:
D.D. Picklyk,
Program Officer,
Frontier Geoscience Program.

FOREWARD

The Frontier Geoscience Program (FGP) is managed by a committee composed of senior departmental officials. This group determines and approves the general course of scientific activity in each of the tasks as well as the level of support. Members of the committe are:

Dr. W.W. Hutchison, ADM, Earth Sciences Sector (ESS).
Dr. R.A. Price, Dirctor General, Geological Survey of Canada.
Dr. J.G. Fyles, Deputy Director-General, Geological Survey of Canada.
Mr. G.D. Hobson, Director, Polar Continental Shelf Project.
Dr. J.E. Harrison, Senior Scientific Advisor, ESS.
Mrs J. McGill, Senior Scientific Co-ordinator, ESS.
Dr. D.D. Picklyk, FGP Program Officer.

In order to ensure that the best use is being made of available resources and that issues of interest to potential user are being addressed, an independent Technical Adisory Committee has also been formed. The committee has examined the program and produced a report recommending a number of changes which have been implemented. The members of the committee and their affiliations are as follows:

Mr. L.P. Purcell, Husky Oil Limited (Chairman).
Mr. P.J. Savage, Pan Canadian Petroleum Limited.
Mr. R.P. Cote, Gulf Canada Limited.
Professor I. Hutcheon, University of Calgary.
Professor Z. Hajnal, University of Saskatchewan.
Mr. M.G. Sheppard, Department of Mines and Energy, Newfoundland.
Mr. W.M. Young, Ministry of Mines and Petroleum Resources, B.C.
Mr. D.J. McDonald, Department of Mines and Energy, Nova Scotia.
Mr. D.F. Sherwin, Canada-Newfoundland Offshore Petroleum Board.
Mr. G. Campbell, Canada Oil and Gas Lands Administration.
MR. H.J. Jacques, Jacques Whitford and Associates Limited.
Dr. J.P. Hea, Petroleum Resources Branch, EMR.
Dr. D.D. Picklyk, Secretary, Geological Survey of Canada.

FRONTIER GEOSCIENCE PROGRAM

EAST COAST TASK

TASK MANAGER: D.I. Ross

SCOTIAN SHELF COMPONENT **Component Manager: D.I. Ross**

COMPONENT SUMMARY

Studies of the Scotian Shelf continue using an oil industry data base which includes data on 115 wells and 350,000 km of multichannel reflection seismic lines. Interpretation of the seismic data has resulted in new structural and isopach maps showing far greater detail than earlier interpretations. When completed, the Scotian Shelf will be the best documented passive margin depocentre anywhere. Map publication is constrained by data release dates but early versions of the maps will be included in the 1987 DNAG volume on offshore eastern Canada.

Biostratigraphic analyses of well samples has provided the detailed correlations needed to document burial histories and and the paleogeographic evolution of the Scotian Shelf. Contracted biostratigraphic studies have been used to augment the data base that has been developed over the last 14 years. A lithological data base has been puchased to provide the lithologic data for specific intervals for the production of paleofacies maps.

Vitrinite reflectance measurements have been made on cuttings and core samples of wells to define the maturation profiles and to augment earlier syntheses based largely on spore colour. Logs and drill records have been analyzed to map today's stress regime. Overpressures are being studied to assess how they are generated.

Vitrinite reflectance levels of 1.0 Ro to 1.2 Ro, representing maturation conditions near the peak of gas generation , are found at 5000m in the gas-prone Jura-Cretaceous Verrill Canyon Formation.

A method to derive in-situ stress from pressure tests and downhole logs of offshore wells has been developed. In applying this in the Venture area, in the interval between 500 and 5500m, the largest and smallest principal stresses are horizontal and the intermediate pricipal stress is vertical. Earlier studies of breakout orientations showed that the greater horizontal stress is oriented NNE-SSW. This stress regime is regional and may reflect mantle traction on the base of the North American lithospheric plate.

A joint borehole drilling program with PetroCanada at the Cohasset well-site provided an opportunity to obtain borehole samples for geological and geotechnical analysis and to monitor seafloor sediment dynamics at the site during storm conditions as part of the continuing studies on hazards and constraints to development.

FGP Project Number: EC14-010 Project Officer: J.S. Bell

TITLE: Sedimentology, Geochronology and Hydrocarbon Potential of the Scotian Shelf.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	1.0	1.5
	Contract	120.0	120.8	300.8
	Other O&M	40.0	22.6	52.6
	Capital	140.0	76.4	159.2

OBJECTIVE:
To evaluate the potential of the Scotian Shelf for oil and gas generation and accumulation by conducting in-house sedimentological studies of individual formations to determine their composition, origin and depositional environment.

DESCRIPTION:
Software to allow manipulation of digitized lithological data and production of facies maps, cross sections, isolith maps, fence diagrams, etc., will be developed under contract.

Continued innovative development of quantitative stratigraphic methodology, utilizing in-house and contractor developed software. QUANSTRAT involves refinement of the Ranking and Scaling Project (RASC) and development of CASC (correlation and subsidence curves). BIOSTRAT development focuses on graphic correlation techniques. Both programs will result in refinement of existing zonations and correlations, materially assisting in the precise delineation of source rock and reservoir horizons, and leading to predictive models for hydrocarbon generation.

Development of new, sophisticated analytical techniques and refinement of previous techniques, to identify and delineate potential hydrocarbon source units, determine organic matter content and their degree of thermal maturation, and quantify their oil and gas capability. The analytical techniques will include vitrinite reflectance, fluorescence, visual kerogen and total organic carbon, organic matter type, typing of biological markers; the latter provides information on oil to oil, and oil to source rock correlation as well as thermal maturation.

SCIENTIFIC RESULTS:
Sedimentologist position offered and accepted. Starting date August 1986.

Lithfile developmwent largely completed.

Reported on problem intervals in deeper parts of a number of Scotian Shelf well, completed a suprageneric classification of dinoflagellates and published an index to genera and species of spores.

Vitrinite reflectance measurements and some selected Rockeval analyses carried out on cuttings and core samples from wells on Scotian Shelf and used to determine generalized subsidence and maturation histories for Venture Field.

Selected well log data purchased for analysis.

Depth to basement analysis of Georges Bank aeromagnetic survey carried out under contract and analysis integrated into geological synthesis.

In-situ stress measurements carried out from pressure tests and downhole logs from a number of Scotian Shelf wells.

OUTPUTS:

MACNAB, R., PLASSE, D., GRAVES, M., 1985. An index of commercially acquired potential field data in the East Coast offshore. *Geol. Surv. Can. Curr. Res. Paper 85-1B, pp. 467-469.*

EARTH & OCEANS RESEARCH LTD., 1985. Index of commercially-aqcuired potential field data in the Canadian east coast offshore. *Geol. Sur. Can. Open File #1158.*

JACKSON. A.E., 1985. Sediment thickness map, offshore Eastern Canada. 1:2,000,000. *Geol, Sur. Can. Open File #1177.*

GRANT, A., MCALPINE, K., WADE, J.A., 1985. The contenetial margin of Eastern Canada - geological framework and petroleum potential. *A.A.P.G. Wallace E. Pratt Memoir.*

NANTAIS, P.T., 1985. A reappraisal of the regional hydrocarbon potential of the Scotian Shelf. *Geol. Sur. Can. Open File #1175.*

GRANT, A.C., MCALPINE, K.D., WADE, J.A., 1985. Offshore geology and petroleum of Eastern Canada. *Energy Exploration and Exploitation.*

CARTER, G.B., D'JORIO, N., GRADSTEIN, F.M., 1985. Geographic distribution of Cenozoic foramerifera dinoflagellates and spores in offshore wells on the Labrador and Scotian Shelves. *Computers and Geoscience, Wichita, October 1985.*

GRADSTEIN, F.M., WILLIAMSON, M., THOMAS, F., STAM, B., 1985. Micropaleontology of the Mesozoic-Cenozoic zonation for 52 wells: database on all sites; 23 plates with zone markers and estuarine bibliography. *Paleozoic Canadiana.*

NANTAIS, P.T. 1985. A re-appraisal of the regional hydrocarbon potential of the Scotian Shelf .*Geol. Sur. Can. Open File #1175*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) on the dispersed organics in the Mobil-Tecto-Petro-Canada Migrant N-20. *Geol. Sur. Can. Open File #1172.*

PODROUZEK, A.J., BELL, J.S., 1985. Stress ortientation from wellbore breakouts on the Scotian Shelf, Eastern Canada. *Geol. Sur. Can. Curr Res. Paper 85-1B, pp. 59-62.*

AVERY, M.P., 1985. Vitrinite refectance (Ro) of the dispersed organics in the Mobil-Texaco-Pex Olympia A-12. *Geol. Sur. Can. Open File #1171.*

HELLER, M., GRADSTEIN, W., GRADSTEIN, F.M., AGTERBERG, F., LEW, S., 1985. RASC. *Geol. Sur. Can. Open File #1203.*

FGP Project Number: EC14-060 Project Officer: D.J.W. Piper

TITLE: Engineering Geology- Development and Application of Capabilities in Physical Properties and Modelling and Acquisition of Surficial and Engineering Geology Information.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	1.0	1.5
	Contract	120.0	99.7	175.7
	Other O&M	30.0	96.3	187.3
	Capital	95.0	281.7	534.2

OBJECTIVE:
To provide a new capability in geotechnical engineering assessment and research in support of regional surficial (200m) geology related to constraints to offshore development.

To provide baseline data and expertise on the distribution of surficial geologic materials, stratigraphic correlation, seabed features and processes in the Scotian Shelf area; to ensure a scientific understanding of site-specific constraints to development.

DESCRIPTION:
Laboratory facilities for specialized marine geotechnical testing will be developed in 1985-86. New laboratory equipment will include x-ray diffraction, simple shear, triaxial testing, velocimeter, microprocessors and peripherals, consolidometer and x-radiography instrumentation. The laboratory will be used for specialized in-house testing to supplement routine geotechnical analyses. Contract development of new field sampling and in-situ measurement equipment will be initiated in 1986, as well as the purchase and/or adaptation of existing technology.

Contract drilling services will be used to obtain geotechnical information beginning in 1986. Contract services will also be utilized to develop numerical modelling processes of relevance to constraints to development; for example, for slope analysis, fluid migration through surficial sediments, wave effects on pore pressure, sediment erosion and transport, seabed scouring.

Research in physical properties will include static and dynamic properties controlling seabed stability, properties affecting sediment transport, gaseous sediment, diapirism, and relations between geotechnical and acoustic properties. Numerical modelling will be directed towards hazard prediction. Property determination will be related to regional geologic investigations.

Stratigraphic and mapping innovations will concentrate on computer-assisted methods of updating open file maps, improvement of methods for identification of palynomorphs, improved methods of isotopic

and other geochemical dating and correlation techniques, improvement of acoustic and other remote sensing methods, acceleration of regional stratigraphic mapping programs and investigation of specific hazards, and improved land-sea stratigraphic correlations.

SCIENTIFIC RESULTS:
Joint program with Petro-Canada to drill a borehole at the Cohasset site provided a geotechnical sample of the upper 40m of sediment and monitoring of sediment dynamics on site.

Physical properties facilities upgraded with core extrusion system for geotechnical analyses, consolidation testing equipment for specialized stress history studies, improved core x-radiography system, and automated image analysis system.

Slope stability studies initiated in conjunction with site specific OERD studies, but weather and ship allocations limited acquisition in this year.

Geotechnical data base established.

OUTPUTS:
AMOS, C.L., MORAN, K., 1986. Sable Island geological/geotechnical borehole site selection. *Geol. Sur. Can. Open File.*

AMOS, C.L., KNOLL, R., 1986. The Quaternary sediments of Banquereau, Scotian Shelf. *A.A.P.G. Bulletin.*

DURLING, P.W., FADER, G.B., 1986. Geological assessment of shallow faults and structural disturbances from the eastern Scotian Shelf and Laurentian Fan. *Geol. Sur. Can. Open File #1371.*

MEDIOLI, F.S., SCHAFER, C.T., SCOTT, D.B., 1985. Distribution of recent benthonic foraminifera near Sable Island, Nova Scotia. *Cdn. Jour. Earth Sci.*

ATLANTIC GEOSCIENCE CENTRE, 1985. Preliminary 1:5 m Quaternary geology map and 1:2 m surficial features map of offshore Eastern Canada. *Geol. Sur. Can. Open File #1076.*

GRAND BANKS COMPONENT

Component Manager D.I. Ross

COMPONENT SUMMARY

Interpretation of industrial seismic data continues involving information from 92 wells and some 300,000 km of seismic reflection lines. A "Base Event" (partly the Avalon Unconformity) has been traced widely and is mapped at 1;250,000.

Studies in the East Newfoundland Shelf during the past year have been conducted in response to active industrial exploration in the Jeanne d'Arc Basin. The stratigraphic framework of the basin has been refined to the stage of formalizing the stratigraphic units. Contracted studies have provided petrographic information on the Jeanne d'Arc Basin reservoir sandstones.

Analysis of single channel seismic reflection data from the Avalon Platform along with biostratigraphic well data shows that Ordovician-Silurian rocks have been folded about N-S axes and are overlain unconformably by ? Devonian red beds. The Lower Paleozoic rocks overlie the early Paleozoic sequence exposed on the Avalon Peninsula thus extending the record of shelf sedimentation.

A report on the geochemical and petrographic properties of the Mesozoic volcanics intersected in some Grand Banks wells has been prepared. The volcanics are alkaline intra-plate extrusives associated with late Early Cretaceous plate re-arrangement. The Grand Banks evaporites have also been comprhensively analyzed and a report prepared.

The oil exploration activity of the last decade has vastly expanded the well data base. Basic and detailed biozonation is being performed to provide consistent biostratigraphic interpretations and "formation picks". This will improve correlation within and between basins and should prove useful for interpretations by both departmental and industry geologists. Two programs that depend critically on the biostratigraphic control these wells can provide are the analysis of the hydrocarbon bearing Jura-Cretaceous reservoir intervals on the shelves and the proposed FGP Basin Atlas.

A suprageneric classification of dinoflagellates has been completed. An index the genera and species of spores has been published. The palynostratigraphy and lithostratigraphy of the Jeanne d'Arc Basin has been refined. Reports have also been completed of forams with range plots for a number of wells, Mesozoic forams and ostracods and Lower Cretaceous foram zonation of the North American Atlantic margin.

Vitrinite reflectance measurements were made on samples from 8 wells on the East Newfoundland Shelf. The derived organic maturation profiles augment the existing data base permiting mapping of regional maturity variations and shows that maturation varies with depth in the Jeanne d'Arc Basin. Results demonstrate that the oil window is thickest downdip of the oil-rich trans-basin faults and that the thickness is structurally controlled.

Geochemical studies show that the Jeanne d'Arc oil can be attributed to rich, widespread Kimmeridgian source rocks.

Modelling of Time-Temperature Indicies continue to assess when oil was generated; preliminary results indicate this began during the Late Cretaceous in the basin centre and shifted to the basin margin by Eocene.

Overpressures as high as those on the Scotian Shelf have been measured. Unlike those onthe Scotian Shelf, Jeanne d'Arc geopressures appear to be stratigraphically controlled and the rocks are undercompacted.

Drilling records and logs have been examined to assess in-situ stress. Although coverage and quality are uneven, the largest and smallest principal stresses are horizontal and the intermediate principal stress is vertical. The Grand Banks appear to be under NE-SW directed regional compression; anomalous areas may reflect recent faulting.

A cruise on the Grand Banks has provided a regional, high-resolution seismic and sidescan framework for detailed investigations. PISCES IV was then used to examine specific problems. The new data supports the contention that glaciation extended across the Grand Banks. A review of the geological engineering constraints to hydrocarbon resource development on the Grand Banks has been prepared. It includes a map of the distribution of surficial features that are important to resource development.

FGP Project Number: EC24-020 Project Officer: J.S. Bell

TITLE: Sedimentology, Geochronolgy and Hydrocarbon Potential of the Grand Banks.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.5	0.5	0.5
	Contract	200.0	155.6	302.6
	Other O&M	48.0	12.4	65.4
	Capital	30.0	0.0	88.0

OBJECTIVE:
To access the hydrocarbon potential of the Grand Banks through specific expanded sedimentological studies of well data, including sandstone diagenesis and clay mineralogy, reservoir occurrence and origin, and depositional environments.

DESCRIPTION:
A geopressure study of East Newfoundland Basin will be implemented in 1987 as a sequel to the Sable Island Study.

An optimum biostratigraphic zonation for the Mesozoic-Cenozoic offshore of eastern Canada will be developed utilizing several groups of microfossils and existing data bases. A major phase will be the implementation of QUANTSTRAT, using the BIOSTRAT and RASC data bases. This should result in more precise correlations of source and reservoir rocks. In-house resources will be used for the generation of the analytical data relating to foraminifera, ostracods, spores, pollen and dinoflagellates. Contractual studies will be needed for analyses of the nannofossils and calcareous dinoflagellates.

Existing techniques for maturation studies will be refined to provide immediate access to S1, S2, Tmax and TOC measurements. Such data will provide the necessary quantitative control for related maturation and source rock studies, including visual kerogen, fluorescence, vitrinite reflectance and biological marker analyses. The results in total should lead to more precise, predictive models for maturation and basin evaluation as the project progresses.

Typing of biological markers will allow oil to oil and oil to source rock correlation. Synthesis of data will allow the reconstruction of depositional environments, the timing and mode of generation, and evaluation of level of maturation.

Deep seismic reflection and aeromagnetic coverage will be obtained in 1987 to provide control for crustal studies.

SCIENTIFIC RESULTS:

Contractural study on the classification, origin and depositional environments of Lower Cretaceous clastic reservoir rocks of Jeanne d'Arc subbasin completed by Robertson Research.

Refined stratigraphic framework of Jeanne d'Arc basin and formalized stratigraphic units. Completed reports of forams with range plots and Mesozoic forams and ostracods for a number of Grand Banks wells and reported on Lower Cretaceous foram zonation of the North Atlantic margin.

RASC and CASC software developed for use at AGC.

Vitrinite reflectance measurements carried out on cuttings and core samples from wells on Grand Banks and used to determine generalized subsidence and maturation histories of Hibernia field.

Drilling records and logs were examined to assess offshore in-situ stress.

Geopressure studies on the Grand Banks were initiated. Geochemical studies carried out in collaboration with staff at ISPG.

OUTPUTS:

MACNAB, R., LONCAREVIC, B.D., COOPER, G., GIROUARD, P., SHOUZHI, F., 1985. A regional marine mulitparameter survey south of Newfoundland. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 325-332.*

MACNAB, R., PLASSE, D., GRAVES, M., 1985. An index of commercially acquired potential field data in the east coast offshore. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 467-469.*

EARTH & OCEAN RESEARCH LTD., 1985. Index of commercially acquired potential field data in the Canadian east coast offshore. *Geol. Sur. Can. Open File #1158.*

JACKSON, A.E., 1985. Sediment thickness map, offshore Eastern Canada. 1:2,000,000. *Geol. Sur. Can. Open File #1177.*

GRANT, A.C., MCALPINE, K.D., WADE, J.A., 1985. The continental margin of Eastern Canada - geological framework and petroleum potential. *A.A.P.G. Wallace E. Pratt Memoir.*

GRANT, A.C., MCALPINE, K.D., WADE, J.A., 1985. Offshore geology and petroleum potential of eastern Canada. *Energy Exploratation and Exploitation.*

WILLIAMSON, M.A., 1985. Quantitative biozonation of Late Jurassic and Early Cretaceous of the East Newfoundland Basin. *Micropaleontology.*

GRADSTEIN, F.M., WILLIAMSON, H., THOMAS, F., STAM, B., 1985. Micropaleontology of the Mesozoic-Cenozoic zonation for 52 wells: database on all sites; 23 plates with zone markers and estuarine bibliography. *Paleozoic Canadiana.*

HARRISON, P.H., 1985. Vitrinite reflectance (Ro) on the dispersed organics in the Amoco-IOE A-1 Murre G-67. *Geol. Sur. Can. Open File #1168.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) on the dispersed organics in the Amoco Imperial Skelly Tern A-68. *Geol. Sur. Can. Open File #1167.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) on the dispersed organics in the Mobil Gulf Adolphus 2K-41. *Geol. Sur. Can. Open File #1166.*

AVERY, M. P., BELL, J.S., 1985 Vitrinite reflectance measurements from the South Whale Basin, Grand Banks, eastern Canada, and implications for hydrocarbon exploration. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 51-57.*

AVERY, M.P., 1986. Vitrinite reflectance (Ro) of the dispersed organics from Mobil *et al* Bonanza M-71. *Geol. Sur. Can. Open File #1346.*

AVERY, M.P., 1986. Vitrinite reflectance (Ro) of dispersed organics from Texaco Shell *et al* Blue H-28. *Geol. Sur. Can. Open File #1345.*

AVERY, M.P., BELL, J.S., MCALPINE, K.D., 1985. Vitrinite reflectance measurements and their implications for oil and gas exploration in the Jeanne d'Arc Basin, Grand Banks, Eastern Canada. *Geol. Sur. Can. Curr, Res. Paper 86-1A, pp. 489-498.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) of the dispersed organics and coaly matter from the Mobil *et al* Hibernia B-08 (revised report). *Geol. Sur. Can. Open File #1201.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) of the dispersed organics from the Esso Voyageur Gabriel C-60. *Geol. Sur. Can. Open File #1206.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) of the dispersed organics in the Mobil Gulf Dominion O-23. *Geol. Sur. Can. Open File #1200.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) of the dispersed organics in the Mobil Gulf Adolphus D-50. *Geol. Sur. Can. Open File #1199.*

ERVINE, W.B., 1985. A synthesis of maturation data for the East Newfounland Basin. *Geol. Sur. Can. Open File #1178.*

HARRISON, P.H., 1985. Vitrinite reflectance (Ro) of the dispersed organics in the Amoco IMP Skelly Egret N-46. *Geol. Sur. Can. Open File #1170.*

HARRISON, P.H., 1985. Vitrinite reflectance (Ro) of the dispersed organics in the Mobil *et al* West Flying Foam L-23. *Geol. Sur. Can. Open File #1169.*

AVERY, M.P., 1985. Vitrinite reflectance (Ro) of the dispersed organics in the Amoco Imperial Puffin B-90. *Geol. Sur. Can. Open File #1165.*

FGP Project Number:EC24-050 Project Officer: D.J.W. Piper

TITLE: Engineering Geology - Development and Application of Capabilities in Physical Properties and Modelling and Acquisition of Surficial and Engineering Geology Information.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	1.0	1.3
	Contract	115.0	12.5	34.5
	Other O&M	30.0	15.1	106.1
	Capital	100.0	0.0	135.0

OBJECTIVE:
To provide a new capability in geotechnical engineering assessment and research in support of regional surficial (200m) geology related to constraints to offshore development.

To provide baseline data and expertise on the distribution of surficial geologic materials, stratigraphic correlation, seabed features and processes in the Grand Bank area; to ensure a scientific understanding of site-specific constraints to development.

DESCRIPTION:
Laboratory facilities for specialized marine geotechnical testing will be developed in 1985-86. New laboratory equipment will include x-ray diffraction, simple shear, triaxial testing, velocimeter, microprocessors and peripherals, consolidometer and x-radiography instrumentation. The laboratory will be used for specialized in-house testing to supplement routine geotechnical analyses. Contract development of new field sampling and in-situ measurement equipment will be initiated in 1986 as well as the purchase and/or adaptation of existing technology.

Contract drilling services will be used to obtain geotechnical information beginning in 1986. Contract services will also be utilized to develop numerical modelling processes of relevance to constraints to development; for example for slope analysis, fluid migration through surficial sediments, wave effects on pore pressure, sediment erosion and transport, seabed scouring.

Research about physical properties will be related to regional geologic investigations and include analyses of static and dynamic properties controlling seabed stability, properties affecting sediment transport, ice-seabed interaction, gaseous sediment, diapirism and relations between geotechnical and acoustic properties. Numerical modelling will be directed towards hazard prediction.

Stratigraphic and mapping innovations will concentrate on computer-assisted methods of updating open file maps; improvement of methods for identification of palynomorphs; improved methods of isotopic and other geochemical dating and correlation techniques; improvement of acoustic and other remote sensing methods; acceleration of regional stratigraphic mapping programs and investigation of specific hazards; and improved land-sea stratigraphic correlations.

SCIENTIFIC RESULTS:
Cruise on CSS Hudson to obtain additional surficial geology data on southern and western Grand Banks completed and specific questions addressed with dives of PISCES IV.

Review of the geological engineering constraints to hydrocarbon development on the Grand Banks was prepared.

Seabed II contract completed and documentation of system and software carried out by contractor.

OUTPUTS:
FADER, G.F., 1986. Surficial and bedrock geology of the Grand Banks. *BIO Review 1985, pp.16-20.*

SEGALL, M.P., BARRIE, J.V., LEWIS, C.F.M., MAHER, M.L.J., 1985. Clay minerals across the Tertiary-Quaternary boundary northeastern Grand Banks of Newfoundland: preliminary results. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 63-68.*

FADER, G.B.J., MILLER, R.O., GEOMARINE ASSOCIATES LTD., 1986. Sidescan survey report - St. Pierre Bank, the Grand Banks of Newfoundland. *Geol. Sur. Curr. Res. Paper 86-1B.*

FADER, G.B.J., LEWIS, C.F.M., BARRIE, J.V., PARROTT, R., COLLINS, W., MILLER, R.O., D'APPALOIA, S., 1985. Quaternary geology of the Hibernia area south of northeast Grand Banks Map 14968G. *Geol. Sur. Can. Open File #1222.*

PEREIRA, C.P.G., PIPER, D.J.W., SHOR, A.N., 1985 Seamarc I midrange sidescan sonar survey of Flemish Pass, east of the Grand Banks of Newfoundland. *Geol. Sur. Can. Open File #1161.*

ATLANTIC GEOSCIENCE CENTRE, 1985. Preliminary 1:5m Quaternary geology map and 1:2m surficial features map of offshore Eastern Canada. *Geol. Sur. Can. Open File #1076*

FADER, G.R., MILLER, R.O., 1986. A reconnaissance study of the surficial and shallow bedrock geology of the southeastern Grand Banks of Newfoundland. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

NORTHEAST NEWFOUNDLAND COMPONENT

Component Manager: D.I. Ross

COMPONENT SUMMARY

The deep seismic reflection study of the N.E. Newfoundland/Grand Banks margin was continued with the acquisition of 1500km of new data recorded to 20 seconds two way travel time across the southern Grand Banks. This completes the acquisition of deep reflection data in this area at this time.

Twenty ocean bottom seismometers were constructed under contract to establish the capability for crustal refraction studies to complement the reflection data in this and other offshore regions.

The contract evaluation of satellite altimeter data for regional gravity mapping carried out under contract with University of New Brunswick was completed and integration of results with the offshore gravity mapping program initiated.

A two part 130,000 line km aeromagnetic survey northeast of Newfoundland was completed in partnership with a consortium of five oil companies. One part was a closely spaced grid over the Northeast Newfoundland Shelf and Orphan Basin, designed to delimit basement structure in this potentially hydrocarbon-rich area; the other consisted of regional lines to identify spreading anomalies in the Labrador Sea. The surveys used advanced navigation - integrated Loran-C and GPS (Global Positioning System). Interpretation of the detailed part of the survey has been contracted to a geophysical consulting firm.

FGP Project Number: EC34-030 Project Officer: C.E. Keen

TITLE; Deep Geology and Evolution of the Rifted Continental Margins Around the Grand Banks and N.E. Newfoundland.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	4.0	4.0	6.0
	Contract	2000.0	1935.1	3375.1
	Other O&M	107.0	60.9	180.9
	Capital	495.0	476.6	676.6

OBJECTIVE:
To acquire and interpret deep seismic reflection and refraction data, aeromagnetic and gravity (including satellite gravity) data in order to define the deep geological controls, thermal history, seismic stratigraphy, and evolution of the rifted continental margins and sedimentary basins around the Grand Banks.

DESCRIPTION:
The work will be conducted by AGC scientists, primarily in the Regional Reconnaissance Subdivision, using contract seismic operators, processing companies and aeromagnetic survey companies, to acquire data. Because of their unique expertise in Canada, University of New Brunswick personnel will be used to evaluate the use of satellite gravity data.

Part of the deep seismic work will be an EMR contribution to LITHOPROBE. Some may also allow ODP site definition.

SCIENTIFIC RESULTS:
Deep multichannel seismic data (15-20 second) was obtained across the Orphan Basin and Hibernia and processed.

Seismic reflection data acquired in 1984-85 was interpreted and presented at Canadian and International meetings.

Joint aeromagnetic survey over northern Grand Banks and Orphan Basin carried out with industry partners and joint interpretation initiated.

Construction of 20 ocean bottom seismometers completed under contract.

Interpretation of siesmic data across transform margin completed,

Seismic cruises to southern margin of Flemish Cap completed on CSS HUDSON.

In-house geophysical processing facility upgraded and software development largely completed.

Contract to evaluate satellite gravity data for offshore mapping completed.

OUTPUTS:
Contractors reports on the seismic refraction surveys northeast of Newfoundland and across the eastern Grand Banks and margin, the use of satellite gravity data and the completion of geophysical surveys in northeast Newfoundland and the Grand Banks have been received.

"Lithopobe East": Results from Marine Deep Seismic Reflection lines across the Appalachians and the Continental Margin Northeast of Newfoundland", papers presented at annual meeting of the Canadian Society of Exploration Geophysicists and Geological Association of Canada.

MACNAB, R., PLASSE, D., GRAVES, M., 1985. An index of commercially acquired potential field data in the east coast offshore. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 467-469.*

EARTH & OCEANS RESEARCH LTD., 1985. Index of comercially acquired potential field data in the Canadian east coast offshore. *Geol. Sur. Can. Open File #1158.*

KEEN, C.E., 1986. Passive margins: the Grand Banks example. *BIO Review 1985, pp. 13-16.*

KEEN, C.E., KAY, W., 1986. Deep marine multichannel seismic data from the northeast Newfoundland continental margin - LITHOPROBE EAST. *Geol. Sur. Can. Open File #1281.*

KEEN, C.E., 1985. Some important consequences of lithospheric extension. *Jour. Geol. Soc. London.*

KEEN, C.E., COLEMAN-SAAD, S., KEEN, M.J., MILLER, H., NICHOLS, B., O'BRIEN, S., QUINLAN, G., REID, I., STOCKMAL, G., WILLIAMS, H., WRIGHT, J., 1985. A deep seismic reflection profile across the northern Appalachians. *Geology.*

LABRADOR/BAFFIN COMPONENT **Component Manager: D.I. Ross**

COMPONENT SUMMARY

A cruise on CSS HUDSON investigated surficial and bedrock geology of parts of the southeast Baffin Shelf and Hudson Strait. Paleozoic or early Mesozoic rocks occur on the southern part of the northeast Baffin Shelf; Late Cretaceous and early Tertiary rocks are found to the south. Cumberland Sound is underlain by a Barremian to Cenomanian (Cretaceous) half graben. Hudson Strait is largely underlain by Ordovician and Silurian carbonates.

Oil slicks discovered on the ocean surface ten years ago at Scott Inlet were studied underwater by PISCES IV dives. The slicks lie directly above submarine seeps which are 400m deep, and which occupy a depression about 100m across. They are of immature , natural oil that has migrated in Cretaceous? source rocks to their with Precambrian basement. The contact, perhaps a fault, dips steeply and has channelled the oil to the sediment-water interface. Whitish slime, an accumulation of sulphur consuming and hydrocarbon degrading bacteria, occurs above the seeps and has helped to pinpoint them.

Canadian scientists participated onboard the *JOIDES RESOLUTION* as part of Leg 105 of the Ocean Drilling Project drilling one hole in Baffin Bay and two holes in Labrador Sea. Drill results confirm the 2.5 Ma age when ice-rafting began in the northwestern Atlantic, that climatic deterioration and southward transport of arctic water began in the middle Miocene or earlier in Baffin Bay and that large sedimentary drifts resulting from intensified deep-water circulation began in the middle to late Miocene in southwestern Baffin Bay and Labrador Sea. An oceanic crustal age of 55-56 Ma was obtained at site 647 in the southern Labrador Sea agreeing with the age earlier determined from magnetic anomaly correlations and confirming tectonic models that require important re-orientation of seafloor spreading centre in the Labrador Sea about that time.

FGP Project Number: EC44-040 Project Officer: J.S. Bell/ C.E. Keen

TITLE: Basin Evolution, Sedimentology, Geochronology and Hydrocarbon Potential.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	1.0	1.0
	Contract	40.0	32.4	47.4
	Other O&M	10.0	20.2	59.2
	Capital	45.0	27.8	106.8

OBJECTIVE:
To establish a formal stratigraphic zonation for the Cretaceous-Tertiary in Baffin Bay, through seismostratigraphic and sedimentological studies carried out to establish marker horizons from shelf to slope to deep sea and to determine their composition and depositional environment.

DESCRIPTION:
Seismostratigraphic analysis of multichannel and well/core data and the sedimentological studies of specific units will be implemented in 1985-86 with hiring of a Petroleum Geophysicist, and will continue throughout the program.

Biostratigraphic zonation will be based on foraminifera, spores, and dinocysts and will incorporate data from wells drilled in the last five years complimented by shallow cores obtained by BIO and NORDCO seabed drills, cores obtained through Canadian participation in the Ocean Drilling Program, and contract drilling to 500 feet in selected locations. Development of the seabed rock core drilling facility will be implemented in 1984 with sampling in Baffin Bay scheduled for 1985.

Deep seismic reflection and refraction , aeromagnetic, and gravity (including satellite gravity) data will be acquired beginning in 1987, in order to define the deep geological controls, thermal histroy, seismic stratigraphy and evolution of rifted continental margins and sedimentary basins around Baffin Bay.

SCIENTIFIC RESULTS:
Additional industry seismic data obtained on Scotian Shelf and Grand Banks and seismic data file including shot point locations updated.

Contract with NORDCO Limited in St. John's Newfoundland resulted in development of rock core drill attachment for Seadrill facility.

NORDCO Seadrill and rock core drill attachment were used on CSS HUDSON to obtain near surface bedrock samples from the southeast Baffin Shelf and Hudson Strait.

OUTPUTS:
SHIH, K.G., DODS, D., MACNAB, R., 1985. Magnetic anomaly map NO-21, National Earth Science Series.

SHIH, K.G., DODS, D., MACNAB, R., 1985. Magnetic anomaly map NN-22, National Earth Science Series.

DODS, D., SHIH, K.G., MACNAB, R., 1985. Magnetic anomaly map NO-20, National Earth Science Series.

DODS, D., SHIH, K.G., MACNAB, R., 1985. Magnetic anomaly map NN-21, National Earth Science Series.

MACNAB, R., PLASSE, D., GRAVES, M., 1985. An index of commercially acquired potential field data in the east coast offshore. *Geol. Sur. Can. Curr. Res. Paper 85-1B, pp. 467-469.*

EARTH & OCEANS RESEARCH LTD., 1985. Index of commercially acquired potential field data in the Canadian east coast offshore. *Geol. Sur. Can. Open File #1158.*

JACKSON, A.E., 1985. Sediment tickness map, offshore Eastern Canada. 1:2,000,000. *Geol. Sur. Can. Open File #1177.*

GRANT, A., MCALPINE, K.D., WADE, J., 1985. The continental margin of Eastern Canada - geological framework and petroleum potential. *A.A.P.G. Wallace E. Pratt Memoir.*

NANTAIS, P.T., 1985. Regional hydrocarbon potential of Labrador Shelf. *Geol. Sur. Can. Open File #1197.*

CARTER, G.B., D'JORIO, N., GRADSTEIN, F.M., 1985. Geographic distribution of Cenozoic foraminifera dinoflagellates and spores in offshore wells on the Labrador and Scotian Shelves. *Computers and Geoscience, Wichita, October 1985.*

MACLEAN, B., WILLIAMS, G.L., SANFORD, B.V., KLASSEN, R.A., BLAKENEY, C.P., JENNINGS, A., 1986. A reconnaissance of the berock and surficial geology of Hudson Strait: preliminary results. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

MACLEAN, B., WILLIAMS, G.L., JENNINGS, A., BLAKENEY, C.P., 1986. Cumberland Sound, N.W.T.: investigations of bedrock and surficial geology. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

GRANT, A.C., MCALPINE, K.D., WADE, J.A., 1985. Offshore geology and petroleum potential of Eastern Canada. *Eastern Exploration and Exploitation.*

GRANT,A.C., LEVY, E.M., LEE, K., MOFFATT, J.D., 1985. PISCES IV research submersible finds oil on Baffin Shelf. *Geol. Sur. Can. Curr. Res. Paper 86-1A, pp.65-69.*

FGP Project Number: EC44-220 Project Officer: D.J.W. Piper

TITLE: Engineering Geology- Development and Application of Capabilities in Physical Properties and Modelling and Acquisition of Surficial and Engineering Geology Information.

RESOURCES:		Planned	Actual	Cummulative Total
	Personnel (PY)	1.0	1.0	1.2
	Contract	100.0	12.6	56.6
	Other O&M	25.0	44.3	135.3
	Capital	95.0	15.1	182.1

OBJECTIVE:
To provide a new capability in geotechnical engineering assessment and research in support of regional surficial (200m) geology related to constraints to offshore development.

To provide baseline data and expertise on the distribution of surficial geologic materials, stratigraphic correlation, seabed features and processes in the Labrador/Baffin Bay areas, including fjord areas, to ensure a scientific understanding of site-specific constraints to development. 1985 field studies in Baffin Bay will provide regional data directly related to ODP drilling and will be integrated with results from the ODP program.

DESCRIPTION:
Laboratory facilities for specialized marine geotechnical testing will be developed in 1985-86. Contract development of new field sampling and in-situ measurement equipment will be initiated in 1986 as well as the purchase and/or adaptation of existing technology.

Contract services will also be utilized to develop numerical modelling processes of relevance to constraints to development, for example for slope analysis, fluid migration through surficial sediments, wave effects on pore pressure, sediment erosion and transport, seabed scouring.

Research in physical properties will be related to regional geological investigations and include static and dynamic analyses of properties controlling seabed stability, properties affecting sediment transport, gaseous sediment, diapirism, and relations between geotechnical and acoustic properties. Numerical modelling will be directed towards hazard prediction.

Stratigraphic and mapping innovations will concentrate on computer-assisted methods of updating open file maps; improvement of methods for identification of palynomorphs; improved methods of isotopic and other geochemical dating and correlation techniques; improvement of acoustic and other remote sensing methods; acceleration of regional stratigraphic mapping programs and investigation of specific hazards; and improved land-sea stratigraphic correlation.

SCIENTIFIC RESULTS:
CSS HUDSON cruises to Baffin and Hudson Strait successfully completed.

Data from ODP cruise in Baffin Bay/Labrador integrated with other field data to provide improved biostratigraphic control.

Synthesis of glacial history and a series of 1:250,000 isopach maps of the surficial sediments on the Labrador Shelf nearly complete.

Landsat thematic maps.

Software development on TAS image analysis system continued and data analysis initiated.

OUTPUTS:

MACLEAN, B., WILLIAMS, G.L., SANFORD, B.V., KLASSEN, R.A., BLAKENEY, C.P., JENNINGS, A., 1986. A reconnaissance of the bedrock and surficial geology of Hudson Strait: preliminary results. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

MACLEAN, B., WILLIAMS, G.L., JENNINGS, A., BLAKENEY, C.P., 1986. Cumberland Sound N.W.T.: Investigations of bedrock and surficial geology. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

ANDREWS, J.T., ASKU, A.E., KELLY, M., KLASSEN, R.A., MILLER, G.H., MODE, W.N., MUDIE, P.J., 1985. Baffin Bay, Baffin Island, and west Greenland during the last interglacial/glacial transition: land/ocean correlations. *Quaternary Research.*

CLARK, P.U., JOSENHANS, W.H., 1986. Late Quaternary land-sea correlations, northern Labrador and Labrador Sea. *Geol. Sur. Can. Curr. Res. Paper 86-1B.*

ROGERSON, R.J., JOSENHANS, W.H., BELL, T., 1985. A 3.5 kHz acoustic survey of Nachvak Fjord, northeastern Labrador. *Geol. Sur. Can. Curr. Res. Paper 86-1A, pp. 221-228.*

DABROS, M.J., MUDIE, P.J., 1985. An automated microscope system for image analysis in palynology and micropaleontology. *Geol. Sur. Can. Curr. Res. Paper 86-1A, pp. 107-112.*

FARROW, G.E., SYVITSKI, J.P.M., ATKINSON, R.J.A., MOORE, P.G., ANDREWS, J.T., 1985. Baffin Island Fjord macrobenthos: bottom communities and environmental significance. *Arctic.*

ATLANTIC GEOSCIENCE CENTRE, 1985. Preliminary 1:5m Quaternary geology map and 1:2m surficial features map of offshore Eastern Canada. *Geol. Sur. Can. Open File #1076.*

JOSENHANS, W.H., KLASSEN, R.A., ZEVENHEUZEN, J., 1985. The Quaternary geology of the Labrador Shelf. *Can. Jour. Earth Sci.*

FGP Project Number: EC44-520 Project Officer: D.I. Ross

TITLE: Canadian Participation in the Ocean Drilling Program.

RESOURCES:	Planned	Actual	Cummulative Total
Personnel (PY)		-	
Contract			
Other O&M	500.0	506.3	506.3
Capital			

OBJECTIVE: This project provides for part of the Canadian participation in the Ocean Drilling Program. The objectives of this participation are to obtain:

Scientific and technological information , expertise and technology in frontier regions for: the oil and gas and the mineral exploration industries; the scientific communities in general; and for the definition of Canada's outer limits offshore.
Technical information and advances with direct industrial application; the opportunity to test and develop new products and to identify and exploit new technological advances.

DESCRIPTION: These objectives will be attained by participation in scientific and technological studies at sea and in the laboratory, development of technology and its testing at sea, dissemination of information concerning opportunities and results to industry, government and universities, participation in international research activities.

SCIENTIFIC RESULTS:
One site in Baffin Bay and two sites in the Labrador Sea successfully drilled and initial results reported.

Canadian participation on Legs 103-106 ensured.

Scientific input in international panels and planning for future cruises continued.

OUTPUTS:
BOILLOT, G., *et al* 1986. Resultats preliminaires de la campagne 103 du *JOIDES RESOLUTION* (Ocean Drilling Program) au large de la Galicia (Espagne): sedimentation et distension pendant le "rifted" d'une marge stable; hypothese d'une denugation tectonique du manteau superieur. *C.R. Acad. Sc. Paris, T.301, Serie II, 1985.*

SRIVASTAVA, S.P., ARTHUR, M.A., 1985. Preliminary report Leg 105 of ODP. Initial report of Leg 105.

ARTHUR, M.A., SRVIASTAVA, S.P., 1985. JOIDES RESOLUTION probes high latitude paleoceanography and tectonics of Baffin Bay - Labrador Sea. *Nature.*

SRIVASTAVA, S.P., ARTHUR, M.A., 1985. Drilling beyond the Arctic Circle; ODP Leg 105. *Geotimes.*

BOILLOT, G., *et al* 1985. Evolution of passive continental margin. *Nature.*

BOILLOT, G., *et al* 1985. Rifting processes and possible tectonic denudation of the upper mantle on the Galacia margin (Spain): preliminary results of ODP Leg 103. *Geotimes.*

BOILLOT, G., *et al* 1985. Rifting processes and possible tectonic denudation of the upper mantle on the Galacia margin (Spain): preliminary results of ODP Leg 103. *Geotimes.*

JANSA, L.F., 1985. Paleoceanography and the evolution of the North Atlantic Ocean basin during the Jurassic. *Geol. Soc. Amer. Decade of North American Geology Series.*

Williams, G.L., 1985. The Deep Sea Drilling Project - a decade of review. *Can. Pet. Geol. Bull.*

PALEOZOIC BASINS COMPONENT **Component manager: D.I. Ross**

COMPONENT SUMMARY

Study of industrial seismic data across the Gulf of St. Lawrence has been used to deliniate the Magdalen and Anticosti basins. They are enigmatic depressions, whose subsidence cannot be explained by simple crustal loading. Thorough understanding of basin geometry will permit modelling the basin's evolution numerically to determine the tectonic causes for the observed crustal flexures.

The geological interpretation of the Northumberland F-25 well has been reassessed. Some basalts previously thought to be Paleozoic are Triassic; they may be related to Atlantic Ocean opening.

Vitrinite reflectance measurements on coals were used to infer the time of faulting in the Mabou-Inverness area, Cape Breton, and coal maceral studies were undertaken in the Sydney coal field. Coal reserves in eastern Canada's largest field, The Gulf of St. Lawrence, were studied and reported on.

FGP Project Number: EC54-160 Project Officer: J.S. Bell

TITLE: Structural geology, sedimentology, basin evolution, hydrocarbon potential of Paleozoic Basins.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.5	0.5	0.5
	Contract	15.0	18.4	18.4
	Other O&M	0.0	3.3	3.3
	Capital	0.0	0.0	0.0

OBJECTIVE:
To determine the structure and evoluntionary history of the Hudson Bay and St. Lawrence basins through integrated geological and geophysical studies.

DESCRIPTION :
The Paleozoic Basins of Eastern Canada include basins in the Gulf of St. Lawrence, Ungava-Foxe and Hudson Bay regions. The regional geology and resource appraisal of theses basins have either been neglected for a decade or not seriously studied. The extensive seismic data must be appraised and integrated with well data. The study will be initiated in-house in 1985 with contract support in compilation and analysis as appropriate. Deep seismic reflection data acquisition is planned for Hudson Bay and Gulf of St.Lawrence in 1986-87 to investigate the underlying controls on the formation and evolution of the basins. The data, if acquired will contribute to the Lithoprobe studies.

SCIENTIFIC RESULTS :
Participation on Baffin Bay/Hudson Strait cruise (FGP Project EC44-040) and preparation of preliminary geology map and report.

Re-contoured CHS bathymetry data in terms of bedrock geology expression in Hudson Strait, Foxe Cove, Hudson Basin and James Bay.

Acquired 7600km of Shell (1973-74) seismic data and completed preliminary interpretation to produce rough basement structural map and isopachs of gross paleozoic units in Hudson Bay.

Arranged for acquisition of an additional 10,000km of 1982-83 industry seismic data.

WEST COAST TASK

TASK MANAGER: R.B. Campbell

TOFINO BASIN COMPONENT **Component Manager: R.G. Currie**

COMPONENT SUMMARY

A preliminary examination of the multichannnel seismic data obtained across the basin shows the Juan de Fuca plate dipping easterly beneath the continental margin. Easterly dipping thrust faults dislocate the sedimentary prism beneath the continental slope. The higher level structure also appears to show tectonic wedging and delamination similar to what is known to be present beneath the foothills of western Alberta.

The regional sidescan sonar survey shows major tectonic elements (transform faults, compressional ridges and thrust fault traces) as well as showing that major slump features and debris flows are present along the entire margin. The variability in the surficial and deep structures along the lenght of the margin is great and is correlated with the postulated variations in the local ocean/continent motion vectors.

FGP Project Number: WC16-210 Project Officer: C.J. Yorath

TITLE: Geology and Structure of Tofino Basin.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	275.0	279.2	285.1
	Other O&M	0.0	0.0	16.0
	Capital	100.0	91.8	107.3

OBJECTIVE:
To conduct stratigraphic, biostratigraphic, structural, geochemical and thermal maturation studies of the subduction complex offshore Vancouver Island.

DESCRIPTION:
Potential field and seismic refraction data from related projects will be integrated with geological studies conducted on the Olympic Peninsula and Vancouver Island. Cuttings and cores from existing and new wells will be examined. Thermal and subsidence models of Tofino basin will be constructed.

SCIENTIFIC RESULTS:
910 km of multichannel seismic reflection data were obtained of which 600 km were processed. The contract was completed on March 27 and all required data are in hand. Data to be on Open File - March 1987. Mapping and stratigraphic studies on southern Vancouver Island were completed.

OUTPUTS:
SUTHERLAND-BROWN, C., YORATH, C., ANDERSON, R.G., DOM, K., 1986. Geological Maps of southern Vancouver Island, Lithoprobe 1. *Geol. Sur. Can. Open File #1272.*

FGP Project Number: WC16-470 Project Officer: B.D. Bornhold

TITLE: Surficial Geology - geomorphology and neotectonics.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	0.0		
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To carry out detailed mapping of the continental slope and shelf morphology, to study the geology, shallow structure and tectonics of the slope environment and to identify the nature and magnitude of sedimentary and tectonic processes on the slope and shelf and their potential impact on exploration and development.

DESCRIPTION :
Analysis of SeaMARC 11 imagery will be carried out to identify the principal morphological elements of the slope and shelf, to interpret the nature and distribution of processes controlling the slope morphology.

SCIENTIFIC RESULTS:
A preliminary onterpretation of the long-range sidescan sonar data is in progress.

Abstracts have been submitted for poster presentations of the data at the Circum-Pacific Conference and the International Association of Sedimentologists Congress, July-August,1986.

FGP Project Number: WC16-480 Project Officer: E. Davis

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	220.0	215.6	215.6
	Other O&M	0.0		
	Capital	96.0	96.7	96.7

OBJECTIVE:
To map and acoustically image the continental slope off western Canada to establish the nature and location of deformational features and their relationship to sedimentary basin formation and geological hazards.

DESCRIPTION:
This will will be conducted as a joint scientific project with the Hawaii Institute of Geophysics, University of Hawaii. Field program to be completed by September 1, 1985.

SCIENTIFIC RESULTS:
SeaMARC II cruise sucessfully completed. Approximately 30,000 sq km of acoustic imagery collected as well as magnetic and gravity data along 3000 km of ship's track. Post survey processing largely completed as well as the preliminary compilation of mosaics. Data to be released in FY 86-87.

Absracts submitted for poster sessions at the Circum-Pacific Conference and the International Association of Sedimentologists Congress.

OUTPUTS:
DAVIS, E.E., CURRIE, R.G., SAWYER, B.S., 1986. The Application of Swath Bathymetric and Acoustic Image Mapping to Contemporary Problems in Maritime Geoscience. *Canadian Petroleum Association Colloquium IV, (in press).*

QUEEN CHARLOTTE COMPONENT **Component Manager: R.G. Currie**

COMPONENT SUMMARY

Stratigraphic and biostratigraphic studies have led to a revision of the Jurassic stratigraphy of the Queen Charlotte Islands, the recognition of a thick Jurassic succession as a potential subsurface reservoir and the identification of Lower Jurassic hydrocarbon source beds. Similar studies of the Cretaceous rocks suggest that they also require a stratigraphic revision and have reservoir potential.

Surficial studies in the region show little evidence of recent tectonism or seabed instability.

The data acquisition phase of the aeromagnetic survey has been completed.

FGP Project Number: WC26-190 Project Officer: B.D. Bornhold

TITLE: Surficial Geology- Geomorphology and Neotectonics.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	66.0	65.4	107.3
	Other O&M	0.0		22.4
	Capital	100.0	81.5	134.7

OBJECTIVE:
To conduct detailed surveys of sediment distribution and sedimentology and seabed morphology and its relationship to the recent tectonics of the northern Queen Charlotte Islands and Dixon Entrance; to assess the degree to which tectonic effects on surficial geology might impact on offshore development (eg. slope failures, faulting).

To carry out detailed mapping of the continental slope morphology, to identify potential hazards to offshore development, to study the shallow structure and tectonics of the slope environment, and to identify the nature and magnitude of sedimentary and tectonic processes on the slope and their potential impact on exploration and development.

DESCRIPTION:
Contract surveys using precision echo-sounding, sidescan sonar and grab sampling will be carried out between Langara Island and Rose Spit off northern Graham Island during three field seasons.

Analysis of results will include preparation of: detailed bathymetric maps, comparison of previously aquired bathymetry with new data, maps and discussion of surficial sediment distribution, surface morphology, including bedrock outcrop and structural elements (fault, joint set and fold orientation), and identification of sedimentary effects due to faulting, seismic activity, uplift or subsidence, and an assessment of the likely impact of such effects on offshore exploration and development. Maps will be compiled at a scale of 1:25,000 with more detailed maps in areas of special interest.

Initially (1986-87) studies of slope morphology will be undertaken using SeaMARC II acoustic imagery, together with shallow and intermediate penetration seismic profiling.

In 1987-88 and 1988-89 detailed investigations of specific target areas will be undertaken using submersible observations, high resolution seismic, possibly deep-towed acoustic imagery, coring and photography.

Analysis of SEAMARC II records will be carried out to identify the principal morphological elements of the slope, to infer the nature and the distribution of processes controlling the slope morphology, and to identify 'type' areas for detailed investigation. These interpretations will be incorporated into an atlas of acoustic imagery for the slope areas, maps of the morphological elements, and a report describing the geomorphology of the slope.

Detailed studies of 'type' areas identified above will address specific questions such as magnitude and frequency of slope failures, nature of erosion and transport of sediments in canyon systems, and characteristics of inter-canyon areas.

SCIENTIFIC RESULTS:
Geoscience survey offshore northern Graham Island was complet4d. 676 samples were submitted for microfossil picking for subsequent age determination and oxygen isotope analysis.

OUTPUTS:
Offshore Surveys and Positioning Ltd., Nearshore sedimentation and recent tectonics, Virago Sound, northern Graham Island. Geological Survey of Canada Open File.

BORNHOLD, B,D., 1986. Bathemetry, surficial sediments and seabed morphology off northwestern Graham Island, Queen Charlotte Islands, B.C. *Geol. Sur. Can. Open File #1280.*

FGP Project Number: WC26-200 Project Officer: R.G. Currie

TITLE: Magnetic Surveys - Data Acquisition and Interpretation.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	201.6	280.8	280.8
	Other O&M	35.0	31.9	37.7
	Capital	0.0		28.3

OBJECTIVE:
To compile a composite magnetic map of the Queen Charlotte Basin and adjacent areas by acquiring data where required and merging it with existing aeromagnetic and marine magnetic data sets.

DESCRIPTION:
The resulting data sets will be interpreted paying particular attention to the distribution of the Oligocene volcanics. These volcanics separate Tertiary and Cretaceous sedimentary successions which may have hydrocarbon potential. This data will provide an additional constraint on the geological model of the basin.

SCIENTIFIC RESULTS:
The data acquisition phase of the aeromagnetic survey was completed, compilation to take place in FY 86-87. Compilation of marine data in relevant areas initiated.

FGP Project Number: WC26-490 Project Officer: B.E.B. Cameron

TITLE: Stratigraphy and Biostratigraphy of West Coast rocks.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	0.0	10.7	10.7
	Other O&M	20.0	13.7	13.7
	Capital	0.0		

OBJECTIVE:
To determine the geologic history of the area through detailed stratigraphic and biostratigraphic studies of the Mesozoic and Cenozoic rocks from available subaerial and offshore exposures and from the subsurface. This research will lead to an understanding of the depositional environments of the rocks and consequently the identification of potential hydrocarbon source beds and reservoir intervals.

DESCRIPTION:
Field work on the Cretaceous rocks in the Skidegate and Cumshewa Inlet areas of the Charlottes will continue. During the summers of 1986 to 88, studies of the Cretaceous rocks in the important northwest Graham Island will continue. The results of these studies will be the publication of the Jurassic microfaunas of the Queen Charlotte Islands and their biostratigraphic importance. Completion of the Cretaceous studies will lead to the publication of a description of Cretaceous microfaunas of the Charlottes and their biostratigraphic importance.

SCIENTIFIC RESULTS:
Work on Jurassic stratigraphy of the Queen Charlotte Islands was completed. Illustration and description of Jurassic microfaunas is proceeding well and should be ready for submission in 1987.

Laboratory and field work on the Cretaceous rocks of the Queen Charlotte Islands was continued. The southern part of the outcrop belt (Skidegate and Cumshewa Inlet areas) was completed. A preliminary report on the stratigraphic revisions of these Cretaceous rocks is in the final stages of preparation.

A manuscript on the Jurassic biostratigraphy of the Queen Charlotte Islands is in editorial stage.

A poster session entitled "Stratigraphy and Hydrocarbon Occurrences in the Queen Charlotte Basin, West Coast of Canada", was presented at the GSC Oil and Gas Forum in Calgary.

OUTPUTS:
CAMERON, B.E.B., TIPPER, H.W., 1986. Jurassic Stratigraphy of the Queen Charlotte Isalands, British Columbia. *Geol. Sur. Can. Bulletin 365.*

FGP Project Number: WC26-500 Project Officer: T. Lewis

TITLE: Geothermal measurements and thermal modelling of the Queen Charlotte Basin.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	10.0		
	Other O&M	5.0	11.8	11.8
	Capital	0.0		

OBJECTIVE:
To obtain geothermal data to provide constraints to basin subsidence and thermal history modelling and to thermal maturation models, i.e. heat flow, heat production, thermal conductivity.

DESCRIPTION:
Borehole measurements are to be made on an opportunity basis, and in boreholes drilled under other FGP projects. This will provide basic data for basin models and constraints to petroleum maturation. This project will be carried out using both contracts and in-house resources to conduct cruises, make measurements and preserve boreholes of opportunity.

SCIENTIFIC RESULTS:
Thermal conductivity was measured on 100 samples from offshore wells within Queen Charlotte Basin and Tofino - Winona Basin. Measurements were made in house due to lack of a suitable contractor. This has delayed publication of results until FY 86-87.

ARCTIC ISLANDS TASK

TASK MANAGER: W.W. Nassichuk

SVERDRUP BASIN COMPONENT **Component Manager: A.F. Embry**

COMPONENT SUMMARY

This component has ten projects which cover many aspacts of the geology of the Sverdrup Basin, the main petroleum and coal bearing basin within the Arctic Islands. Field and laboratory studies on Upper Paleozoic, Mesozoic and Tertiary strata have elucidated the stratigraphy and sedimentology of petroleum reservoir and source strata as well as coal-bearing strata.

Upper Paleozoic - Twenty-five subsurface sections in the western Sverdrup Basin were analyzed and compared with surface sections of Ellesmere Island. Reef development at five different stratigraphic levels was documented from outcrop studies. The Lower Carboniferous Emma Fiord Formation on Devon Island was established as an organic-rich lacustrine deposit and, as such, may be an important petroleum source rock along the southern margin of the basin. Conodont and spore studies are allowing more precise age correlation for the strata.

Mesozoic - Field work in the eastern Sverdrup has led to the deliniation of bituminous shales in the Lower Triassic section and the documentation of regional unconformities of pre-Callovian, pre-Oxfordian and pre-Late Cretaceous age. All cores from the Lower Jurassic strata of the western Sverdrup, which contain important petroleum reservoir rocks, were logged in detail and a wide spectrum of depositional environments was recognized. Two cores from the Middle Triassic strata which include petroleum source rocks were described and sampled for detailed organic and inorganic geochemical studies. A suite of cuttings from Middle-Upper Triassic source rocks has been analyzed for a biomarker study and a source-oil correlation has been established. A suite of Cretaceous coals from Melville Island were studied using reflected microscopy. The microfaunal zonation for the Jurassic-Cretaceous succession has been refined and integrated with ongoing ammonite and pelecypod studies.

Tertiary - Field work on Axel Heiberg and Ellesmere Islands has led to the establishment of a formal stratigraphic framework and four formations have been defined and delineated. A GSC Bulletin describing the succession on western Axel Heiberg Island has been completed and this study includes a detailed coal resource analysis for the area. A preliminary map for the strata in the Strathcona fiord area of Ellesmere Island, where the thickest coals yet recognized in the Arctic Islands are located, has been placed on Open File. Palynology studies of the strata contributed much to the establishment of the stratigraphic framework and have allowed more precise dating of uplift and thrust faulting on Axel Heiberg Island.

Thermal Maturation - These studies are in the data collection stage and include colour index of conodonts, TAI of spores, and vitrinite refelection of carbonaceous material and bitumen. Samples under study

cover a wide geographic area and span the entire stratigraphic succession.

Regional Maps - Both 1:5,000,000 and 1:2,000,000 scale maps for the entire Arctic Archipelago have been completed and are presently being edited.

FGP Project Number: AI15-070 Project Officer: B.S Norford

TITLE:Thermal Maturity of the Paleozoic Sedimentary Rocks.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.2	-	.7
	Contract	50.0	59.2	151.1
	Other O&M	0.0	-	.1
	Capital	5.0	4.0	79.0

OBJECTIVE:
Determination of organic maturity of rocks of Ordovician-Permian age in the Arctic Islands.

DESCRIPTION:
The thermal maturity of the rocks will be established through the use of conodonts (colour alteration and fluorescence), palynology (TAI), scolecodonts and graptolites (Vitrinite Reflectance) and sediments (Vitrinite Reflectance). Radiogenic dating of the conodonts will be attempted.

SCIENTIFIC RESULTS:
All available well material has been sampled for conodont and palynology processing. Outcrop samples from the Lower and Upper paleozoic of Melville Island , Ellesmere Island and Devon Island have been processed and are being studied.

A new scale based on the vitrinite reflectance of scolecodonts has been determined and a manuscript describing the work completed.

Vitrinite reflectance studies have been carried out on many of the microfossil samples.

OUTPUTS:
GOODARZI, F., HIGGINS, A.C., In Press. Optical properties of Scolecodonts and their use as indicators of thermal maturity, *Marine and Petroleum Geology.*

FGP Project Number: AI15-080 Project Officer: A.V. Okulitch

TITLE: Geology of the Arctic Islands.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0	0.1	0.1
	Contract	56.0	50.7	86.8
	Other O&M	0.0		-
	Capital	15.0	18.8	18.8

OBJECTIVE:
To provide regional summaries and assessments of geologic knowledge of the Arctic Islands through compilation of bedrock geology maps and cross-sections at 1:1,000,000 scale, geotectonic correlation charts and

well data.

DESCRIPTION:
The compilation will focus on the status of the data base for current models of basin analysis and for future problem areas, and will provide a concise summary for resource assessment. Cooperation and integration with industry and universities is intended. Compilation will take 4-5 years by contract personnel (A. Zolnai, P. Gann, J. Greggs) supervised by the project officer, who is also responsible for editing. Compilations at 1:1,000,000 will be used to produce regional maps at 1:2,000,000 and 1:5,000,000 scales for planning purposes and large scale tectonic syntheses. These maps will also be submitted for publication in the DNAG Arctic volume.

SCIENTIFIC RESULTS:
Compilation of 1;5,000,000 and 1:2,000,000 scale maps was completed. The first has been submitted to the editor of the Innuitian volume, DNAG, in final form. The second is undergoing internal critical review prior to final submission to DNAG editors. Four of the 6 1:1,000,000 maps compiled last year have received revision in light of new data from Melville Island. Previously compiled correlation chart data has been partially transferred to the new computer-aided drafting and data base management system. Assembly of other materials (block legend,index maps and reference list) and editorial review has been completed for 1 of 6 maps. Compilation of 3 of the next 4 maps planned has begun.

FGP Project Number: AI15-120 Project Officer: J.A. Podruski

TITLE: Basin Analysis of Western Sverdrup.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	.5	0.3	0.3
	Contract	0.0		
	Other O&M	50.0	39.6	39.6
	Capital	0.0		

OBJECTIVE:
Develop reports and hydrocarbon play maps for the Arctic Islands which define plays and play areas.

DESCRIPTION:
The reports and play maps will be based on surface and subsurface geology, geophysics, geochemistry, heat flow and hydrodynamics.

Establish research into specific petroleum geology problems in the region.

SCIENTIFIC RESULTS:
During 1985, core was obtained from two Sverdrup Basin wells, East Drake L-06 and Skybattle M-11. These cores were obtained as part of an integrated geological-organic and inorganic study of the diagenetic history and source character part of the Schei Point Group (Triassic). The cores have been described, and samples taken for organuc and

inorganic analyses are keyed to geologic descriptions and interpretations. The core represents the only core material of source rock facies of the Triassic of the entire Sverdrup Basin.

Significant regional geochemical work on biomarkers also contribute to this project. A hand-pickes suite of cuttings samples of prime Schei Point source facies has been obtained and analyzed, using the stratigraphic framework provided by A.F. Embry.

FGP Project Number: AI15-140 Project Officer: W.W. Nassichuk

TITLE: A Review of Upper Paleozoic Surface and Subsurface Stratigraphy and Carbonate Petrology in the Sverdrup Basin.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	1.0	1.0
	Contract	15.0	5.0	19.7
	Other O&M	0.0	10.0	10.0
	Capital	95.0	101.0	101.0

OBJECTIVE:
To correlate the upper Paleozoic subsurface stratigraphy on Melville Island with the stratigraphy elsewhere in the Sverdrup Basin and to establish a depositional and stratigraphic framework for the basin.

DESCRIPTION:
The subsurface upper Paleozoic stratigraphy on Melville Island will be compared with better known surface stratigraphy elsewhere in the Sverdrup Basin, including northern Ellesmere and Axel Heiberg Islands. The depositional and stratigraphic framework will include a review of diagenesis and reef development critical to an assessment for petroleum potential.

SCIENTIFIC RESULTS:
Data from 25 wells in the western Sverdrup Basin, particularly on and adjacent to Melville Island, were analyzed and compared to surface data on Ellesmere Island. The subsurface data was incorporated into a DNAG (Innuitian volume) chapter on the upper Paleozoic geology of the Sverdrup Basin.

A report on reef development in upper Paleozoic strata in the Sverdrup Basin was prepared for publication in GEOS. Reefs occur at 5 levels in the upper Paleozoic succession in the Sverdrup Basin from Upper Carboniferous through Lower Permian and those at each level were described in terms of regional setting, organic composition and diagenesis.

The Emma Fjord Formation on Ellesmere and Devon Island is now known to be a lacustrine shale in part.

OUTPUTS:
HIGGINS, A.C., NASSICHUK, W.W., 1986. Possible Carboniferous boundary stratotype sections in the Sverdrup Basin, Arctic Islands, Canada.

Newsletter, Middle Pennsylvanian Working Group, International Union of Geological Sciences Subcommission on Carboniferous Stratigraphy, 4ms pages.

DAVIES, G.R., NASSICHUK,W.W., 1986. Carboniferous to Permian geology of the Sverdrup Basin, Canadian Arctic Archipelago. *DNAG, Innuitian Vol., H.P. Trettin (ed), 30 ms pages,19 figs.*

FGP Project Number: AI15-230 Project Officer: A.C. Higgins

TITLE: Paleozoic Biostratigraphy and Biofacies Studies.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0	0.9	1.6
	Contract	34.0	35.5	56.0
	Other O&M	7.0	-	-
	Capital	5.0	40.0	40.0

OBJECTIVE:
Establishment and refinement of biostratigraphic zonations and correlations, and outlining of major biofacies in rocks of Ordovician to Permian age in the Arctic Islands.

DESCRIPTION:
Biostratigraphic zonations will be defined on combined studies of microfaunas, palynomorphs, and macrofaunas; in support of ongoing exploration and regional geology program.

SCIENTIFIC RESULTS:
In support of Operation Melville, conodont and spore assemblages from the Canyon Fjord-Assistance Formations, Pennslyvanian-Permian which should provide detailed datings of these formations. A paper on the palynology of the Permian and lowermost Triassic of the Sabine Peninsula has been prepared. Numerous internal reports on the Devonian palynology of Melville Island hane been prepared for the Regional Subdivision, providing a zonal scheme integrated with that of the conodonts and brachiopods.

Conodont faunas from the Late Carboniferous and Permian of Ellesmere Island are being studied and integrated with a comparable sedimentological study and zonation of the smaller foraminifera. Collection of Upper Carboniferous-Permian corals from Blind Fjord, Ellesmere Island was completed and are being studied. These studies are producing more precise and new dating of Upper Carboniferous-Permian rocks and integrating the various zonal schemes.

FGP Project Number: AI15-270 Project Officer: F. Goodarzi

TITLE: Organic maturation and properties of kerogen and bitumen in clastic and carbonate sequences of the Sverdrup Basin and Franklinian Geosyncline.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.0	0.2	0.2
	Contract	115.0	130.9	130.9
	Other O&M	25.0	-	
	Capital	100.0	40.3	40.3

OBJECTIVE:
To determine kerogen and bitumen types in clastic and carbonate sediments, to determine their properties (optical, chemical, trace element content). To classify the bitumen, its origin and to make a comparision of the bitumen from frontier areas to those occurringin the rest of Canada and major bitumen occurrences in the world. To determine the bitumen-hydrocarbon relationship and oil migration path.

DESCRIPTION:
Contract work to miscellaneous companies and/or consultants will be awarded in order to collect and prepare outcrop and/or well samples from the Arctic Islands sedimentary basins.

Petrographic analyses will be carried out both in-house and on a contract basis through commercial laboratories and a PhD student working in-house. Geochemical analyses will be carried out in-house partially under contract with a PhD student.

The petrographic, organic and inorganic results will be combined, compared and contrasted in several publicationsas well as a theis.

SCIENTIFIC RESULTS:
About 2800 core, borehole, surface and concentrate were collected and their reflectance determined.

A suite of Cretaceous coals from Melville Island were examined using reflected light mocroscopy.

Petrographical and rock eval analyses were carried out on 25 oil shales from Grinnell Section, Emma Fjord Formation, Devon Island.

A suite of samples from Kleybolte Section, Emma Fjord Formation were examined and the results compared with those from Grinnell Section.

Detailed geochemical and petrological studies were carried out on needle coal from Arctic Islands.

Detailed studies of maturation of four boreholes on Melville Island were carried out.

FGP Project Number: AI15-290 Project Officer: J.H. Wall

TITLE: Mesozoic and Teriary biostratigraphy and paleoecology.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.2	0.5	0.5
	Contract	54.0	41.5	41.5
	Other O&M	19.0	19.8	19.8
	Capital	10.0	11.7	11.7

OBJECTIVE:
To assess the assemblage composition, biochronological significance and paleoecology of Mesozoic and Teriary microfaunas (chiefly foraminifera), microfloras, ammonites and bivalves of the Sverdrup Basin in order to better define subsurface and outcrop stratigraphy.

DESCRIPTION:
Comprehensive microfossil studies of outcrop and subsurface sections, including samples taken from the Ice Island, will be integrated with macrofaunal control data to determine what microfossils are sufficiently time sensitive for dating the Mesozoic and Tertiary successions. Compelmentary analyses of all ther above fossil groups will be applied toward interpretation of the depositional environments and thermal maturation of these beds. Principal goal is the generation of GSC and outside papers for establishing biostratigraphic schemes and correlations, and combining stratigraphy, sedimentology and biostratigraphy of the Mesozoic and Tertiaty successions.

SCIENTIFIC RESULTS:
Microfossil studies from Jurassic outcrops of western Axel Heiberg Island resulted in the establishment of correlations with other sections in the Sverdrup Basin. A mocrofaunal component was integrated into a paper on Middle Jurassic to Cretaceous stratigraphy of the Arctic Islands, presented to a special session on basin analysis at the GAC annual meeting in Fredricton, N.B., May, 1985. An investigation of Lower Cretaceous to MIddle Triassic strata from three wells in the Lougheed Island area led to the compilation of a poater session featuring the ages and environments of Jurassic and Cretaceous assemblages contiguous with two of the producing sands, which was displayed at the GSC Oil and Gas Forum in February 1986 and was solicited for the CSPG annual convention in June.

Ten days feild work were conducted on western Axel Heiberg Island to study Jurassic facies and to collect fossils. A manuscript on two new genera and species of Canadian Volgian oxytomid bivalves was completed. A computer program to enter data on the collections and distriburion of Canadian Jurassic macrofossils was partially completed.

A paper on new data for the Eurekan Orogeny including significant palynological information, was accepted for publication in GSC Current Research.

FGP Project Number: AI15-350 Project Officer: A.F. Embry

TITLE: Mesozoic basin analysis of Sverdrup Basin, Arctic Archipelago.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	.4	0.4	0.4
	Contract	0.0		
	Other O&M	125.0	69.0	69.0
	Capital	0.0		

OBJECTIVE:
To determine regional stratigraphic relationships and envirnments of deposition for the Mesozoic history of the basin and to evaluate its petroleum potential.

DESCRIPTION:
The objectives will be accomplished by studying and correlating surface and subsurface sections, integrating all biostratigraphic data, preparing cross-sections and maps (isopach, facies, structure, paleoecology), and integrating all geophysical and geochemical data. Lithostraigraphic studies will be performed in close consultation with workers in other disciplines.

SCIENTIFIC RESULTS:
A field party on western Ellesmere Island and Axel Heiberg Island was organized and led from late June to mid August and 40 sections were measured and sampled in the Mesozoic succession. Important stratigraphic discoveries include the deliniation of bituminous shales in the Lower Triassic Blind Fjord Formation, the establishment of pre-Callovian, pre-Oxfordian and pre-Upper Cretaceous unconformities, and the occurrence of thick, Cretaceous basaltic volcanics on northwestern Ellesmere Island.

All cores in the lower Jurassic succession of the western Sverdrup Basin were examined and described in detail. A detailed facies analysis of these strata has been completed and a broad range of sedimentary environments represented.

OUTPUTS:
EMBRY, A.F., 1986. Triassic Sea-Level Changes: Evidence from the Canadian Arctic Archipelago, *in, Sea Level Changes: an Integrated Approach, SEPM Special Publication.*

RICKETTS, B.D., EMBRY, A.F., 1986. Coal in the Canadian Arctic Archipelago. *GEOS, Vol 15, pp. 16-18.*

FGP Project Number: AI15-380 Project Officer: R.A. Stephenson

TITLE: Structural, tectonic and stratigraphic analysis of the Arctic Islands.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)		0.1	0.1
	Contract			
	Other O&M			
	Capital			

OBJECTIVE:
To determine intermediate and deep structure of the Arctic Archipelago through application of reflection and refraction seismic techniques.

DESCRIPTION:
Aseries of seismic lines across northern ELLesmere Island will permit extrapolation of reasonably well-known surface structures to depth along a regional cross-section. This project will provide data in an area where no company-devised data exist.

SCIENTIFIC RESULTS:
A workshop involving government, university and industry geologists and geophysicists was held at ISPG to determine where deep reflection and refraction data could most advantageously be acquired to further our knowledge of the stratigraphic and structural architecture of Arctic Basins. A north-south line across eastern Melvelle Island was agreed upon because both the Franklinian and Sverdrup basins as well as two large gas fields occur in the area, the program could be done on land, and the Panarctic camp at Rea Point was a convenient logistical base. The project was subseqently deferred until economic exploration conditions in the Arctic improve and all existing data thoroughly examined.

FGP Project Number: AI15-440 Project Officer: B.D. Ricketts

TITLE: Studies of coal deposits of western and northern Canada.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	.6	.4	.4
	Contract	0.0		
	Other O&M	38.2	9.5	9.5
	Capital	0.0		

OBJECTIVE:
To develop a stratigraphic framework for the Eureka Sound Formation that will allow interpretation of the evolution of coal-bearing basins.

To establish the timing and nature of different phases of Eureka deformation.

Analysis of coals to determine rank, quality, and depths of burial of strata.

Using this stratigraphic framework, establish the resource potential of the formation.

Additional studies will be conducted on older coal-bearing formations in both the Sverdrup Basin and Franklinian Geosyncline, to provide basic data for Canada's National Coal Inventory.

DESCRIPTION:
These studies will be accomplished by basic mapping, detailed measurement of stratigraphic sections. This will include critical biostratigraphic analyses of coal for rank and composition. All available drill hole data will be used.

SCIENTIFIC RESULTS:
Research continued on the stratigraphic and coal resource of coal bearing basins on western Ellesmere and eastern Axel Heiberg Islands, with several surface sections measured in the Cretaceous-Tertiary Eureka Sound Formation. A new marine shale unit was recognized and mapped within the formation on central Ellesmere Island and the Tertiary stratigraphy of eastern Axel Heiberg Island was clarified. A preliminary unedited 1:50,000 map has been released showing the distribution of the Eureka Sound Formation and its important units in the area of Strathcona Fjord. A GSC Bulletin has been submitted for publication which will provide detailed information on the stratigraphy, sedimentology and paleontology of the Eureka Sound Fromation on western Axel Heiberg Island. The bulletin also contains a detailed analysis of the coal resource potential of Eureka Sound strata on Western Axel Heiberg Island, adding new data for Canada's National Coal Inventory.

OUTPUTS:
RICKETTS, B.D., , 1986. Eureka Sound Formation, Strathcona Fjord Map Sheet, Ellesmers Island. *GSC Open File #1182*

RICKETTS, B.D., EMBRY, A.F., 1986. Coal in the Canadian Arctic Archipelago. *GEOS*

RICKETTS,B.D., 1986. Delta evolution in the Eureka Sound Fromation, Western Axel Heiberg Island: the transition from wave-dominated to fluvial dominated deltas. *GSC Bulletin, in press.*

PALEOZOIC PLATFORM-MIOGEOCLINE COMPONENT **Component Manager: R.L. Christie**

COMPONENT SUMMARY

Field work has been completed for mapping and related stratigraphic, sedimentologic and structural studies on Melville Island. Preliminary results have been published in GSC Current Research. Work is proceeding on a full report, including four 1:250,000 map sheets as a GSC Paper. A structural analysis of Melville Island was presented at the annual meeting of the Canadian Society of Petroleum Geologists in June 1986. Refinement of the stratigraphy, including facies frameworks indicates the presence of deepwater shale basin and carbonate platform at depth (Ordovician to lower Devonian) with overlying shallow marine shale-siltstone deposits overwhelmed from east to west by advancing deltaic and fluvial sandstones (Middle and Upper Devonian). The sediments lie within the "petroleum window" of thermal maturity. Younger, Paleozoic and Mesozoic carbonates, shales, sandstones, and conglomerates formed in rift-dominated shallow-marine marginal parts of the Sverdrup Basin.

Air-photo reconnaissance and logistic preparations were completed for an integrated mapping and stratigraphic program on Grinnell Peninsula (Devon Island) to begin in June 1986.

Oil shales on Southampton Island were sampled for organic geochemical analysis. Results have been released in GSC Open File 1285.

All thermal data for Paleozoic conodonts, graptolites, and spores were compiled and are being prepared for presentation on regional maps.

Biostratigraphy for all Paleozoic systems continued at an accelerated pace and several papers werer prepared for publication in scientific journals.

FGP Project Number: AI25-110 Project Officer: R.L. Christie

TITLE: Structure and Stratigraphy of the Paleozoic-Mesozoic Basins of Melville and Adjacent Islands.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.3	1.6	1.6
	Contract	0.0		11.9
	Other O&M	189.0	197.7	197.7
	Capital	0.0		-

OBJECTIVE:
To obtain an improved understanding of the sedimentary and tectonic elements of the Franklinian and Sverdrup basins in the Melville-Bathurst Islands region, to better understand the source and migration mechanisms, and entrapment of hydrocarbons.

To derive improved models of Franklinian and Sverdrup basin evolution in the context of circum-Arctic tectonics.

DESCRIPTION:
These objectives will be achieved through airphoto and field study and from well and geophysical data.

SCIENTIFIC RESULTS:
A second and final season of helicopter supported fieldwork was completed.

OUTPUTS:
CHRISTIE, R.L., 1986. The Melville Project, 1984-84 progress report. *Current Research, Part A, GCS Paper 86-1A, pp. 795-799.*

HARRISON,J.C., GOODBODY, Q.H., CHRISTIE, R.L., 1985. Stratigraphic and structural studies on Melville Island, District of Franklin. *Current Research, Part A, GSC Paper 85-1A, pp. 629-637.*

ROBSON, M.J., 1985. Lower Paleozoic stratigraphy of northwestern Melville Island, District of Franklin. *Current Research, Part B, GSC Paper 85-1B, pp. 281-284.*

UTTING, J., 1985. Preliminary palynological results from the Permian and lowermost Triassic of Sabine Peninsula, Melville Island, Canadian Arctic archipelago. *Current Research, Part B, GSC Paper 85-1B, pp. 231-238.*

FGP Project Number: AI25-280 Project Officer: U. Mayr

TITLE: Investigation of stratigraphy and tectonic development of lower Paleozoic Platform-Miogeocline margin zone.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	.1	0.1	0.1
	Contract	0.0		
	Other O&M	30.0	10.1	10.1
	Capital	0.0		

OBJECTIVE:
To describe and understand significant facies and thickness changes in terrigenous and carbonate formations in the lower Paleozoic platform Miogeocline margin zone.

To describe and understand deformation related to intersecting Silurian and Devonian fold belts on Grinnell Peninsula.

To describe and understand Tertiary transverse faults in the Mackinson Inlet region and to interpret their relationship, if any, to seafloor spreading in Baffin Bay.

DESCRIPTION:
The margin zone is to be investigated on Devon Island (Grinnell Peninsula and adjacent areas). Significant facies changes and thickness increases of terrigenous and carbonate formations occur in this zone. Additionally, in the Grinnell area Silurian and Devonian fold belts intersect, while the Mackinson Inlet area contains Tertiary continental transform faults probably connected to seafloor spreading in Baffin Bay.

SCIENTIFIC RESULTS:
Logistical preparation for field work which will begin in June 1986.

FGP Project Number: AI25-460 Project Officer: N.J. McMillan

TITLE: Analysis of Arctic Platform rocks - Proterozoic,Cambrian, Ordovician, Silurian.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.1	1.5	1.5
	Contract	50.0	34.6	34.6
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To determine the distribution of organic matter in Proterozoic and lower Paleozoic rocks of the Arctic Platform. To assess these rocks as sources for hydrocarbons and to provide input into heat regime modelling.

DESCRIPTION:
This work will be done in liason with contractors and Canadian Universities. Subsidence models will be made to understand hydrodynamics, heat regimes and maturation.

SCIENTIFIC RESULTS:
Field samples were obtained in August 1985 from Southampton Island; organic geochemical analyses were completed and a report was placed on Open File.

OUTPUTS:
MACAULEY, G., 1985. Geochemistry of the Ordovician Boas oil shale, Southampton Island, N.W.T. *Geol. Sur. Can. Open File #1285.*

CONTINENTAL SHELF COMPONENT **Component Manager: A.F. Embry**

COMPONENT SUMMARY

Two projects comprise this component which covers the Arctic Continental Shelf - a virtual *terra incognita* in terms of geological knowledge. Studies conducted in the area have used the Ice Island as a base for operations.

Three seismic refraction lines totalling 300 km were shot north of Axel Heiberg Island. Preliminary interpretation of the data indicates that highly deformed Lower Paleozoic strata are near the surface on the inner shelf. On the outer shelf up to 10 km Cretaceous-Tertiary strata overlie the basement.

Seismic reflection profiles were shot along the path of the Ice Island and the data are being processed.

Surfical sediments were studied by means of gravity cores, bottom photography qand dredge samples. The inner shelf seems to be covered by mud interbedded with gravel. Sponge reefs up to 10 m high were observed growing on gravel beds.

FGP Project Number: AI35-090 Project Officer: A.F. Embry

TITLE: Stratigraphy and Structure of Arctic Continental Shelf.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.3	0.3	0.4
	Contract		542.0	785.2
	Other O&M	850.0	69.1	495.4
	Capital	50.0	265.2	716.6

OBJECTIVE:
To determine the crustal structure of the continental shelf with emphasis on the Phanerozoic portion, and to evaluate its petroleum potential.

DESCRIPTION:
These objectives will be accomplished by: shooting and interpreting seismic refraction lines on the shelf and adjacent slope (R. Jackson, AGC and D. Forsyth, EPB, co-leaders); shooting and interpreting seismic reflection profiles along and near the path of an ice island which is drifting southwestward along the shelf (A. Overton, RGG, leader); integrating all geophysical data with known geology and geophysics of adjacent Arctic Islands (A. Embry, ISPG, leader).

SCIENTIFIC RESULTS:
Three seismic refraction lines were shot north of Axel Heiberg Island. Preliminary interpretation indicate the sedimentary column near the outer edge of the shelf is up to 12 km thick and consists of 2 km of undeformed Neogene strata overlying up to 10 km of deformed Cretaceous to lower Tertiary strata.

Seismic reflection profiles were obtained along the path of the Ice Island from mid-July to early August. Processing of the data by both university researchers and industry is underway.

OUTPUTS:
Asudeh, I., Forsyth, D.A., Jackson, H.R., Stephenson, R., and White, D., 1985. 1985 Ice Island refraction survey, phase I report. *GSC Open File Report #1196.*

WESTERN ARCTIC TASK

TASK MANAGER: W.W. Nassichuk

MACKENZIE DELTA-BEAUFORT SEA COMPONENT Component Manager: D.K. Norris
COMPONENT SUMMARY:
Field work was completed in early April 1986 for a deep reflection seismic program designed to increase our understanding of the deep structure of the Mackenzie Delta region, an area of significant exploration activity. The program os managed by University of Calgary under contract , and was designed in consultation with industry personnel, particularly from Chevron and Esso. Examination of field records indicates that high quality data were received. Deep refectors previously identified on Chevron records have recognized in our data. Processing is proceeding. This program will address a number of basic geologic problems including, depth to Paleozoic strata, depth to basement, relationship of Eskimo Lakes fault zone to deep crustal structure, and geometry of Campbell Lake uplift.

Topography at 1:50,000 scale in the northern Yukon was digitized under contract completing the digitizing of the Canadian Cordillera. Terrain corrections are now being calculated for the cordilleran Bouger gravity national data base.

To permit assessment of earthequake hazards along and adjacent to the Beaufort Sea coast, an earthquake station array was reactivated with stations at Komakuk Beach, Shingle Point, Dawson, and Sacks Harbour. Large earthequakes have not occurred during the reporting period.

Biostratigraphic zonations based on diatoms and palynomorphs are being established for the Beaufort Sea, and distribution charts have been prepared for 4 more wells (total of 10). Work on diatoms is proceeding in cooperation with Amoco personnel at Denver Colorado. A preliminary Tertiary zonation will be presented at the annual meeting of the Canadian Society of Petroleum Geologists in June 1986.

A short course, by ISPG personnel, sponsored by the CSPG, on the geology, biostratigraphy, and geochemistry of the Beaufort-Mackenzie Basin was presented in Calgary, November 18-19, and was very well received by industry. The course notes have been published by CSPG.

Geopressure maps of the Mackenzie-Beaufort area are being prepared by Alberta Research Council, under contract. A computer file has been produced which includes drill stem tests, stratigraphic tops, and pressure data, all extracted from well history reports.

FGP Project Number: WA15-100 Project Officer: D.G. Cook

TITLE: Structural Geology and Tectonic and Stratigraphic Analyses, Northern Mainland and Adjacent Continental Shelf.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.1	0.3	0.3
	Contract	1205.0	886.8	919.4
	Other O&M	0.0	75.6	396.7
	Capital	100.0		105.7

OBJECTIVE:
To determine the geometry, sequential development, temporal and genetic relationships of normal faults and diapiric structures; establishing the basic structural geometry and seismostratigaphy of the lower part of the supracrustal wedge and subjacent lithosphere from the northern mainland across the continental shelf to the southern edge of the Canada basin.

DESCRIPTION:
Aeromagnetic and deep seismic data will be used to complement geological data to determine the geometry and development of the Canada Basin.

SCIENTIFIC RESULTS:
A detailed gravity survey was completed by the Earth Physics Branch along the planned seismic reflection line northwest from Inuvik to the Beafort Sea. Station spacing is 5 and 2.5 km and 216 stations were occupied. A contour map (5 mGal interval) and station plot have been distributed to interested researchers. The work shows a strong gradient of over 2 mGal/km that coincides with surface traces of the Eskimo Lake fault system.

A planned marine reflection seismic program could not be carried out because no contractor had a ship available capable of this program. An on-land program was designed in lieu of the marine program at year end. It was run using vibroseis under contract supervised by University of Calgary. Examination of field records indicates that high quality data were received. Data from this program are being processed and should substantially increase our understanding of the deep structure of the Mackenzie Delta including the nature of the Eskimo Lake fault zone, the geometry of Mesozoic, Paleozoic, and Proterozoic stratigraphic sequences, and the geometry of Campbell Lake Uplift.

A workshop to discuss a lithoprobe proposal for the northern Yukon which might complement ISPG's FGP program in the Delta and Beaufort Sea was organized and chaired by D.G. Cook at ISPG. It involved government, university, and industry geologists and geophysicists. A steering committee continued to work on this proposal and have solicited suggestions from a wide array of geoscientists.

In 1984-85, 1:50,000 scale topography north of 62 deg. 30 min. N in the Yukon and adjacent zones in Alaska and District of Mackenzie were digitized under contract. The output was 372,000 points from 559 map sheets. This provides a regional base for computer generated terrain corrections to 600 Bouguer values derived from the 1984 regional gravity survey centered along the Dempster Highway from Dawson th Fort

Macpherson. The success of this effort led, in 1985-86, to complete digitization of the Canadian cordillera at the above interval and scale, about 2,300,000 total points. With these data terrain corrections are now being calculated for the 20,000 cordilleran Bouguer gravity values in the national data base. Removal of terrain effects brings gravity data to bear, for the first time in a consistent way, on the problems of cordilleran regional density structure and crustal mass distribution. The digital terrain data and complete (i.e. terrain corrected) Bouguer anomaly values are available to the public at cost.

FGP Project Number: WA15-240 Project Officer: D.H. Weichert

TITLE: Beaufort Earthquake Station Array - Seismicity and Inferred Faults, Deep Structure and Tectonic Processes.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	0.0		24.6
	Other O&M	60.0	50.6	61.0
	Capital	0.0		15.0

OBJECTIVE:
To reactivate existing stations with data collection at the EPB standard station at Inuvik.

To operate the earthquake station array along the coast of the Beaufort Sea and adjacent areas to continuously monitor and record earthquakes in the region, particularly the offshore concentration.

DESCRIPTION:
Collected data will be processed to determine earthquake parameters; i.e., locations, depths, magnitudes, mechanisms (for larger events) and statistics.

SCIENTIFIC RESULTS:
Data collection continued from stations at Komakuk Beach, Shingle Point, Dawson and Sachs Harbour. The first two are telemetered to Inuvik, where they are recorded on paper (under contract). The other two are regional packages recording locally and operated by contract. The Komakuk seismometer stopped operating in December and repair awaits spring breakup.

Large earthquakes requiring special processing beyond the contracted work have not occurred in the Beaufort Sea during the reporting period. However, unexpectedly large earthquakes (m6.9) have occurred in the Mackenzie Mountains, which are seismotectonically as yet indistinguishable from the Beafort Sea seismic cluster.

A seismic station was maintained on the Ice Island during the summer of 1985, in order to gain experience with this type of operation. Preliminary evaluation rates the station as poor but when it drifts over the Beaufort Sea seismic cluster during the next five summers it should provide a constraint on the depths of earthquakes occurring during that time.

FGP Project Number: WA15-260 Project Officer: A.E. Foscolos

TITLE: Mass transfer of elements in clastic sequences.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0	0.3	0.3
	Contract	190.0		
	Other O&M	0.0	181.5	181.5
	Capital	300.0	324.1	324.1

OBJECTIVE:
To study mass transfer of elements from shales to sandstone in order to understand the processes of cementation in reservoir rocks and diagenesis of shales. This data will be used to establish mineralogical stability fields for common allogenic components in shales and sandstones.

DESCRIPTION:
Detailed mineralogical and inorganic analysis of a shale on a metre by metre scale away from a sandstone contact as well as analysis of the adjacent sandstone will be necessary in order to carry out mass balance calculations and understand the process of mineral phase migration in clastic sequences. AA, XRF, SEM and ICP-MS analyses will be used to examine static conditions and thermodynamic and kinetic studies will be used to generate dynamic models.

SCIENTIFIC RESULTS:
Samples were collected from East Drake L-06 and Skybattle Bay M-11 wells, Arctic Islands. In-house work began by logging and sampling both wells for organic and inorganic analysis.

FGP Project Number: WA15-320 Project Officer: D.H. McNeil

TITLE: Cretaceous-Tertiary biostratigraphy and paleoecology, palynomorphs and microfossils.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.3	1.2	1.2
	Contract	43.4	16.6	16.6
	Other O&M	5.0	4.8	4.8
	Capital	40.0	27.5	27.5

OBJECTIVE:
Establishment, refinement, and application of microfaunal and microfloral zonations in onshore and offshore subsurface successions of Late Cretaceous and Tertiary age in the Mackenzie Delta and Beaufort Sea.

DESCRIPTION:
The objectives are to be attained by detailed description of microfaunal and microfloral assemblages and analysis of their paleoecological, correlative, and chronostratigraphic significance. Data will be derived from outcrop and subsurface sources. Computer processing of data and quantitative analysis will be utilized where appropriate. Outcrop

sequences, especially type sections, will provide important standards for subsurface correlations. A field component will be considered where logistical support is available.

SCIENTIFIC RESULTS:
Preliminary biostratigraphic analyses of three new wells in the west Beaufort Sea were obtained (Edlok N-56, Natiak O-44, Adlartok P-09). Biostratigraphic control has proven to be critical in the west Beaufort Sea frontier where major structures and unconformities complicate seismic profiles which are the main source of data in the area.

Detailed distribution charts have been prepared for 4 more Beafort Sea wells (total of 10 now). Approximately 20 wells will be utilized in the final Tertiary zonation of the Beaufort-Mackenzie Basin (preliminary results presented at the CSPG "Reserves Canada 21" conference in Calgary in June 1986).

Continued work on establishment of standard biostratigraphic zonation for Beaufort-Mackenzie Basin based on palynology of well and outcrop sections.

Reference material from the Tertiary of the Isle of Wight has been collected for comparison with dinoflagellates from the Beaufort-Mackenzie are.

Internal report on palynomorphs of Natsek E-56 well completed.

Contributed to CSPG short course "Geology, biostratigraphy and organic geochemistry of Jurassic to Pleistocene strata, Beufort-Mackenzie area, Northwest Canada".

Biostratigraphic correlations based on diatom zones in the Beaufort-Mackenzie Basin were presented in a poster display at the GSC Oil and Gas Forum held in Calgary, February 18-19.

FGP Project Number: WA15-410 Project Officer: N.J. McMillan

TITLE: Hydrocarbon potential in stratigraphic and unconformity related traps - siesmic stratigraphy.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.3		
	Contract	40.0	39.9	39.9
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To evaluate the details of subsurface stratigraphy within parts of the Mackenzie-Beaufort.

DESCRIPTION:
Models for the deltas in the Mackenzie/Beaufort allow growth faults, erosion intervals, delta plains, slopes, fronts, turbidites. Some of these environments (and combinations of them), are more ideal than others for hydrocarbon entrapment. Accordingly it is essential to use

seismic lithostratigraphy in finding and describing these fovoured zones.

FGP Project Number: WA15-420 Project Officer: N.J. McMillan

TITLE: Geological nature of abnormal pressure zones of Mackenzie Delta-Beaufort Sea.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.5	0.5	0.5
	Contract	65.0	48.2	48.2
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
Conduct a petrographic, petrologic, chemical study of the overpressured zones and normal zones in wells drilled.

DESCRIPTION:
Initiate contracts with consultants and possibly research groups in oil companies. A complete literature review will be made and a critical path of research established.

Between 1985 and 1989 ISPG will, in collaboration with the Alberta Research Council and other government/non-government agencies, produce maps of pressure zones. Subsequently these zones will be subjected to petrographic, chemical, geochemical studies to learn of the origin of zones of geopressure.

SCIENTIFIC RESULTS:
The stratigraphic framework which has evolved for the area involves stratigraphy, reflection seismic studies, sedimentology and paleontology and is being used to acquire and study the hydrogeological and other aspects of abnormal pressures. The work is contracted through the Alberta Geological Survey, with the study divided into three phases. Phases one and two have involved data gathering and processing, and a full report of this activity has been received. Phase three is planned for 1986-87, will involve synthesis of all data collected.

FGP Project Number: WA15-450 Project Officer: A.C. Higgins

TITLE: Thermal maturity studies of the Paleozoic of the northern mainland and Tertiary of the Beaufort Sea/Mackenzie Delta.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.1	0.1	0.1
	Contract	20.0	39.8	39.8
	Other O&M	0.0	30.0	30.0
	Capital	5.0		

OBJECTIVE:
Determination of organic maturity of rocks of Paleozoic and Tertiary age by the use of conodonts, palynology, scolecodonts, graptolites and sediments to determine burial and erosional history.

DESCRIPTION:
Colour assessments of conodonts (CAI) and palynomorphs (TAI) vitrinite reflectance measurements on palynomorph residues, grptolites and scolecodonts, and fluorescence measurements on conodonts to determine thermal maturity as an aid to hydrocarbon and mineral exploration. This project will complement Mesozoic thermal maturity studies. Samples will be collected from Arctic wells, outcrop and existing ISPG collections. Field component includes Paleozoic and Tertiary sampling on the northern mainland and Mackenzie Delta. Study of modern heat flow will be carried out by the Earth Physics Branch.

SCIENTIFIC RESULTS:
Two hundred and fifty conodont samples were processed by outside contract. The maturity assessments of these samples will be used to produce isograd maps.

INTERIOR PLAINS COMPONENT **Component Manager: D.G. Cook**

COMPONENT SUMMARY:
A report on the subsurface Precambrian and Paleozoic stratigraphy of the northern interior plains was completed, has been critically read and is being edited. Stratigraphic cross-sections from this report have been released as GSC Open File #1176.

From discussions with Petro-Canada personnel it is known that most Coleville Hills structures involve Precambrian strata and many structures have probably been localized by reactivation of Precambrian structures.

Field work has beem completed on the stratigraphic, biostratigraphic , and thermal maturation studies of Brackett Coal Basin. Preliminary results will be presented at the annual meeting of the Canadian Society of Petroleum Geologists in June 1986.

A collaborative activity with the Royal Institute of Natural Sciences, Belgium, will establish brachiopod and conodont biostratigraphy of the bituminous member of the Pine Point Formation.

Devonian bituminous shales have been sampled to determine oil/source correlations for Norman Wells crude. Both the Canol and the Bluefish Member are potential sources for Norman Wells oil. A report is in preparation.

A 5.3 metre thick Carboniferous anthracite bed was discovered south of Barn Mountains. A description of it and other Carboniferous, Cretaceous, and Paleocene coals will appear in the next volume of Current Research.

A study of the development of permafrost and ground ice in the western Arctic coastal region was carried out under contract. Two progress reports have been received.

FGP Project Number: WA25-250 Project Officer: L.R. Snowdon

TITLE: Oil source correlation for northern interior plains crudes.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.2	0.2	0.2
	Contract	18.0		
	Other O&M	2.0	7.1	7.1
	Capital	0.0		

OBJECTIVE:
Acquire and analyze oil, condensate and possible source rock samples to make hydrocarbon/source correlations in the Northern Interior Plains. Map probale source distributions once source beds have been identified in order to predict location of possible undiscovered reserves.

DESCRIPTION:
Oil and rock samples will be collected and preparation and analysis will be carried out under contract to an organic geochemist. Geochemical and geological data will be merged and published as maps and cross-sections in open file reports and refereed journals.

This project will be carried out as series of one year contracts to identify probale source rocks in the Northern Interior Plains, collect sample and analyze, then make oil/source correlations. The character of the source rocks will also be investigated.

SCIENTIFIC RESULTS:
Samples of Norman Wells crude oil and shale samples from the Canol Formation and Bluefish Member (potential source rocks) were collected. One hundred and twenty samples were analyzed for total organic carbon, RockEval pyrolysis, and total sulphur content. About 20 samples were solvent extracted and analyzed for saturate fraction gas chromatography.

The tentative interpretation is that both the Canol Formation and Bluefish Member are potential sources for Norman Wells oil.

FGP Project Number: WA25-330 Project Officer: A.R. Sweet

TITLE: Macropaleontology, micropaleontology and palynology of Devonian, Cretaceous and Tertiary rocks of the Interior Plains.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.7	1.8	1.8
	Contract	0.0		
	Other O&M	26.7	15.7	15.7
	Capital	5.0		

OBJECTIVE:
To establish and refine biostratigraphic zonations utilzing Cretaceous and Tertiary palynomorphs, Cretaceous ammonoids and bivalves, and Devonian brachiopods, corals and conodonys and apply these to resolving stratigraphic problems arising from energy inventory and regional geological studies within the Interior Plains.

DESCRIPTION:
By developing a detailed understanding of morphological changes within the groups studied, expressed within a formal taxonomic framework, and interrelating this to paleoecological influences on occurrences, a logical basis for limiting the ranges of individual taxa will be provided.

Fossils will be obtained from outcrops through field programs integrated with regional studies and subsurface sources. Study will involve both light and scanning electron microscopy. Data handling will be assisted by computer processing. In addition to library research, direct examination of macro and microfaunas and floras from other biogeographic provinces will be necessary ti identify specimens and establish continuity with internationally recognized time scales. Consultation with other researchers in North America and abroad will ensure this study is placed within an international geological and geographical framework.

SCIENTIFIC RESULTS:
Samples were collected from sections spanning the Cretaceous-Tertiary boundary in Brackett Coal Basin. The sections measured during this sampling provide additional information on the lateral distribution of some of the coal zones.

In preparation towards the proposed manuscript on Devonian brachiopods and conodont biostratigraphy, range charts for species of brachiopods were constructed.

A prelominary draft on the sedimentology of the Brackett Coal Basin has been prepared. An abstract has been submitted for a talk to be presented to the Reserves Canada 21 conference, June 1986.

Laboratory work of a collaborative project on the brachiopod and conodont faunas of the Bituminous limestone member of the Pine Point Formation on the south side of Great Slave Lake has been completed. A review of all previous paleontological work on the Middle Devonian of the south side of Great Slave Lake has been prepared for inclusion in the final report.

Revision and update of the manuscript on the "Devonian Geology of the Operation Porcupine area" for inclusion in a GSC Memoir on the Geology of the Porcupine area has been completed.

FGP Project Number: WA25-370 Project Officer: D.G. Cook

TITLE: Stratigraphy and structure of northern Franklin Mountains and adjacent plains.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.1	0.1	0.1
	Contract	25.0	27.5	27.5
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To carry out stratigraphic and structural studies of the Northern Interior Plains including Franklin Mountains and Coleville Hills in order to gain a better understanding of the Proterozoic framework underlying the Phanerozoic basins, Phanerozoic depositional sequences and relationships to tectonic controls, and subsequent deformational geometry and mechanism. To evaluate the potential for source rockd and trapping conditions for hydrocarbons.

DESCRIPTION:
Work will be managed by D.G. Cook, but carried out initially under contract (stratigraphic studies by D.C. Pugh, gravity studies by the University of Calgary), and later by a recruit subsurface stratigrapher, in cooperation with a geophysicist.

SCIENTIFIC RESULTS:
A report on the subsurface Precambrian and Paleozoic stratigraphy of the northern interior plains north of 60N and east of 132W has been completed under contract.

Informal sessions have been held with Petro Canada personnel to examine and discuss non-confidential geophysical records in the Coleville Hills, Franklin Mountains and environs. Most Coleville Hills structures involve Precambrian strata and the data can be interpreted to indicate that many if not all Colville structures have been localoized by Precambrian strucures, possibly wrench faults.

A new method for balancing basement-cored structures has been developed and presented to the Structural Division of CSPG, and the annual meeting of GSA.

OUTPUTS:
PUGH, D.C., 1986. Stratigraphic cross-sections of the northern interior plains. *Geol. Sur. Can. Open File #1176.*

FGP Project Number: WA25-510 Project Officer:J.A. Heginbottom

TITLE: Modelling of ground ice regimes.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	80.0	54.6	54.6
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To develop conceptual and mathematical models of the growth, development and decay of perennial ground ice,so as to enhance understanding of the processes involved and of the implications for man's activities, and to improve ability to provide advice to other government departments and industry.

DESCRIPTION:
The work will be done by a combination of field observation and sampling, field experiments, laboratory testing and analysis, and

theoretical studies and analysis. The results will be published in the open, scientific literature. The project will be undertaken mainly by means of contract research; some in-house research may be appropriate.

SCIENTIFIC RESULTS:
Two progress reports have been submitted under a contract study of the development of permafrost and ground ice in the western Arctic Coast region of Canada.

NORTHERN CORDILLERA COMPONENT

Component Manager: M.P. Cecile

COMPONENT SUMMARY:
Activities in this component were diverse and involved significant field work. Research studies ranged from sampling of organic rich rocks for hydrocarbon maturation; stratigraphy and mapping of Devonian carbonate and clastics; structural analysis; collection and identification of Late Paleozoic to Tertiary macro- and microfauna; description of bitumen occurrences in the Y.T.; and an information course for industry focussed on the Beaufort-Mackenzie area. Selected highlights are:

Sampling of organic rich strata along the Dempster highway is now complete and vitrinite relectance values are being determined. More surface samples of Late Devonian shales were collected from the frontal Mackenzies, completing coverage for a regional organic maturation study.

A major potential hydrocarbon source rock, Beaufort Mackenzie Basin was sampled for microfossils, and a report on microfossils in the Eagle Plains area was completed.

A significant carbonate to shale transition implying subsurface hydrocarbon potential was delineated in the Ogilvie Mountains.

Studies of Devonian clastic stratigraphy in the Selwyn Moutains is now complete. During this map-stratigraphic study a major decollement sheet was identified, the recognition of which indicates much greater potential for tungsten occurrences in contact metamorphic rocks intruding this structural zone, due to repetition of carbonate strata.

FGP Project Number: WA35-300 Project Officer: D.H. McNeil

TITLE: Macropaleontology, micropaleontology and palynology of the Mesozoic and Lower Tertiary of the northern Yukon and western District of Mackenzie.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.1	0.7	0.7
	Contract	18.5	4.4	4.4
	Other O&M	7.5	1.3	1.3
	Capital	0.0		

OBJECTIVE:
To apply and expand existing biostratigraphic zonations in macropaleontology (ammonoids and bivalves) and micropaleontology (Foramanifera) and palynology; relationships of these zonations to onshore Mackenzie Delta and Interior Plains sequences as part of an integrated regional study.

DESCRIPTION:
The objectives are to be attained by detailed description of molluscan, foramaniferal, and palynological assemblages and analysis of their paleoecological, correlative and chronostratigraphic significance. Data will be derived from outcrop and subsurface sources. Computer processing of data and quantitative analysis will be utilized where appropriate. Outcrop sequences, especially type sections, will provide important standards for subsurface correlations. Afield component will be considered where logistical support is available.

SCIENTIFIC RESULTS:
Field work was undertaken on Upper Cretaceous outcrops to the east and west of the Mackenzie Delta during July, 1985. Palynological collections were made from the Boundary Creek and Smoking Hills Formations, both potential source rocks for oils in the Beaufort-Mackenzie Basin.

A data file for all Jurassic macrofossils collected from northern Yukon and adjacent District of Mackenzie was completed.

Work on a paper on the foraminifera of the Maastrichtian-Paleocene Tent Island and Lower Moose Channel Formations of the Yukon Coastal Plain is now in progress.

A contract to S. Fowler for a report on Neocomian foraminifera of the northern Yukon and adjacent western District of Mackenzie was completed during the past year.

A manuscript describing Lower Jurassic and Aalenian ammonites and bivalves from the northern Yukon and adjacent N.W.T. is in progress.

OUTPUTS:
FOWLER, S., 1986. A report on the micropaleontology of 49 outcrop samples from Upper Jurassic - Lower Cretaceous sections, Richardson and Barn Mountains. *Internal report submitted to the Paleontology subdivision of ISPG, GSC, Calgary.*

FOWLER, S., 1986. Micropaleontology of 33 outcrop samples from Jurassic and Cretaceous sections, Richardson, Ogilvie mountains and Eagle and Horton River plains areas. *Internal report submitted to the Paleontology subdivision, ISPG, GSC, Calgary.*

McNeil, D.H., 1986. Biostratigraphy of the Beaufort Mackenzie Basin; *In*, Dixon *et al*, Geology, biostratigraphy and organic geochemistry of Jurassic to Pleistocene strata, Beaufort Mackenzie area, N.W.T. *Notes for Short Course, published by the Canadian Society of Petroleum Geologists.*

MacKintyre, D.J., 1986. Palynology; *In*, Dixon *et al*, Geology, biostratigraphy and organic geochemistry of Jurassic to Pleistocene strata, Beaufort Mackenzie area, N.W.T. *Notes for short course, published by the Canadian Society of Petroleum Geologists.*

Poulton, T.P., 1986. Internal GSC fossil report on Jurassic Ammonites, northern Alaska; *GSC Paleontological Report J1-TPP-1985.*

FGP Project Number: WA35-310 Project Officer: E.W. Bamber

TITLE: Micropaleontology, palynology and macropaleontology of the surface and subsurface Paleozoic of the northern Yukon and western District of Mackenzie.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.2	1.0	1.0
	Contract	5.0	8.3	8.3
	Other O&M	27.0	5.3	5.3
	Capital	0.0		

OBJECTIVE:
To establish and extend biostratigraphic zonations for the following fossil groups: palynomorphs (Carboniferous/Permian), conodonts (Upper Paleozoic), corals (Devonian/Carboniferous), brachiopods (Devonian) and Lower Paleozoic macrofauna.

DESCRIPTION:
Collections of Paleozoic fossil groups listed above will be obtained through field work on surface sections, and from available subsurface cores. Taxonomic description and biostratigraphic and paleoecological analysis of these faunas and floras will be undertaken with the purpose of establishing one or more comprehensive, integrated biostratigraphic schemes for the area and determining the paleoenvironmental significance of the fossil assemblages. Where appropriate, studies of minor groups will be carried out by outside specialists under contract.

SCIENTIFIC RESULTS:
An outside contract on the "Biostratigraphy of Carboniferous and Permian palynomorphs from the Eagle Plain - Ogilvie Mountains area, Yukon" has been completed and submitted to Paleontology section of the ISPG.

A.E.H. Pedder completed compilation of literature of Silurian and Devonian corals of the USSR. As part of the Canada/USSR Arctic Science

project, two weeks were spent at the All Union Institute for Geology and Mineral Resources of the World's Oceans in Leningrad. Data was assembled for preliminary correlation tables for the Devonian of Canada and the USSR.

Laboratory and literature searches for two manuscripts were completed. The first on Pridolian rugose corals from Ellesmere Island; and the second on Taimyrophyllum (Devonian Rugosa), Yukon and Canadian Arctic.

OUTPUTS:
JERZYKIEWICZ, J., 1986. Biostratigraphy of Carboniferous and Permian palynomorphs from the Eagle Plain - Ogilvie Mountains area, Yukon. *Internal report submitted to the Paleontology subdivision of ISPG, GSC, Calgary.*

FGP Project Number: WA35-340 Project Officer: M.P. Cecile

TITLE: Stratigraphic and structural analysis of Late Paleozoic strata in the northern Mackenzie and Selwyn Mountains.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.6	0.6	0.6
	Contract	0.0		
	Other O&M	40.0	31.4	31.4
	Capital	7.0	-	

OBJECTIVE:
Late Paleozoic rocks in the northern Canadian Cordillera formed a large foredeep basin that provided the source and host strata for the Norman Wells oil. This project combines mapping, stratigraphic, paleontological and organic geochemical studies in the western part of this foredeep basin (NTS 105-O, 106-A,B). The objectives are to unravel its very complex stratigraphy and establish data on the basin characteristics in this area.

DESCRIPTION:
Field work, foot traverses, and section measuring, will be carried out using casual helicopter charters during the 1985 and 1987 field seasons. Paleontological and organic geochemical studies will be carried out using ISPG facilities.

SCIENTIFIC RESULTS:
Geological mapping at 1:50,000 scale was completed for the two map sheets in the Niddery Lake (1050) map-area. Including mapping of three sheets by G. Abbott of DIAND, the entire Niddery Lake map area has now been completed. On the basis of this work an Open File report on the Geology of the Central Macmillan fold belt was released in 1986. The report consists of a geological map and legend which features Late Paleozoic stratigraphy and illustrates local Devonian growth faulting. The area is on a trend with and in the same facies position as two large Zn-Pb-Ag deposits found in the Macmillan Pass area Y.T.

An important highlight of this summers activity was recognition that a peculiar and highly shortened structural package characteristic of most of the Niddery Lake map-area (Niddery Decollement Sheet) continues to

the south through the Sheldon Lake map-area. Abrupt curvatures in fold trends within this belt are coincidental with (wrap-around) peculiar east-west trending fold belt (Macmillan Fold Belt) which features two large east-west trending grabens filled with chert pebble conglomerate. It would appear that the conglomerates have partly acted as buttresses during emplacement of this far traveled structural package.

A second important highlight is that stratigraphic and biostratigraphic studies on Devonian-Mississippian stratigraphy are now complete. With this and previous work we can now correlate this complex package of rocks from the Selwyn Basin into the Northern Interior Plains.

Additional samples of Devonian shales were collected from the mountain front near the Arctic Red and Gayna Rivers for organic geochemical maturation analysis.

A manuscript on "Ordovician and Silurian of western Canada" was completed, reviewed, corrected and submitted for publication to DNAG editors.

An abstract was published and paper presented at the Calgary Geological Survey of Canada Oil and Gas Forum on "Lower Paleozoic Embayments, Troughs, and Arches, Northern Canadian Cordillera". The implication of these features for petroleum exploration was reviewed.

OUTPUTS:

Cecile, M.P., 1986. Geology of the central MacMillan Fold Belt (NTS 1050 - 3). *Geol. Sur. Can. Open File #1242.*

Cecile, M.P., 1986. *(Abstract)*, Lower Paleozoic embayments, troughs and arches, Northern Canadian Cordillera; Geological Survey of Canada. *Abstracts for forum on "Oil and Gas in Canada", p. 5.*

Cecile, M.P., and Norford, B.S., 1985. Ordovician and Silurian paleogeographic maps and cross-sections for western and northwestern Canada. *Geol.Sur. Can. Open File #1137.*

Cecile, M.P., and Norford, B.S., in press. Ordovician and Silurian of western Canada. *Western Canada Volume, Decade of North American Geology, Geological Survey of Canada Publication.*

Cecile, M.P., and Norford, B.S., in press. Ordovician and Silurian of western Canada. *Canadian Cordilleran Volume, Decade of North American Geology, Geological Survey of Canada Publication.*

Potter, A.W., and Cecile, M.P., 1985. *(Abstract)* Paleogeographic significance of two Late Ordovician brachiopod faunules from the Misty Creek Embayment, Selwyn Basin, Northwest Territories, Canada. *Geol. Soc. Am., Abstracts with Program v. 17, p. 401.*

Cecile, M.P., and Norford, B.S., 1985. *(Abstract)*, The Ordovician and Silurian of Western Canada. *Geol. Soc. Am., Abstracts with Program v. 17, p. 347.*

FGP Project Number: WA35-360 Project Officer: J. Dixon

TITLE: Stratigraphy and sedimentology of Jurassic - Cretaceous strata, northern Cordillera.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.3	0.3	0.3
	Contract	0.0		
	Other O&M	25.0	32.2	32.2
	Capital	10.0		

OBJECTIVE:
To evaluate the present stratigraphic scheme and to undertake detailed facies analysis of Jurassic-Cretaceous strata. To establish an understanding of the on-shore Jurassic-Cretaceous geology and to project that into the offshore Beaufort Sea.

DESCRIPTION:
Helicopter supported stratigraphic-sedimentologic field studies will be carried out. Understanding the Jurassic-Cretaceous geology onshore will permit projecting the geology into the offshore Beaufort Sea. This in turn will allow for some well-based speculation on the deep geology in the offshore and aid in the evaluation of petroleum potential of the deeper strata.

SCIENTIFIC RESULTS:
Examination of Jurassic-Cretaceous strata in the Keele Range, northern Y.T., was undertaken in 1985. Newly identified exposures of Albian strata were examined and compared with the Albian Sharp Mountain Fm. Sedimentological data from these Albian units indicate a deep-water origin, rather than the shallow water marine origin originally suggested. On the basis of this research a manuscript titled "Comments on the stratigraphy, sedimentology and distribution of the Albian Sharp Mountain Fm., northern Y.T.", has been submitted for publication in GSC's Current Research.

OUTPUTS:
DIXON,J., DIETRICH, J.R., MCNEIL, D.H., MCINTYRE, D.J., SNOWDON, L.R., BROOKS, P., 1986. Geology, biostratigraphy, and organic geochemistry of Jurassic to Pleistocene strata, Beaufort-Mackenzie area, northwest Canada. *Notes. Short course published by Can. Soc. Pet. Geologists.*

Dixon, J., in press. Cretaceous to Pleistocene stratigraphy and paleogeography. *Can. Soc. Pet. Geologists Bull.*

FGP Project Number: WA35-390 Project Officer: D.W. Morrow

TITLE: Lower Paleozoic stratigraphy and facies relationships in the Wernecke, Ogilvie and Mackenzie Mountains.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	1.8	0.4	0.4
	Contract	0.0		
	Other O&M	10.0	9.7	9.7
	Capital	0.0		

OBJECTIVE:
To determine the spatial relationships between the lower Paleozoic formations and unnamed map units in the Wernecke and Ogilvie Mountains of the Yukon Territory ans in the Mackenzie Mountains in the Northwest Territories and to identify the major facies within these formations; to outline their sedimentologic-tectonic settings and post-depositional diagenetic changes that have affected them; to highlight regions that contain abrupt interfaces such as shelf-to-basin transitions between shelf and margin facies and shelf interior deposits that commonly influence diagenetic patterns and tha emplacement of hydrocarbons and mineral deposits.

DESCRIPTION:
Stratigraphic sections measured during field work in 1985 and 1986 in conjunction with previously acquired, unpublished stratigraphic sections will be the primary data source.

SCIENTIFIC RESULTS:
Stratigraphic field work on the southernmost exposures of the Kutchin and Ogilvie Formations adjacent to shales of the Selwyn basin was completed in the central Nash Creek map-area, 106D. This field work showed that large but discontinuous patch reefs are present in the Ogilvie Fm., at the southern limits of the Ogilvie Platform. Similar strata, in a comparable facies position, are extensive in the subsurface of the northern Interior Plains and thus are excellent potential hydrocarbon exploration targets.

OUTPUTS:
MORROW, D. W., 1986. Shelf-to-basin transition of the Ogilvie Formation, Hart River Y.T. *Geol. Sur. Can. Curr. Res. Paper 86-1B (in press).*

Morrow, D.W., and Cummings, G.L., in press. The Gas Bearing Manetoe Facies, Yukon and Northwest Territories. *Geol. Sur. Can. Bull.*

FGP Project Number: WA35-400 Project Officer: A.R. Cameron

TITLE: Coal - Paleozoic, Mesozoic and Tertiary, western District of Mackenzie and northern Yukon Territory.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.6	0.5	0.5
	Contract	0.0		
	Other O&M	40.0	27.6	27.6
	Capital	0.0		

OBJECTIVE:
To examine the structural framework, burial history, stratigraphy quality, composition and areal distribution of Upper Devonian

(Frasnian), Lower Carboniferous (Visean), Lower Cretaceous (Neocomian), Upper Cretaceous (Maastrichtian) and Lower Teriary (Paleocene to Oligocene) coal seams in the northern Cordillera and contiguous Interior Platform. The results will have immediate application to the National Coal Inventory and to hydrocarbon exploration.

DESCRIPTION:
Fiscal year 1985/86 will be the first of a two-year project and will include sampling of coal seams on a regional basis.The work will be carried out in Brackett Basin with helicopter support from Norman Wells, by car and helicopter from Inuvik and by helicopter from Komakuk Beach.

SCIENTIFIC RESULTS:
During the summer of 1985, three weeks were spent examining and collecting from coal seams in Devonian to Oligocene rocks of the Fort Norman, Inuvik and British Mountains areas. This and subsequent laboratory work defined an occurrence of massive bitumen near Rengleng River N.W.T. and a high quality anthracite bed (5m) south of the Barn Mountains, Y.T. Conodonts in these rocks indicate a maturation beyond the oil window.

OUTPUTS:
NORRIS, D.K., 1986. Lower Devonian Road River Formation on the north flank of the Romanzof Uplift, northern Yukon Territitory. *Geol. Sur. Can. Curr. Res. Paper 86-1A.*

NORRIS, D.K., CAMERON, A.R., 1986. An occurrence of bitumen in the interior platform near Rengleng River, District of Mackenzie. *Geol. Sur. Can. Curr. Res. Paper 86-1A.*

FGP Project Number:WA35-430 Project Officer: R.W. Macqueen

TITLE: Dempster Highway vitrinite reflectance/geochemistry cross-section - Northern Cordillera.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.2	0.2	0.2
	Contract	20.0	17.1	17.1
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To investigate the maturation profiles of Paleozoic and Mesozoic sedimentary rocks in the northern Yukon in order to better understand their tectonic setting and the mantle/lithosphere relationships in the northern Cordillera.

DESCRIPTION:
The work will be performed by University of British Columbia staff and students. Coaly and organic samples will be collected along the Dempster Highway and analyzed (including vitrinite reflectance), to determine their maturation.

SCIENTIFIC RESULTS:
Samples of all available outcrops of Paleozoic and Mesozoic rocks between Dawson and Aklavik have been collected and are in process of having their vitrinite refectance determined.

OUTPUTS:
LINK, C., 1985. An investigation of sedimentary rock maturation - profile in northern Yukon and N,W.T. *Internal report submitted to Petroleum subdivision, ISPG, GSC, Calgary.*

SUPPORT R&D TASK

TASK MANAGER: J.G. Fyles

FGP Project Number: SR11-540 Project Officer: J.G. Fyles

TITLE: R&D support to various FGP projects.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	(2.0)		-
	Contract	0.0		-
	Other O&M	(390.0)		(300.0)
	Capital	(240.0)		(200.0)

OBJECTIVE:
To facilitate the attainment of particular FGP research objectives by supplementing the funds and person-years allocated to selected FGP projects.

DESCRIPTION:
Supplementary funding will be provided to selected projects in which the anticipated results will have a bearing on, and contribution to, a wide range of projects within a component or task.

FGP Project Number: SR14-550 Project Officer: P.J. Mudie

TITLE: Ice Island sampling and investigation of sediments.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	0.0	27.4	27.4
	Other O&M	50.0	117.2	117.2
	Capital	0.0	1.0	1.0

NOTE: FGP resources are supplementary to other resources assigned to this project by AGC.

OBJECTIVE:
To determine the spatial distribution of microfossils, sediment texture, mineralogy and geotechnical properties of the sediment cover on the continental margin of Canada Basin; to define, map and interpret surficial lithofacies on this margin where conditions are probably analagous to glacial stage environments off Eastern Canada; to conduct high resolution biostratigraphic ans stable isotope studies of the High Arctic shelf sediments in areas of high sedimentation rates; to correlate paleoenvironmental data from a Canadian Basin Margin with CESAR data from the central Arctic Ocean; to construct a sediment budget for the Arctic Ocean margin.

DESCRIPTION:
The Ice Island will be used as base for sample collection, to obtain and interpret geological information on the surface and near-surface seabed materials of the Arctic Continental Shelf.

SCIENTIFIC RESULTS:
Data and sample collection by AGC, Memorial University and Acadia University staff as follows:
- construction of sampling facilities and installation of equipment,
- 41 days of 3.5 kHz seismic profiles.
- 34 Shipek samples, 24 dredge samples, 6 gravity cores,
- 24 camera stations,
- 19 plankton tows, 6 sets (29 samples) Nansen bottle water samples,
- 2 trap settings for amphipods (approx. 40 amphipods recovered in each), pollen traps for particulate collection.

OUTPUTS:
MUDIE, P.J., MOSHER,D.C., VANWAGONER,N.A., AKSU, A.E., MACKO,S.A., 1986. ISIS Field Report 1985. *BIO Internal Report.*
JACKSON, H.R., 1986. Ice Island lab shows petroleum potential. *GEOS vol. 15, no. 2, pp. 1-4.*

LOGISTIC SUPPORT TASK

TASK SUMMARY **Task Manager: G.D. Hobson**

Logistical support for projects within the Arctic Islands component continued. Experience gained last year resulted in a smooth start-up for activities conducted on and from the Ice Island. Both the seismic (reflection and refraction) and bottom sampling programs have produced high quality results. Support was extened to the Western Arctic Component by the provision of navigation facilities and other support in the Beaufort Sea.

LOGISTICS-ARCTIC ISLANDS COMPONENT **Component Manager: G.D. Hobson**

COMPONENT SUMMARY

Logistic support, navigation facilities and room and board were provided as necessary for activities on and from the Ice Island as well as projects on the Arctic Islands.

FGP Project Number: LS11-530 Project Officer: D.D. Picklyk

TITLE: Program Administration.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		1.0
	Contract	5.0	4.5	4.5
	Other O&M	0.0		-
	Capital	0.0		47.9

OBJECTIVE:
To provide effective management of the Frontier Geoscience Program.

DESCRIPTION :
To provide effective management of the Frontier Geoscience Program by maintaining relevant program records and planning documents and providing administrative support by the maintenance of management committee minutes and the production of special reports as required.

SCIENTIFIC RESULTS:
The Financial Administration and Management Information System was modified to only accept information when accompanied by a valid FGP project number.

FGP Project Number: LS13-170 Project Officer: G.D. Hobson

TITLE: Logistic Support - Arctic Islands.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	553.0	242.4	1292.2
	Other O&M	0.0		0.0
	Capital	0.0		-

NOTE: PCSP has contributed an additional $452,672.18 to this project which is not included in the above total.

OBJECTIVE:
To provide logistic support, including transportation and communications to the FGP as required to meet hostile working conditions in the Arctic Islands.

DESCRIPTION:
Services will be arranged through PCSP or directly by the Arctic Islands Task Manager. The annual budget will be established by consultation between PCSP and the Arctic Islands Task Manager. These services will include air transportation, radio communications, and mobilization costs for seismic surveys and geological sampling programs. Part of the operating expenses of a scientific base camp on the "Ice Island" will be included in the annual budgets in those years in which the camp may be stategically situated and functional.

SCIENTIFIC RESULTS:
Refraction seismic experiments were conducted off-island using the Ice Island camp as a base during April 1985. Bathymetric and gravity data were acquired over the same profiles. Aircraft (Twin Otter, 206B and 205A helicopters) were arranged through PCSP long term contracts.

Geological sampling of bottom sediments at selected locations and continuous profiling of bottom and bottom stratigraphy was supported at PCSP expense during the period June to August 1985.

A continuous reflection seismic profile beneath the track of the Ice Island was acquired in the period June to August 1985.

FGP Project Number: LS13-180 Project Officer: J. Popelar

TITLE: Logistic Support - Navigation.

		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		-
	Contract	0.0		-
	Other O&M	200.0	200.0	200.0
	Capital	0.0		200.0

OBJECTIVE:
To provide navigation services to the FGP as required from the ice island or from onshore stations in the Arctic Islands or Western Arctic.

DESCRIPTION:
Services will be arranged through PCSP. This navigation service will be used for geophysical surveys and geological sampling programs. System development for ice island navigation will be carried out with collaboration of Geodetic Survey, S&MB, and will provide position orientation and related base station services for ice island projects.

SCIENTIFIC RESULTS:
All planned activities were completed. Navigation for Ice Island and for projects off-island was provided for the period April 8 to August 27, 1985. Positions for the Ice Island were acquired and reported on a daily basis while positions for on- and off-island projects was provided as required. The 1985 track of the island is available in hard copy.

LOGISTICS - WESTERN ARCTIC COMPONENT Component Manager: G.D. Hobson

COMPONENT SUMMARY

Logistic support and navigation facilities were provided as necessary for projects within the Beaufort Sea and northern mainland areas.

FGP Project Number: LS23-150 Project Officer: G.D. Hobson

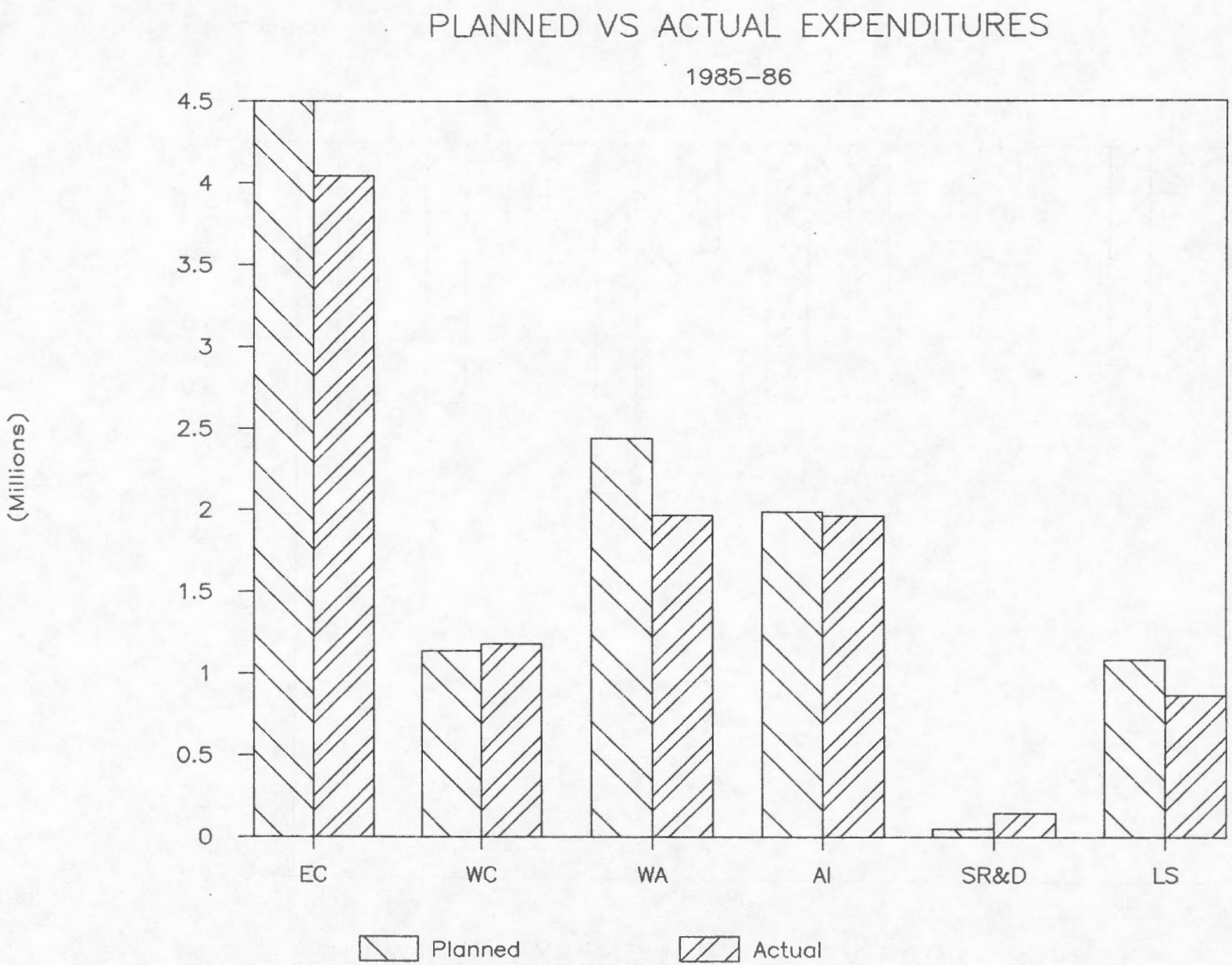
TITLE: Logistic support - Western Arctic.

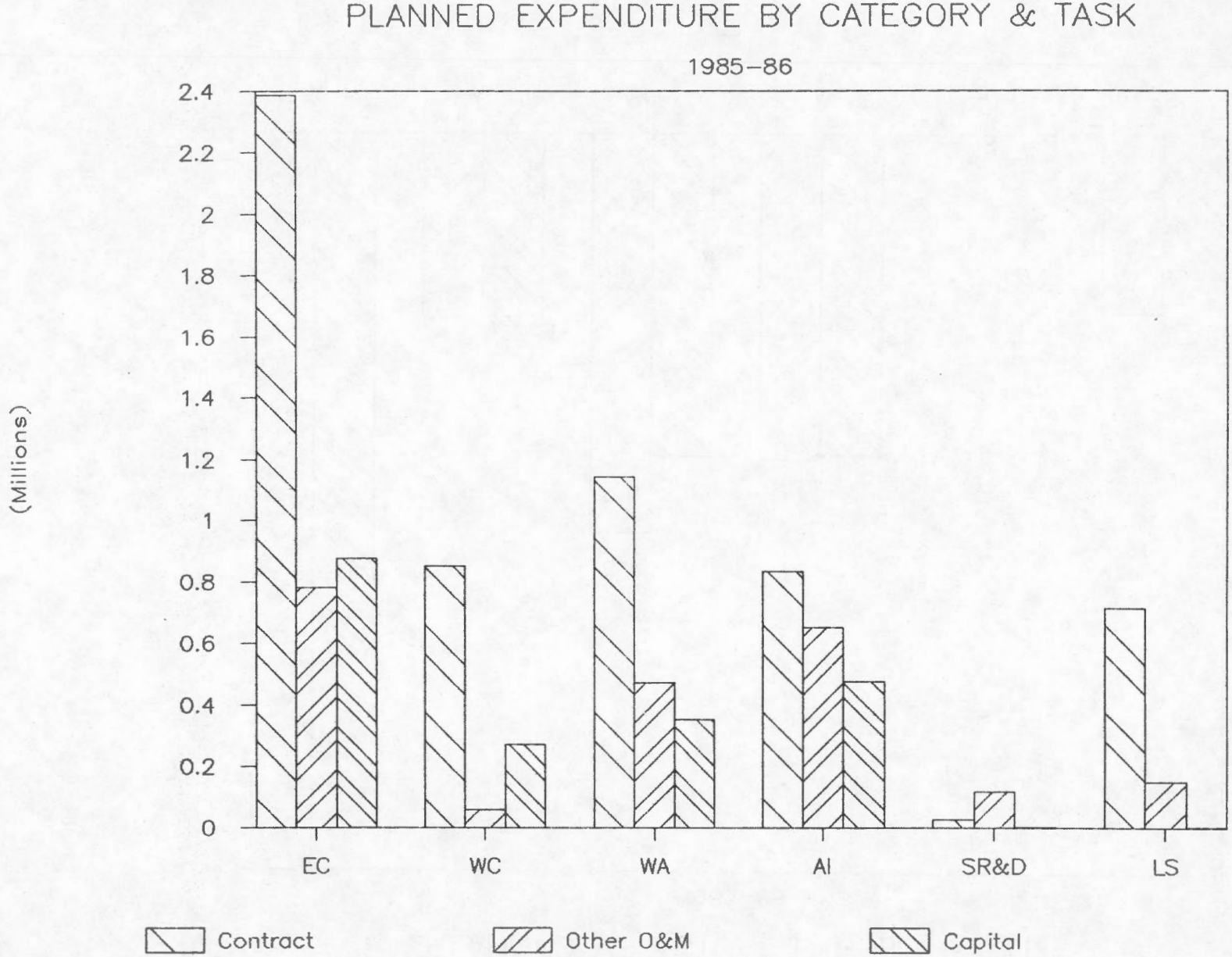
		Planned	Actual	Cummulative Total
RESOURCES:	Personnel (PY)	0.0		
	Contract	325.0	325.0	325.0
	Other O&M	0.0		
	Capital	0.0		

OBJECTIVE:
To provide logistic support including transportation and communications to the FGP as required to meet hostile working conditions in the Western Arctic. Services will be arranged through PCSP or directly by the Western Arctic Task Manager.

DESCRIPTION
The annual budget will be established by consultation between PCSP and the Western Arctic Task Manager. These services will include air transportation, radio communications and mobilization costs for the scientific projects,

SCIENTIFIC RESULTS:
A Decca Navigation chain was established to cover the Beaufort Sea and the near-shore land areas. Magnetic base station facilities were provided as were workshop, room and board for aircrew and technicians.


PLANNED VS ACTUAL EXPENDITURES
1985–86
(Millions)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
EC
WC
WA
AI
SR&D
LS
Planned
Actual


PLANNED EXPENDITURE BY CATEGORY & TASK
1985–86
(Millions)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
EC
WC
WA
AI
SR&D
LS
Contract
Other O&M
Capital