MINISTRY OF ENERGY & NATURAL RESOURCES

REPORT ON THE GEOLOGICAL SURVEYS & MINES DEPARTMENT FOR THE YEAR 1973.

12th Dec 1975

Geological Surveys & Mines Department
P.O. Box 1028
Georgetown, Guyana.

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E R R A T A

p. 1 Line 14 should read "... of over 30 bateaux are moored at Bartica during ..."

p. 4 Line 14 should read "... the spectrum without interference of the CN band".

p. 12 line 47 should read "Dr. M.A. Lee, Deputy Commissioner".

p. 22 line 39 should read "... chalcedony matrix"

p. 23 line 22 should read "and carbonaceous deposits ...

p. 23 line 40 should read "Since commercial ore ..."

p. 24 line 29 3rd column should read "Pure Al_2SiO_5

p. 28 line 5 should read "... portion of magnetic lineaments"

p. 29 line 33 should read "... 2nd Field Season 1973"

p. 32 line 27 should read "Licences - Miscellaneous

p. 32 line 29 should read "Duty on transportation".

CONTENTS

INTRODUCTION

The Geological Surveys & Mines Department has its Headquarters in Georgetown. It has one district office situated at Bartica, at the confluence of the Essequibo and Mazaruni Rivers, a focal point for access to the interior and about 50 miles from Georgetown.

The headquarters in Georgetown incorporates the units of the Geological and Mines Administrative offices, the Petrological, X-Ray, Geophysics, Spectrographic, Colorimetric, Atomic Absorption, Fire Assay, Sample Preparation and Lapidary Laboratories; a Wireless and Geophysical Workshop; a Cartographic Office, a Library and a Museum. Other facilities include a Rock Store, Mechanical Workshop and Field Equipment Stores. The District Office at Bartica continued to function as a sub-store and intransit centre for equipment and personnel between headquarters and field operations. The Department's fleet of over 30 bateaux are moored during the off season period of the year.

The functions of the Geological Surveys and Mines Department are to establish the nature and extent of the country's geology and mineral resources, as far as possible and necessary for Government purposes; to undertake or advise Government on any other projects, in the public interest, which have geological implications; to undertake the collection of revenues to Government from mining activities, to execute incumbent statutory functions to ensure compliance of mining activities with the Mining, Petroleum and other relevant laws; generally, to advise Government on matters relating to Mining.

During the year the Department fell within the responsibility of the Ministry of Energy & Natural Resources.

STAFFING DURING THE YEAR

Professional Staffing.

The level of professional staffing in both the Geological and the Mines Division continued to improve, with the addition of 2 Geologists and 2 Mining Engineers.

Mr. Brian Sucre, Government Scholar in Geology graduated from the University of Manitoba, Canada. He returned to Guyana on 7th May and was appointed geologist.

Mr. G.W. Walrond graduated from the University of Ottawa and returned on 20th June as a geologist.

Mr. J.V. Loncke, Government Conditional Scholar obtained the B. Eng. from McGill University and assumed duty on 2nd January as Inspector of Mines.

Mr. W. Swain obtained the A.C.S.M. and assumed duty on 8th December as Inspector of Mines.

At the year end there were 10 students in Geology and 5 students in Mining Engineering at Universities in Canada and England.

Training of Professional Staff.

Post-graduate training in geochemistry, economic geology, petroleum reservoir engineering and engineering geology was undertaken as follows:-

Mr. J.D.N. Punwasee left for the University of New Brunswick for 6 weeks (14th March - 1st May) for the defence of his thesis for the M.Sc. degree in Geochemistry. He returned to Guyana and was appointed geochemist with effect from 1st May, 1973.

Mr. J.C. Inasi returned to Guyana on 5th August to do research for his M.Sc. thesis based upon the Eagle Mountain Mineralisation. In April 1974 he would return to Fredericton for the defence of his thesis.

Mr. C. Pollydore who was awarded a DEMINEX scholarship to do a post-graduate course in Petroleum Reservoir Engineering at Imperial College of Science and Technology London, left Guyana early September.

Mr. M. Patterson left early September to pursue training in Engineering Geology leading to the M.Sc. (Applied) degree at McGill University.

The availability of Professional staff during the year is given in Appendix I.

HEADQUARTERS WORK

THE CHEMICAL LABORATORIES

The year 1973 was one in which all sections of the laboratory performed satisfactorily with little or no work stoppages caused by the breakdown of machines and laboratory equipment.

The laboratory was visited by a number of personnel from East Germany, England and the United States.

The East German representatives were interested in the availability of suitable raw materials for the setting up of a chinaware factory for the Government of Guyana. Samples were tested for their physical properties by the laboratory.

The American representatives came on a similar mission to determine the raw materials available for paper or china-ware manufacture.

Mr. Tony Reid from Imperial College London, was studying the possibility of setting up an ore dressing laboratory.

Mr. M.A.A. Shariff was on his vacational leave at the beginning of the year. He resumed duty on 6th May.

The Sample Preparation Section

This section during the year has performed satisfactorily except for two short periods when go-slows were called by the workers' representative. In order to improve working conditions the following steps were taken:-

1. The entire floor of the section was resurfaced and the part which housed the grinding machine was rubber-tiled.
2. An exhaust system for dust removal was on order; this piece of equipment arrived in December and preparations are being made for its erection.

The out-put of the year 1973 compared with that for 1972 was:-

	1973	1972
Soil and stream sediments	1922	5274
Core samples	1063	266
Rock samples	87	320
Concentrates	206	215
Quartz Vein and Quartz	256	Nil
Sludge)	62	Nil
Clays and Kaolin) Mixed	48 + 49	102
Lime mud) Samples	195	Nil

Spectrographic Section

A new arc stand was received during the year.

The United Nations chemist, Mr. George Peiker, was involved in a series of experiments with the aim of improving the overall quality and quantity of the work in the section; he set out by preparing three standard plates with the following elements:-

1. Be, Th, In, Nb, La, Y, W, As
2. Cd, In, Sn, Ti, Bi, Hg, Ca, Ge, Ba, B, As
3. Cu, Pb, Cr, Co, Na, Mo, Ag, Ti, Ni, Mn.

The steps used were eighteen in number ranging from 2500-1.5 ppm. The matrix material used was pure quartz sand. Two spectral plates were prepared with wave length ranges 2480-261A° and 2250-467A°. The lower wave length permits the evaluation in the lighter range of the spectrum without the interference of CN band.

Matrix effects were also studied; the results showed that feldspar (microcline) and granite were the two most suitable materials.

Production for the year 1973 together with the value of 1972 are:

	1973	1972
No. of Samples	1,248	6,487
No. of determinations	6,240	76,844

Wet Chemical Section

The Atomic Absorption instrument is now being used to determine a range of elements, elements which in the past were done by the classical method.

Wet Chemical analysis: This method is normally used for the determination of the major components in samples such as rocks, bauxite and kaolin. Today it is possible to use instruments for these analyses. The spectro-photometer -600 is used for the determination of silicate and alumina from one solution and the atomic absorption is used for Fe, Mg, Ca, K and Na from another solution. This method is a fast one and quality of the result is as good as that obtained from the classical method.

Output for 1973 together with values of 1972

	1973		1972	
	Samples	Det.	Samples	Det.
Colorimetric	887	1774	3,352	3907
Atomic Absorption	981	4905	2,843	3999
Wet Analysis	28	336	137	799

Fire Assay Section

Because of low values of gold recovery from samples which previously have shown high values, five assay portions were taken from one sample. A number of samples were assayed in this manner.

This experimentation has shown that the existing assaying method was not responsible for the low values obtained. This was revealed by the recovery of silver in quartz which was added to the sample at the time of fusion.

The floor of the section was rubber-tiled thereby creating a cleaner and healthier atmosphere in which to work. Workers were also provided with comfortable working desks.

This section, on a number of occasions carried out firing of clay bricks to determine the suitability of the coastal clay for use in the construction industry.

PETROLOGICAL LABORATORY

Staff:

Mr. W.C. Patterson left in October and was succeeded by Miss V. Davidson as Laboratory Assistant; Mr. Asheek Ally (Laboratory Attendant) was seconded to the Government Lapidary (Ruimveldt) as from October, to learn the various techniques of cutting and polishing rocks.

X-Ray:

X-Ray diffraction was frequently used to identify minerals occuring throughout the country. Among the rare occurrences were Bastnaesite (RF) CO_3, from Saroung Creek, Kurupung River, Olivine in the Bauxite deposits and Celestita -$SrSO_4$ from Eagle Mountain, Mahdia.

Kodak Medical X-Ray films which were very dark after processing, have had to be replaced with Illford Industrial 'G' type films. The darkness of the Kodak film was believed to be due to the large Fe content of our water supply. This matter is now receiving the attention of the Kodak Co., in U.S.A.

Mineral Separation and Identification.

A total of 756 stream concentrate samples were separated with bromoform and the heavy concentratesexamined under a binocular microscope. In addition to this, 455 stream sediment samples from Coral Snake Creek/Tapir Ck-Pomeroon Head Area, were examined for chromite occurrence.

Petrological Section

A Laborlux microscope which was sent to West Germany early in the year for servicing, has since been returned. Arrangements are now in progress for sending the others to be serviced as well.

Our present complement of Leitz microscopes is four. One is continually being used for heavy mineral study whilst another is outfitted with facilities for 'reflected light' examinations.

Thin and Polished Sections.

A total of 427 thin and 344 polished sections were completed for the year.

With the opening of a Government Lapidary Laboratory, assistance was given in slabbing both jasper and agate (100 pieces) so that students could have sufficient material to work on.

Specific Gravity.

With the acquisition of a Jolly Balance, the specific gravities of several samples submitted by geologists, were accurately determined.

Miscellaneous.

Assistance was given to the Guyana Bauxite Co. to identify the impurities in some bauxites. Samples of the ore, were first x-rayed and subsequently pulverised and washed. The residue was then examined and minerals identified and a quantitative assessment made. This assisted Guybau with its digestion problems at the alumina plant. Several meetings were held and their mines visited.

With the opening of a Lapidary Laboratory at Ruimveldt, the petrological section was frequently consulted with regard to suitable material for cutting and polishing. Jasper and Agate are exclusively used at the moment, and the possibility of utilising other materials is actively being looked into.

Specimens of typical rocks were presented to St. Stanislaus College and St. Ambrose School, Alberttown. Suitable descriptions were given to these specimens and important features pointed out to the teachers.

DRAWING OFFICE

Staff Changes:

Two Assistant Draughtsmen were promoted to Draughtsmen viz. Mr. J. Ramballi and Mr. M. Persaud.

Two Apprentice Draughtsmen were promoted to Assistant Draughtsmen viz. Mr. W. Overton and Miss J. George.

Two new appointments to Apprentice Draughtsmen were made viz. Miss G. Clement and Mr. F. Ali with effect from 16th and 9th November respectively.

Miss J. George, Assistant Draughtsman resigned with effect from 8th December.

Summary of Work:

Under supervision by the Chief Draughtsman, the staff were engaged in the following:-

Cartography:

Illustrations for reports: Maps and diagrams draughted included one hundred and seventy (170) illustrations for geologists' reports. Among them were thirteen (13) for the Pakaraimas Investigation (Keats); nineteen (19) for Supenaam Kyanite Investigation (Mabbula); fifteen (15) for Kaolin Investigation (Ghansam); twenty three (23) for the Laterite Project (Cameron); and five (5) for the West Kaburi Expedition (Olukoya and Pollydore).

Nine (9) maps of the proposed Cuyuni Dam Site Project were prepared at the request of the Hydropower Division.

Mining: Sixty (60) maps were drawn or coloured for mining applications and investigations. Several compilations were prepared under the direction of Dr. E.A. Gerousse to illustrate his report on "Exploration for Oil in Guyana", prepared under the auspices of the U.N.D.P. A beginning was made in the task of plotting the location of claims in the Middle and Upper Mazaruni River area for our records.

Compilations: In the geological Atlas Series, quarter degree sheet Puruni NE was completed. Five (5) other compilations were also completed to be used as base maps.

Miscellaneous: These included preparation of assorted labels, signs, and plans and display material for the Geological Survey Exhibit at the Mackenzie Sports Club Fair on November 1st to 3rd. Several atlasses consisting of geophysical maps in the U.N. and Canadian Aeromagnetic Series were compiled and bounded.

Map Reproduction:

Off-Set Printing: In view of the project to establish an off-set Printing on the Department's premises, planning of physical layout, equipment and material, and staffing had to be given considerable time and attention at sectional head level. Orders were placed for a Rotaprint R20 -3R Printing Press, a Michaelmaster electric Guillotine, as well as supplies of paper, ink, chemicals etc. Job descriptions for new posts were also prepared.

Photographic Laboratory: Photo-mechanical reproduction work for this Department, as well as requests, processed officially for other Departments and Corporations kept this unit in full operation. Nearly one hundred (100) external jobs were undertaken utilizing more than two thousand dollars ($2,000.00) worth of materials.

Archiving: In addition to cataloguing and filing geologists' maps for illustration of field reports, staff was engaged in cataloguing and filing aerial photographs donated by Geoterrex Ltd. About 4,000 Terra Surveys photographs covering

twenty eight (28) Quarter Degree Sheets were processed for the year. One hundred and thirty (130) geologists' maps and two hundred (200) photograph negatives were also filed.

PRODUCTION TABLE

Cartography:	Technical Illustrations draughted	180
	Mining maps and sketches prepared	60
	Maps compiled	6
	Miscellaneous plans prepared	25
Dyeline Printing:		
	Illustrations for Reports (copies)	2,050
	Mining maps	500
	Other requests	1,150
	Total -	3,800
	Sq. ft. of paper used - 16,400.	
Archiving:	Geologists' maps filed	130
	Aerial photographs filed	4,500
	15 minute sheets Topographic Base maps filed	50
	Aerial photograph negatives	191
Photo-mechanical Reproduction:		
	Negatives printed	900
	Paper positives printed	950
	Film positives printed	175
	Direct positives printed	150
	Offset plates	4

Value of 92 jobs printed for external agencies - $2,200.00

LIBRARY AND PUBLICATIONS

During the year 1973, the Library assisted 1,956 persons, including Guyanese and foreign geologists, students and prospectors.

Staff General:

This year has witnessed two major changes in staff. With the new, added responsibility of processing scientific reports written by the geologists, the need for the services of another typist to perform this task, was created. In keeping with this, Miss Rita Jaggernauth was transferred to the Library on February 5th, 1973.

The other changes came later in the year, when the Department bade farewell to Mrs. Joanne Bannister, the former Librarian. Mrs. Bannister departed on December 11, 1973 and Miss Myrna Bradshaw was appointed to act in her place with effect from 12th December, 1973.

Records and Statistics.

A total of 38 books were ordered during the year. Out of these, only 17 were received, thus increasing the number of books in stock to 14,087. Of these, 9 were purchased at the request of Geologists and Sectional Heads, the remaining 8 were received as gifts through liaison with foreign Universities and Libraries. The total number of weekly, monthly and quarterly periodicals remained on 58. No new periodicals were subscribed to during the year.

Table I shows the number of books and periodicals loaned during the year, and the number of books and periodicals to which geologists had access for reference purposes.

TABLE I

	Publications	Periodicals
Loaned	198	131
Reference	238	453
	436	584

Table II, Part I shows the number of publications and maps sold locally and overseas, and Part II, the amount of revenue collected.

TABLE II

Part I

	Locally	Overseas	Total
*Annual Reports for 1949 - 1971 incl.	19	4	23
Bulletins	91	23	114
Records	24	7	31
Maps (Topographic, Mineral, Geological, Aeromagnetic, Electronic and Degree Squares)	425	10	435
Mineral Resources Pamphlets	34	10	44
Conference Reports	3	11	14
Geological Summary	10	5	15
Total -	606	70	676

*Annual Report for 1972 is still 'In Press'.

TABLE II

Part II, Sales

i)	Local Sale of publications and maps	$1,105.81
ii)	Foreign sale of publications and maps	390.65
iii)	Postage collected from (ii)	189.10
	Total sale at 31.12.73	$1,685.56
	Amount of revenue not collected at 31.12.73	50.02
	Total revenue collected at 31.12.73	$1,635.54

Table III shows the number of publications, records and maps, which were distributed free to Libraries, Universities, schools and organisations in Guyana and Overseas, in the main,on an exchange basis.

TABLE III

1.	Annual Reports	24
2.	Bulletins	44
3.	Conference Proceedings	11
4.	Maps (Topographic, Mineral, Geological, Aeromagnetic, Electromagnetic)	336
5.	Geological Summary No. 1	6
6.	Records	28
7.	Mineral Resources Pamphlets	13
8.	Other Reports	96
	Total -	558

Aeromagnetic maps on scales of 1:50,000, 1:200,000, 1:1,000,000 covering some 60% of the country, were received, and 14 reports were written by geologists on the staff.

Reorganisation:

Initial arrangements have been made for the extension of the outer wing of the Library, in order to house our new Printery . It is hoped that, when complete, this new section will be capable of handling and improving the standard of output of all publications, produced by the Department.

RADIO ELECTRONICS AND GEOPHYSICS WORKSHOP:

During the year eight (8) Stoner Transceivers, five (5) SSB-100B and three (3) SSB-40MA) and eight (8) Domestic Radio Receivers were added to our communication network.

The field network now operates:- Eight (8) RCA-5A, Five (5) Stoner SSB-100B and seven (7) Stoner SSB-40MA Transceivers which are used as mobiles in various parts of the interior. Twenty one (21) Philips Radio receivers were also in use.

A Collins Transceiver, with a Telephone-Coupler and voice operated relay remained as our Base station, providing telephone links between field parties, other sections of the Geological Surveys & Mines Department, the Ministry of Energy and Natural Resources and other telephone subscribers whenever necessary.

Maintenance work was also carried out with routine checks and repairs on other electronic equipment in the Department, mainly the Chemical, Assay, Spectrographic laboratories and the Drawing Office.

At year end serviceable equipment included:-

Communication

7 RCA Transmitters
7 RCA Power Supplies
5 Stoner SSB-100B Transmitters
5 " Power Supplies
2 Mercury Pye Radiophones
7 Stoner Power 40MA Supplies
21 Philips Radio receivers.

Geophysical Equipment

4 Sharp Schmidt type Magnetometers (2 vertical, 2 horizontal)
1 Jalander Fluxgate vertical magnetometer
1 World Wide Gravimeter
1 Pye SP Meter
1 Elsec Proton Magnetometer
1 Sharp S.P. meter
1 ABEM Gun (sent for repair)
2 Turam Electromagnetic Units (under repair)
1 IMPR-7 Transmitter) I.P. Unit
1 I PC-8 Receiver)
2 Scintillometers
1 Magnetic Susceptibility Bridge.

MECHANICAL WORKSHOP

The Mechanical Workshop continued in the charge of the Foreman/Mechanic Mr. Albert Edwards, to render invaluable maintenance repairs to all the Department's vehicles and machines.

The active equipment held at year end were as follows:-

6 Land Rovers - 6 cylinder
5 " " - 4 "
1 " Rover Truck
1 Austin Lorry
2 Tractors - Dexter & Ford Major with trailer
2 Bombardiers
1 Lancer Boss Forklift
1 Austin Pick-up
1 Morris J2 Van

Outboard Engines:	37	Archimedes 10-12 h.p.
	1	" 25 h.p.
	7	Johnson 40 h.p.
	1	" 33 h.p.
	1	" 20 h.p.
	4	" 6 h.p.
	1	Evinrude 2 h.p.
	1	" 40 h.p.
	3	" 33 h.p.
	12	Seagull
Chain Saws:	4	Remingtons
	4	McCullocks
Generators:		
	11	Honda Generators E 300
	3	" " E 800
	1	" " E1500
	2	Sud-JLO-Werk-Turam Generator
	6	Windpower Generators with Gasolene Engines
	1	Craftsman Lighting Plant.
Drills:	1	Longyear Trailer-Mounted unit - "34"
	2	" Drills - "34"
	1	" Drill - "24"
	1	Warsap Rock Drill
	11	Boyles BBS 17A Diesel Drill
	4	" BBS1 Gasolene Drills
	2	with hydraulic feed
Pumps:	2	Large Longyear water pumps
	1	small " " pump
	5	Briggs & Straton 5 h.p. - 4 cycle water pumps
	2	Petter Engine & Water pumps
	2	Goodenough Water pumps
	6	Briggs & Straton 9 h.p. water pumps.

CONFERENCES AND VISITS

Dr. Sobharam Singh, Commissioner of Geological Surveys and Mines visited kaolin operations of Engelhard Minerals and Chemical Corp., in Georgia, U.S.A. from 8th-13th January 1973. He was accompanied by Mr. J. Ghansam, Geologist.

Dr. Singh also attended the Second Latin American Geological Congress held in Caracas, Venezuela from 12th-16th November, 1973 as Leader of Guyana Delegation. He was accompanied by Dr. G.A. Sampson, Petrologist/Mineralogist and Mr. W. Keats, Geologist.

He also represented the Hon. Minister of Energy & Natural Resources at the IX General Meeting of ARPEL held in Caracas from 12th-16th November, 1973.

Dr. M.A. Lee, Deputy Commissioner attended the United Nations Panel Meeting on the Applications of Remote Sensing of Earth Resources held in Buenos Aires from 2nd-8th December, 1973.

Dr. Lee also accompanied Mr. Walters as technical adviser to Quito, Ecuador at OLADE meeting from 17th-20th September 1973.

COLLABORATION PROJECTS WITH OVERSEAS GOVERNMENTS AND INSTITUTIONS-

Aeromagnetic Survey of Guyana 1971-73.

An aerogeophysical survey was carried out during 1971/72 by Terra Surveys Limited of Ottawa, Canada over the central and Northern part of Guyana covering an area of 37,000 square miles (about 75,000 line miles). This was funded under a soft loan by the Canadian International Development Agency. The resultant maps have been published on scales of 1:50,000 and 1:200,000 together with interpretation maps at a scale of 1;200,000. An additional end product of the survey is a coloured 1:1,000,000 residual magnetic anomaly map, which incorporates the aeromagnetic data from a previous U.N.D.P. Survey. On completion of the present survey some 60% of Guyana will have been covered by aeromagnetics.

LIST OF INVESTIGATIONS UNDERTAKEN DURING 1973

BASE METAL INVESTIGATIONS

1) Eagle Mountain Geochemical Survey by A.H. Fawcett, 1st Field Season.
2) Dickman's Hill Molybdenum Prospect by C. Gibson, 1st Field Season.
3) Coral Snake Creek Chromite Investigation, Pomeroon Head Area by C.A. Pollydore, 1st Field Season.
4) Lead Prospection West of Port Kaituma by G. Walrond, 2nd Field Season.

GOLD INVESTIGATIONS

5) Honey Camp Gold Prospect by J. Alexander, 1st & 2nd Field Seasons.
6) Baramita Goldfield N.W.D. by C. Gibson, 2nd Field Season.
7) Hicks Vein and Eldorado Mine by B. Stephenson, 2nd Field Season.

INDUSTRIAL MINERALS

8) Warababaru and Kamakabra Koalin Drilling by J. Ghansam, 2nd Field Season 1972, 1st Field Season 1973.
9) Rupununi Agate Project by K. Narine, 1st Field Season.
10) Graphite Prospection at Popekai, Guyana River by B. Stephenson, 1st Field Season.
11) Kyanite Prospect near the Upper Supenaam River by S.S. Mabbula 1st and 2nd Field Seasons.
12) Orealla Kaolin Drilling Expedition by B. Sucre, 2nd Field Season.

GEOPHYSICAL EXPLORATION

14) Gravity and Magnetic Investigations over the Takutu Basin by R.N. Chakraborti, 1st Field Season.
15) Geomagnetic Investigation of the "Land of Promise" Aeromagnetic Anomaly, Pomeroon by R.N. Chakraborti, 2nd Field Season.
16) Turam E.M. and Magnetic Surveys in Eldorado and Mile 13 (Issano Road) Areas, Potaro District by R.N. Chakraborti, 2nd Field Season.

ENGINEERING GEOLOGY

17) Upper Mazaruni Hydroelectric Project by A. Olukoya, 2nd Field Season.

MISCELLANEOUS AND RESEARCH

18) Manaka Expedition, Essequibo Estuary by K. Narine, 2nd Field Season.

19) The Roraima Formation Project by W. Keats 1st and 2nd Field Seasons.

20) Land of Promise Magnetic Anomaly, Pomeroon River by B. Sucre, 2nd Field Season.

21) Muruwa Expedition by W. Keats, 2nd Field Season.

SUMMARY OF FIELD WORK 1973

BASE METAL INVESTIGATIONS

Eagle Mountain Geochemical Survey by A.H. Fawcett, 1st Field Season 1973, Report AHF: 1/73.

The Eagle Mountain Molybdenum Prospect was discovered during drilling for gold in 1947. Later, the Geological Survey carried out a reconnaissance geochemical examination of the area, followed by further drilling.

During this season, more detailed geochemical soil and pit surveys were carried out over the best areas, to determine whether the soil molybdenum dispersion patterns showed significant correspondence with the results from drilling.

Correlation between geochemical results and those of earlier drill holes proved to be good, thus encouraging use of the cheaper soil sampling methods both to extrapolate from drill results and to plan any further holes needed in the future to determine grade and depths of the deposits.

At present, the inferred grade and extent of the mineralisation - some 25 - 40 million tons at 0.1% plus, to 600' depth - does not warrant the expense of further drilling. There is still the possibility of an extension of the field to north and south. where the geochemical anomaly is not completely closed, and this should be checked by a limited programme of further soil sampling in these areas.

Dickman's Hill Molybdenum Prospect,by C. Gibson, 1st Field Season 1973. Report CG: 1/73.

The Dickman's Hill Molybdenum Prospect was discovered during geochemical reconnaissance at the same time as the Eagle Mountain Prospect. As at Eagle Mountain, the area has been drilled and more recently has been covered by a close soil sampling programme (Narine 1972). On Dickman's Hill, however, the relief largely corresponds to a old lateritised surface, which appears to distort the geochemical dispersion pattern. During this season, a number of pits were dug and sampled to investigate this and several small molybdenum mineralised bodies were defined lying roughly along a NNE line, and apparently related to the granite-diorite contact. One of these had been cut by 2 previous drill holes (A and B) which showed values of.2% Mo over 120 feet, mainly as molybdenite in quartz veins. As a result, a further 3 east-directed angle-holes were drilled nearby to intersect the edge of the geochemically anomalous zone. However, no significant mineralisation was encountered and it is concluded that marked lateral dispersion of the soil molybdenum - reported from similar heavily lateritised terrains elsewhere - is responsible. Since the most optimistic assessment of the size of the bodies as indicated by the geochemical survey, is still well below present economically-interesting levels, further work is not recommended.

DD Dickman's Hill is near the south end of the Proto Mahdia, a system of buried auriferous river channels which has been followed 5 - 6 miles further north as far as the Small Konawak River. Soil samples from above this do not, of course, properly reflect any

underlying mineralisation, and the better definition of the position of these channels during this season clarified several doubtful areas of the geochemical surveys.

Some "loaming" (hillfoot pitting) and other traverses were also made in an effort to define the source of the gold in Turtle Creek and further north. It was concluded that much of it was derived from weathered basement, though the Proto-Mahdia soils, makes location of the actual source of loaming anomalies hard to determine. These results will be valuable when a full examination is made of the Proto-Mahdia auriferous deposits.

Coral Snake Creek Chromite Investigation, Pomeroon Head Area by C.A. Pollydore, 1st Field Season 1973. Report CAP: 1/73.

Following the discovery of alluvial chromite in this area by Milner in 1970, an attempt was made during this season to follow up the chromite to its source.

The area is underlain by metasediments on the east, and metabasic rocks on the west. Both are intruded by small bodies of muscovite granite.

Estimation of chromite in concentrates in the field proved more difficult than expected, and the samples were, therefore, sent to Georgetown for examination. For this reason, time was insufficient to locate the exact source rock. However, the distribution of alluvial chromite indicates derivation from the northwest end of the area underlain by metabasic rocks (amphibolites), probably from a particular type of amphibolite not distinguished during the survey. The chromite from Carol Snake Creek may derive from terrace deposits derived from the higher amphibolite country. A less favoured origin would be from hydrothermal quartz veins associated with late faulting.

Although the precise source rock was not located, the fine grain size and low concentration of the alluvial chromite suggests disseminated mineralisation of very low and certainly sub-economic grade, such as a basic lava, rather than a massive body such as a podiform chromitite or a differentiated basic intrusive.

For this reason, no further work is recommended.

Lead Prospection West of Port Kaituma by G. Walrond, 2nd Field Season 1973. Report GW: 1/73

During investigation of Aero-EM Conductor 4 in 1967, Steiger met high lead values in pegmatites and skioliths in a quarry in the Kaituma Syenite.

Although a thorough geochemical examination of rocks, soils and sediments in the area during this season showed some variation in the lead content over the principle rock types (syenite and metadiorite), mineralisation was entirely absent. Soil values reached 225 ppm. with a background of 70 ppm.

This is the Survey's first investigation of a lead anomaly, and although no further work can be recommended in the immediate area, the North West District shows clear evidence of being a geochemical lead province, and the results obtained in the Port Kaituma area will provide a useful indication of the significance of soil lead values obtained during future surveys in the District.

GOLD INVESTIGATIONS

Honey Camp Gold Prospect by J. Alexander, 1st and 2nd Field Seasons 1973. Reports JA: 1/73 and 74.

During Stephenson and Patterson's examination of the colluvial (scree/soil) gold deposits of Honey Camp in 1972, a number of gold quartz veins were discovered. Some of these had been sampled by Guimond in 1948, and from his results, combined with the evidence of the previous derived colluvial deposits, a rough assessment was made of the value of the other veins. These computations were made for the uppermost part of the veins, which generally appear to dip steeply, down to the 100 ft. level. This part is "oxidised", so that the gold is likely to be free-milling, and is readily accessible from adits into the base of the hills. The weathered rock is easily dug, but does not collapse readily.

During this season, most of the veins were sampled by means of shallow cross-cut trenches dug down to the veins at 20-30 foot intervals. Overburden rarely exceeds 3 feet. The results are very erratic, and indicate the need for closer and larger sampling. Thus the Brenda Vein was covered first by 11 sample trenches at about 30 feet intervals, giving mainly trace values with a mean of 0.02 oz/ton. Eleven further trenches between these gave a further 11 samples, also covering the whole length of the vein, but averaging 0.25 oz/ton. It is clear from this and similar evidence that the results of the wide-interval trenching and sampling carried out during this season are quite inadequate to evaluate the Honey Camp quartz veins, even at the surface level.

Bearing this in mind, the results are summarised below to a depth of 100 feet down the veins. Figures indicate ounces and (grade).

Vein	Previous estimates		Alexander 1973		
	From colluvials	Guimond	Vein	Wall Rock	Vein Width (average ins.).
Rainbow (A-C)		7050 (.13)	2600(.19)	2700 (.21)	25
Brian	1,700 (.1)	-	5400 (.19)	20,000 (3.6)	9
Brenda			230(.07)*	not sampled	13
Gossen	2,200 (.65)	-	300(.05)	1,100(.17)	17
5 others	11,300 (-)		trace or nil		
2 others	13,700 (-)	-	not sampled		
Total:	35,950 oz. gold		27,330 oz. gold		

(* gross sample assayed .12 oz/ton).

Note: 1) Estimates based on fewer samples are likely to be low, since there will be less chance of meeting the high concentrations which, though rare, provide much pf the gold when mined. Also, for this reason, high values have not been excluded.

2) Guimond's vein-width estimates are greater than Alexander's. However, the latter also sampled one foot of wall rock on each side, which proved to be of roughly the same grade as the vein.

3) Colluvial estimates assume the grade of the buried part of the vein (to 100 ft.) is the same as that of the part already eroded.

As a result of the patent inadequacy of the sampling methods employed hitherto, drilling was undertaken during the second season. This was intended to sample the wall rock and veins at frequent intervals, down to 100 feet. Unfortunately the drilling techniques were not equal to the task, and it was only possible to sink 11 holes instead of the 50 or so intended. In addition, coring of the weathered wall rock was not possible, and sampling of sludge for gold is unsatisfactory due to the density of the latter. None of the few core samples carried gold. However, the veins have been shown to be present to a depth of at least 100 feet, and the oxidised (weathered) zone to at least 150 feet. Also, the driving of adits and drifts in Rainbow Vein by Guimond had earlier shown that values persisted to at least 60 feet depth. It is concluded that drilling techniques must be considerably modified if they are to be useful for taking an adequate number of good samples at depth, or that driving of small adits must be used instead.

In conclusion, except perhaps for Guimond's work on Rainbow Vein, sampling has not so far been adequate for a proper evaluation of the potential of Honey Camp gold veins in the oxidised zone. The sampling has, however, shown that gold is certainly present in economically interesting amounts.

Further work should be undertaken as soon as possible both at the surface and at depth, to determine the grades more reliably, and the most suitable mining methods for the types of ore present. If the present promise is confirmed, this work should culminate in pilot plant testing and finally full-scale mining using a portable mill with a through-put of some 100 - 150 tons per day.

Baramita Gold, N.W.D. by C. Gibson, 2nd Field Season 1973. Report CG: 2/73.

The large airstrip at Baramita makes it one of the more accessible goldfields in Guyana, and since one of the mines there- Old World - was producing until a few years ago, an expedition was sent in to determine whether, with the increased price of gold, some of the mines could be profitably reactivated.

Geology was done over an area of about 20 square miles in the Baramita district. As indicated by Bracewell (1939) most of the old mines lie along an approximate 140° trend and the gold was associated with quartz veins which exhibited a similar strike. 140° is dominant direction in the area, as is evident in the direction of the dolerite dikes, the schistosity of the phyllites and schists, the foliation of the granite gneiss, and some prominent joints in the massive granite.

Methodical prospecting over the whole area showed, for the first time, that significant amounts of gold occur in parts of the hilly schist/quartzite country to the southwest. They had not previously been discovered due to the extremely fine-grained nature of the gold.

Most of the gold that was recovered from the old mines along the 140° zone was also rather fine-grained and of rather low purity (75%). However, one mine - Golden City - which lies east of the zone and in the granite gneiss, yielded coarse gold but again of rather low purity. Most of the auriferous veins and adjacent grading (loose gravel) has been worked out. At Old World and Golden City, however, particularly rich veins are left at depths of more than 40 feet. These could not be examined during the expedition, but information is based on reports by the Axel Johnson Co., (1948) by geologists Dixon (1948) and Fernandes (1959) and by a miner, Mr. Baird.

At Reserve on the left bank of the Barama River, where the gold was the finest, much of the grading has been worked, but the veins have hardly been touched or not yet discovered. It is understood, however, that the yield is relatively low.

Other auriferous quartz veins have been inferred both within and without the zone.

Any decision on reopening the mines must await detailed underground sampling, and probably also the completion of the road from Five Stars and Matthews Ridge.

Hicks Vein and Eldorado Mine by B. Stephenson, 2nd Field Season 1973. Reports BS: 3/73 & 4/73.

The area including Hick's Vein, Larken's Vein, Eldorado and Kaburi Mines carries numerous old gold workings and is readily accessible by road. The geological setting of the deposits suggests that in addition to their immediate interest for small mechanised operations, the continuation of the mineralisation under the White Sand could lead to a considerably larger operation. The present work was intended as the first stage of a major exploration programme to investigate this possibility and eventually to evaluate the area as a whole. The object of this first season's work was to study the mineralisation at Hick's Vein and Eldorado so as to produce a basis for extension of the deposits. An assessment of the potential was also attempted. Since the operation, a joint Cominco - Government programme has been proposed for the whole year.

At Hick's Vein, the economically interesting gold values are confined to metasediments intruded by a diorite/granodiorite body. Three types of metasediments were recognised, the richest mineralisation being in the soft green, cream to purple, closely banded type soon at the Mine. J.W. Carter (1964) showed that the gold mineralisation here is closely associated with high soil chromium. This reaches 1500 - 2250 ppm over residual material, and about 500 ppm over white sand cover where it still clearly recognisable above the background. During this season two grids were sampled at 50 ft. (locally 25 ft.) centres. At the same time, all the five exposures along the vein (H1-H5) were examined in detail. The vein is best exposed in H1 at the NW end, where it is 18" to 8 feet wide and often shows visible gold, especially associated with blebs of blue quartz. At H2, mining appears to have left less vein, but the mineralised zone is about 30 feet wide.

(It has also been suggested that the vein may have been removed partly in solution, leaving a "cruddy" zone where it was). In the other exposures the vein is smaller, or present only as float. Chromium values, hence probably the gold, show continuity for 989 feet from H1 to H4 on the main Black Water River. H4-H5 and southeast showed quartz float, but chromium values only reached 300 ppm. maximum. Ridge and spur sampling met significant (1500 - 2250 ppm), chromium values on one line only, on strike with the vein. In all, a strike length of about 3000 feet is indicated. A very speculative estimate without proper sampling of the gold values, suggests some 100,000 ounces to 150 ft. depth, from about a quarter million tons of clay and quartz. The main problems are likely to be the fine grain size, and testing the grades at depth. Hick's Vein is a very promising prospect and merits further attention at an early date.

At Eldorado Mine, methodical prospection of the open pit is made very difficult by slumping and despite digging and close sampling of trenches totalling 270 feet across the pit and the presumed direction of the mineralised zone, no significant amounts of gold were found. The past history of the mine and the recent Turam exercise (6.43) to trace the zone away from the mine suggest that it may be more localised than supposed. It is also probable that the best values have been mined out down to the vein itself (Kahanes Veins) which is now hidden below the slumped workings. Further work here must await reopening of the mine.

The base of the White Sand here is known to carry good values locally, but is very variable lithologically and structurally.

INDUSTRIAL MINERALS

Warababaru and Kamakabra Kaolin Drilling by J. Ghansam, 2nd Field Season 1972 - 1st Field Season 1973. Report JG: 1/73.

The encouraging results of the Topira Kaolin Drilling Project led to the present investigations of other deposits in the Ituni area, exposed by removal of the overlying bauxite.

In the Warababaru Mine (Blocks 18,19), 48 holes were drilled at 50-100' separations over an area of 1,087,000 square feet. The thickness averages 35', maximum 58 feet. Overburden is 0-36 feet. The reserves computed on this drilling are 1.2 million metric tons.

In the old Kamakabra Mine (land 5), 13 holes were drilled along the length of the mine, and 4 others at intervals of 50-250 feet across the width. The average thickness of the kaolin was 20 feet with overburden between 0 and 25 feet. Computed reserves on this drilling are 1 million metric tons.

The bedrock in Block 19 is fine grained dolerite, but elsewhere is a granitic rock.

Laboratory work has been carried out in Japan on the Topira deposits, and at Leeds University on the Topira, Hope and Warababaru deposits. The Japanese results show about 42% Paper Coating Grade and 23% Paper Filling Grade (dry weights) Brightness of bleached samples was 77-80%. The work at Leeds showed that the brightness of lower grade samples could be readily

raised to 85%. Some average samples from Hope Mine gave a brightness of 88% for the -4 micron fraction, representing 30% of the sample.

In view of the variability of the deposits, it is important to carry out tests on samples from more locations in the drilled deposits. Plans for such a pitting/sampling/testing programme will be made in August, when the Guyanese research student responsible for the Leeds work returns here.

No further exploration or drilling is recommended at present.

Rupununi Agate Project by K. Narine, 1st Field Season 1973. Report KN: 1/73.

Preliminary investigation of agate occurrences in the North Rupununi Savannas was carried out by prospecting along the Ireng, Takutu, Pirara, Manari, Nappi and Rego rivers. Pitting and trenching were done wherever good indications of agate were found. The Ireng, Takutu and Manari Rivers were the only ones that showed agates and consequently further work was done in these rivers.

The agates occur in the partially indurated Manari conglomerate bed which lies at the base of the North Savanna Formation and overlies the Takutu Formation. The conglomerate also consists of well rounded and unsorted quartz sand, pebbles and cobbles.

The best values were obtained in Bon Mille near Sunnyside on the Ireng River some 31 miles north of Lethem, where about 430,000 cubic feet gravel was present, at the sample indicated grade of 0.85 lbs/cubic foot. This should contain 373,000 lbs. of agate.

Lower grade deposits were found in the Manari River (both present gravels and the Older Manari Conglomerate), in the Takutu River, and in a large gravel bed at Shishwa 4 miles down the Ireng from Bon Millee. These provided too few agates per pit to permit reliable extrapolation, but the large size of the Shishwa bed, in particular, implies sizeable reserves. The measured grade varied from about 0.01 - 0.25 lbs. per cubic feet.

The agates quantified above, consist mainly of banded and "fire" varieties: the latter carries needles of quartz in a chalcodeny matrix. Quality is fair to good, but one deposit near Bon Millee, not included in the above figures is weathered to a white, vesicular material. Percussion cracks are common in all the deposits.

It is recommended that the Bon Millee deposit be worked out, using a saw at the site to check on quality before shipping. A programme of pitting to trace the Manari conglomerate under the Savannas, is suggested particularly since this could lead to the discovery of less travelled, and hence less fractured agates. A report of agate-like masses in the weathered volcanics of the Takutu Formation exposed in road cuttings across the border in Brazil is significant in this respect (Barron verb. comm.).

Graphite prospection at Popekai, Cuyuni River by B. Stephenson, 1st Field Season 1973. Report BS: 1/73.

As a result of a projected demand for graphite and carbon for a proposed local aluminum smelter, and in other proposed industrial developments throughout Carifta, the Geological Survey was asked by Government to investigate the possibility of supplying this demand from domestic sources. The amount required is not likely to be large, so that deposits must be workable with minimum capitalisation.

For most purposes, fine grained, so called "amorphous" graphite is used. This is mined on a large scale in Mexico, and the price is very low. Local production of this would not be economically feasible.

Coarser "crystalline" graphite is produced in a small "pork-knocker type" operation in Madagascar. It depends on readily accessible ore adjacent to the upper reaches of small streams, which are used both to disintegrate the ore and carry it down to the mill. To operate economically in Guyana, similarly situated deposits would be needed. A low-lying deposit especially under alluvium would involve additional digging, pumping and transportation costs.

The Geological Survey had previously indentified graphite and catbonaceous deposits at Popekai on the Cuyuni River some 52 miles north-west of Bartica. These were chosen for evaluation and the main objectives were to estimate tonnage relative to their physiographic environment, define types and quality of material available and to ascertain possible methods and costs of recovery.

Three thick and continuous major units were found within phyllites, two of relatively good grade, but unfortunately covered by alluvial material so they would be difficult to extract. The third, designated localities 4 and 7, has potential. The material is soft but of poor quality averaging about ten per cent amorphous carbon/graphite, and a considerably lower percentage of gradeable "crystalline" graphite. (compare typical Madegascar ore with 4-8% "crystalline" graphite). There are also numerous minor lenses of harder graphitic slates and carbonaceous phyllites in the area. These could be workable deposits on their own depending on the results of laboratory costs. Some quartz veins contain lenses of crystalline graphite, but these are rare and only a few inches in size.

Since commercial are only carries less than 10% of graphite, hard to distinguish from the abundant associated amorphous carbon, samples have been sent to China for testing, through the Industrial Development Corporation. No results have yet been received.

On present outlook, it seems unlikely that an economically workable deposit is present, and in view of the cost of exploration compared with the low price and small amount of graphite required, further work is not recommended.

Kyanite Prospect, near the Upper Supenaam River by S.S. Mabbula 1st and 2nd Field Seasons 1973. Report: SSM.2/73.

The Kyanite Prospect lies some 8 miles north of the Supenaam River, about 50 miles from Georgetown. It is connected with the Lower Supenaam by a tractor road through the forest.

Weathering of a band of kyanite schist has led to the formation of a body of kyanite-bearing clay at least 100 feet in depth. Nearly 3 miles of the band have been explored, between a granite at the east end and thick white sand under which it plunges at the west end. The width varies from 650 to 1650 feet.

During the first season, 17 holes were drilled on cross lines 500 feet apart, to evaluate the western end of the deposit. 13 pits were also dug here. During the second season, 6 further holes were drilled on cross lines 1500 feet apart to test the eastern section. All except two drill holes met predominant kyanite, and figures for the whole area are as follows:

Coarse (plus 20 mesh) Fraction - 1.36 million tons kyanite, .040 tons per cu. yd.

Fine Fraction (kyanite rich concentrate): 35-88% kyanite (20-36 mes tons per cubic yd.

Average value per cubic yard: £ 0.80 - 1.12/cu. yd. (values based on 1974 price of Indian Kyanite of £ 14.70/ton F.O.B. India).

The main impurity, apart from the clay gangue, is quartz, sometimes accompanied by staurolite, hematite, muscovite, magnetite and ilmenite. The kyanite crystals may reach 2 cms. in length. Partial analyses are given below -

	U.S. Stock pile	Pure Al_2SiO_2	GUYANA KYANITE ANALYSES Bracewell	St. John	Mabbula Range	(12 analyses). Aver.
SiO_2	39	37	41.1	38.2-36.7	40.9-53.8	47.4
TiO_2			.7	-	0- .8	
Al_2O_3	59	63	47	49.8-50.5	38.4-53.6	46.7
Fe_2O_3	.75		6.6		2.4-5.9	4.7
Na_2O					.23-3.73	1.7
K_2O	1					
CaO						
MgO						
L.O.I.			1.4		0-2.0	
Undet.			3.1			

Inclusions of quartz, ilmenite and magnetite in the kyanite are up to 8 microns in size; they can be removed by grinding, magnetic/gravity separation, and acid treatment.

There appears to be an economically interesting deposit here. It is recommended that bulk samples be sent for testing to potential customers, and that equipment be purchased to run ore dressing tests with a view to eventual mining.

Rupununi Lime Expedition by D.A. Dublin, 2nd Field Season 1973. Report DAD: 1/73.

During last field season a traverse was made up the Takutu River with a view to finding outcrops of lime-mud deposits. One such outcrop was observed on the Brazilian side of the border, opposite San Jose. This season's work was primarily concerned with picking up this deposit on the Guyana side, and in addition locating any other in the area. After boring about 8 holes with the engine-drill in the area, lime-mud was encountered. The deposit proved to be small with dimensions of 200' x 150' and average thickness of 6'. The tonnage is estimated to be between 9 and 10,000 tons. The maximum calcium content in the form of CaO is 18% with an average of 9% for the central part of the deposit. The maximum MgO content is 5%.

Another outcrop of lime-mud was observed just below the mouth of Inaja Creek, which is about 3 miles from San Jose. Three holes were put down just before the close of the expedition, and indications are that it is another small deposit.

It is recommended that further exploration for lime-mud in the Rupununi be suspended, since the grade is too low for cement purposes, and enough tonnage has already been proved for agricultural purposes.

Orealla Kaolin Drilling Expedition by B. Sucre, 2nd Field Season 1973. Report BS: 1/73.

Following reports of "kaolin" exposures along the bank of the Corentyne River near Orealla, 16 exploratory holes were drilled on a 600 foot grid to a depth averaging 120 feet. Light brown to light grey sedimentary (ball) clays were intersected in 12 of the holes, but there appears to be very little continuity, and the clay presumably occurs in small lenses. For this reason reserves are only calculated for an assumed distance of 50 feet round each hole, and considering only those with 28 feet or less overburden, amount to 19,000 long tons averaging 7.6' thickness. The quartz sand and heavy mineral content of the drilled clay has not yet been determined. Clays from the same general depth range are exposed in the river banks in the drill area and closely resemble those from the drill holes. Eight samples of these carry a non-clay content varying from 0.3 to 15.5%, average 6.5%. Most of the impurity is quartz, but ilmenite, rutile and occasionally zircon and muscovite and other minerals are also present.

Clearly these deposits are too small and impersistent to be economically interesting, and any further investigations should be more inland.

GEOPHYSICAL EXPLORATION

Gravity and Magnetic Investigations over the Takutu Basin by R.N. Chakraborti, 1st Field Season 1973. Report RNC: 1/73.

The aeromagnetic investigation conducted by Terra Surveys during 1972 suggested the existence of a steep graben structure filled with sediments of the Takutu Formation in the western half of the North Savanna area. A ground gravity and geomagnetic expedition was organised during the first field season of 1973

to follow up the aeromagnetic results on the ground and to correlate the ground gravity and aeromagnetic findings.

A preliminary structural interpretation of the gravity and geomagnetic data revealed a steep gravity gradient on the northern and southern boundaries of the basin suggestive of normal boundary faults. An extensive gravity 'low' zone was picked up in the neighbourhood of Moco Moco village and north of Manari suggesting a basin type structure. Another localised gravity 'high' with aeromagnetic 'low' was observed near Lethem indicative of the occurrence of an intrusive body in the basin. A gravity 'high' associated with a geomagnetic anomaly was observed in the neighbourhood of Sunny Side. Another gravity 'low' zone was picked up to the neighbourhood of Cajuerno.

It is concluded that significant structurds occur in the Takutu Graben, associated at least in part, with intrusive and probably also extrusive basic rocks.

Geomagnetic Investigation: Land of Promise Aeromagnetic Anomaly, Pomeroon, by R.N. Chakraborti, 2nd Field Season 1973. Report 29/6(a).

An aeromagnetic anomaly zone was picked up by Terra Surveys during the Airborne Magnetic Surveys of Guyana in 1972. This anomaly is situated near "Land of Promise" along the Pomeroon River, a few miles north of Charity. It is a "butterfly type" anomaly in that it consists of a central 1680 gamma 'high' with two 'low', zones on either side, which indicate that the bottom of the causative body is at no great depth.

A ground magnetic reconnaissance follow-up was organised during the second field season of 1973, so as to establish exactly the aeromagnetic anomaly zone on the ground. Geomagnetic traverses were carried out along a few dams, as the eastern part of the area near the sea is inaccessible because of deep swamps. A nearly 7,000 gamma 'peak' of the magnetic anomaly zone was pinpointed on the ground, about a mile to the east of Pomeroon River along the northern dam of Mr. Van Sluytman's house. This indication 'point' was recommended for exploratory drilling. The causative body, supposed to be an ultrabasic one, was struck at 325 ft. from the ground surface. Examination of the drill cores showed that the rock encountered was pyroxenite. The results of the drilling are more fully reported in B.Su.2/74 of this report.(p.29).

Turam E.M. and Magnetic Surveys in Eldorado and Mile 13 (Issano Road Areas, Potaro District by R.N Chakraborti, 2nd Field Season 1973. Report RNC: 2/73.

Reconnaissance Turam electromagnetic and geomagnetic investigations were conducted during the second field season of 1973 in Eldorado Mines and Mile 13 (Issano Road) areas, Potaro District.

In the above mentioned areas carbonaceous bands are associated with the volcanics and meta-sediments. Both areas are covered by a thick blanket of white sand obscuring the geological formations.

The object of the Geological Surveys was to trace the carbonaceous bands under the sand cover.

In the Eldorado mine area, a few conductive zones were traced striking NW-SE over a distance of two miles. It is also reported that at places near the conductive zones graphite schists/ carbonaceous bands are exposed and consequently the causative bodies for these conductive zones are to be attributed to graphitic schist/ carbonaceous bands. The geomagnetic results have also distinguished the basic from the acid rocks in the area, apparently along a N-S fault.

In the Mile 13 (Issano Road) area, the Turam E.M. surveys have not been able to bring out any significant and conductive zones which may indicate the existence of graphitic schists/carbonaceous bands except at a few isolated places. This area is more magnetically active than the Eldorado area as inferred from geomagnetic observations. This geomagnetic anomaly may be attributed to either intrusive basic bodies or basic geological formations.

It is concluded that the Turam Electro-magnetic and Geomagnetic investigations in both areas have brought out a few significant indicative zones which warrant exploratory drilling, pitting and trenching.

ENGINEERING GEOLOGY

Upper Mazaruni Hydroelectric Project by A. Olukoya. 2nd Field Season 1973. Reports AO: 2/73 - 5/73; 1.2/74.

The investigations works executed during the second half of 1973 was based on the programme prepared by Energo-Projekt of Belgrade. The primary investigation was to define the nature of the geological conditions which will be encountered during the construction of the dam and all appurtenant structures (spillway structure, outlet of diversion tunnel etc.). Locations of the boreholes, especially along the proposed dam site (Latipu) and the alternative dam site (Sand Landing) were designed to check the depth of the bedrock, and the existence of postulated faults.

The total length of boreholes drilled at Latipu is 876'4" on five locations and at Sand Landing 1150'6" on six locations.

Drilling on two (2) locations (550'9") was also completed along the Kurupung-Memberu Tunnel Alignment.

Permeability pressure tests and open end tests were also carried out in the boreholes.

The results obtained indicate sound rock conditions along the tunnel alighment and for the dam sites, it seems that the Sand Landing dam site is a better one with regard to foundation conditions, the thin overburden and the availability of construction materials.

MISCELLANEOUS AND RESEARCH

Manaka Expedition, Essequibo Estuary by K. Narine, 2nd Field Season 1973. Report KN: 2/73.

The recently available aeromagnetic cover of this part of Guyana suggested that the eastern portion of magnetic leneaments associated with the Groete Creek Copper show might be faulted north to the Manaka area. The present expedition was designed to check this.

The eastern part of the area is part of the Essequibo flood plain. Further west a thick White Sand cover develops. The central part carries outcrops of Barama Group metavolcanics and metasediments intruded by metabasic rocks (amphibolites) and biotite granite gneiss of the Bartica Assemblage. A steep foliation strikes ESE, locally SE and ENE. These rocks are intruded by dolerite dikes.

Stream concentrates taken at 1000 ft. intervals showed poor gold values up to 10 eyes per batel at best.

Stream bank sediments, clays and soils were sampled over the whole area, with special emphasis on an aeromagnetic anomaly in the centre. Sulphate and pH tests were carried out in all stream in the project area.

The Roraima Formation Project by W. Keats 1st and 2nd Field Season 1973. Report WK: 1/73.

The Roraima Formation in Guyana, up to and including the jasper sequence is divided into nine Stratigraphical Units, on the basis of lithology and expected changes of lithology with variations in depositional environments as follows.

Unit	I	Polymictic basal conglomerates
Unit	II	An arkosic section
Unit	III	- Domiantly quartzose sandstone
Unit	IV	Dominantly quartz conglomerates
Unit	V	-- Arkosic and quartz sandstones
Unit	VI	- Silts, shales and fine sandstones
Unit	VII	- Quartz conglomerates
Unit	VIII	- Dominantly sand grade sediments
Unit	IX	- Jasper sequence.

Sufficient data for sub-dividing the Formation in a similar way above this level is not available to the author.

The Units are correlated throughout the Pakaraima Mountain range in Guyana, wherever mapping by the author or previous workers has been carried out, and by interpretation of air photographs, and topographical and geological maps of the Pakaraimas, on a scale of 1:200,000 are presented. Where information is available, an attempt is made to correlate the Roraima Formation in Guyana with that of Brazil and Venezuela.

Depositional environments for the above Units are proposed using sedimentological evidence. The environment proposed for the Formation as a whole is one of fluvial, deltaic and possibly shallow marine molasse type sedimentation. Two Units, IV and VII are proposed as the major hosts of diamond and detrital gold.

It is recommended that further investigation be made of the Roraima Formation itself as a gold source, for example at Cheong-a-Shak's workings near Puwa Mouth.

The green jasper deposits in the upper Kako River should also be examined as a source of decorative stone.

Land of Promise Magnetic Anomaly, Pomeroon River b 2nd Field Season 1973. Report BSu: 2/74. B. Sucre,

With 60% of Guyana covered by aeromagnetics, this 8300 gamma "butterfly type" anomaly is the largest yet encountered. It lies on the 2 mile wide strip of alluvium between the sea and the Pomeroon River, near the mouth of the latter.

Early in 1973, Doctors Hood and Cameron of the Canadian Geological Surveys used a computer to fit a "thin plate" model to the airborne and ground magnetic data. They found that the closest fit to the observations would be given by a plate some 4500 feet thick and dipping at about 60° towards the NNW. Its top would be about 200 feet below ground level and its lowest part about 3100 feet deep. The calculated magnetic properties (susceptibility contrast) of such a body would imply a magnetite content of at least 10% magnetite.

To test this conclusion, a vertical drill hole was sunk 400 feet deep to intersect the computed sub-outcrop of the hypothetical causative body. In fact, it passed through 325 feet of alluvium, followed by meta-pyroxenite locally intruded by biotite muscovite granite. The metapyroxenite carries original augite and orthopyroxene, partly replaced by actinolitic amphibole, and is cut by minor magnetite, biotite, serpentine and pyrite veins; its overall magnetite content does not exceed 2%, but may rise to 5% where the amphibolitic alteration is extensive. At 331' there is a 1/2-1" intersection of magnetite. The granite carries no magnetite but is also cut by minor pyrite and serpentine veins.

Clearly the causative body has not been intersected, and further drilling is indicated.

Muruwa Expedition by W. Keats, end Field Season 1973.

The Muruwa Expedition took place over a period of approximately 7 weeks during the month of September and October. The purpose of the expedition was to study the molasse type Muruwa Formation and to compare it with the younger, more wide-spread Roraima Formation which the author had studied previously. Also it was hoped to clear up certain points of debate regarding outcrops on Takwari Mountain.

A stratigraphic sequence of the Muruwa Formation was built up from the outcrop section in the Essequibo River, but due to high water, this sequence is rather incomplete. It is similar in a broad sense, to parts of the Roraima Formation, though generally much more immature as reflected by a high proportion of arkoses. It changes more rapidly laterally and was presumably deposited in a smaller or more restricted basin. Its environment of deposition was very variable, from proximal deltaic to marine or mud-flats.

A few scintillometer traverses were run in the Muruwa area where high values had been previously noted. The exact location of the anomalous area was not found, but samples from areas giving up to 3 times background were collected and brought to Georgetown. Now that the Self-help road provides ready access, Cominco's radio-active anomaly in the Muruwa area should be further investigated.

Stream concentrates were also collected for Heavy Mineral analysis. Some of these showed fair gold values in the Pott Falls area, where the Muruwa Formation is transitional to the Iwokrama Formation, and in creeks draining immature Muruwa Formation conglomerates on Takawari Mountain.

During the return journey, east lines were cut across the north and south ends of the prominent hills across the Essequibo from Konawaruk Mouth. Those on the north met alluvial gold values in several unworked streams, and should be drawn to the attention of the small-mining community. On the south, old gold workings were met in the White Sand plain; sillimanite has previously been found in these workings, though not in economic quantities.

Any further work on the Muruwa Formation should attempt to trace this and the Iwokrama Formation towards Mahdia with the object of eventually determining their relations with the Patience Creek and Haimaraka Formations.

MINES DIVISION

GENERAL CONCLUSIONS AND COMMENTS

The Mines Division has been strengthened in its field activities by the appointments of three Mines Officers with effect from 1st January 1973. The officers were put in charge of the Mazaruni, Potaro and Rupununi District. However, the officer who operated in the Rupununi District returned to his substantive post of Field Assistant in April 1973. All disputes in the districts were dealt with expeditiously by these officers.

Mr. H. Bacchus, Magistrate, was appointed Hearing Officer to hear and determine mining challenges and disputes. All such cases that had been pending for a long time are now in the process of being heard.

Mineral Production and Development.

Bauxite.

Raw bauxite production for 1973 from all mines in the country is given in Table I below and compared with the last four years.

Table I. Raw Bauxite Production (Long Tons) 1969-1973.

	1969	1970	1971	1972	1973
Guyana Bauxite Co. Ltd.	3,116,413	3,314,002	3,012,133	2,815,738	2,752,398
Reynolds Guyana Mines Ltd.	1,121,033	1,033,449	1,154,676	852,647	812,022
Total	4,237,446	4,347,451	4,166,809	3,668,385	3,564,420

The Total production of export product streams from all operations is given in Table 2 below.

Table 2. Production of Export Product Streams

	1973		1972	
	Guybau Long Tons	Reynolds Long Tons	Guybau Long Tons	Reynolds Long Tons
Dried Metal Grade Bauxite)	960,425	472,392	859,744	547,620
Chemical Grade	-	213,089	-	199,345
Calcined bauxite (main refractory)	595,702	67,333	653,010	51,400
Alumina	233,849		259,458	-

Gold:

The production of gold increased by 3523 ozs. (87%) over the production of the previous year. This increase was mostly accounted for in the Mazaruni District and was due to the Assistance to Miners Scheme and the attractiveness of the high price of gold.

Exploration and Prospecting:

1,668 Claims Licences and 547 River Location Licences were in existence during 1973 as compared with 1,439 Claims Licences and 508 River Location Licences for 1972.

Prospecting Licences

246 Prospecting Licences were issued during 1973 in Georgetown.

Trading Licences

65 Licences to trade in precious stones and/or gold and 60 Goldsmiths' Licences were issued in 1973.

Table 3. Gold Production (Troy Ounces) 1969-1973.

Districts	1969	1970	1971	1972	1973
Berbice	-	-	-	-	9
Potaro	86	241	228	1,370	1,871
Mazaruni	1,258	2,822	538	1,846	
Cuyuni	317	1,264	488	598	903
North West	399	71	83	129	162
Rupununi	42	35	70	84	110
	2,102	4,433	1,407	4,027	7,550

Table 4. Diamond Production (Metric Carats) 1969-1973.

Districts	1969	1970	1971	1972	1973
Berbice	.19	77.16	7.70	171.50	295.97
Potaro	9,923.51	19,037.73	7,230.24	5,330.08	12,649.79
Mazaruni	31,026.06	27,824.80	29,333.94	25,657.81	22,714.67
Cuyuni	3,504.52	11,317.53	9,093.92	14,450.98	11,848.86
North West	-	23.99	-	-	-
Rupununi	4,811.20	2,790.31	2,253.28	3,055.04	4,992.82
	49,266.38	61,080.54	47,919.08	48,665.41	52,502.11

Revenue collected for 1973:

Inland Revenue:		
Licences - Trading		$ 21,413.00
" Miscellanesou		59.00
Other Tax Revenue:		
Duty on transporta		283.00
Sale of Publications		118.00
Rents, Royalties, etc.		
Fees		2,074.49
Licences - Prospecting		3,092.64
Claims (Gold)		1,650.48
" (Precious Stones)		16,548.92
" (Others)		
Oil Exploration		61,191.07
Mining Leases		
		$ 108,430.60

	B/Fwd	106,430.60
Mining Privileges		407.94
Exclusive permissions		6,538.32
Concessions - Mining)		
Registration - Mining Labourers)		122.43
Royalties		641,040.93
Sundry contribution & receipt:		
Sundries		2.21
	Total -	$ 754,542.43

Revenue collected from the various Districts.

Districts	
Mazaruni-Cuyuni	$ 6,598.73
Mahdia-Potaro	5,150.50
Kamarang	494.08
Enachu	1,424.04
Christianburg	20.48
Orinduik	390.08
Rupununi	1,947.44
	$ 16,025.35

APPENDIX I. STAFF AVAILABILITY

Geological Surveys & Mines Department

SENIOR PROFESSIONAL

Geological Division

Establishment	Name	Availability
1 Commissioner	S. Singh*, B.Sc. (Hons.), Ph.D., F.R.G.S., C.Eng., F.I.M.M., S.E.G.	1st Jan.-31st Dec.
1 Deputy Commissioner	M.A. Lee*, B.Sc., (Hons.), Ph.D., A.R.S.M., D.I.C., M.I.M.M.	1st Jan.-31st Dec.
1 Geochemist	J.D.N. Punwasee*, B.Sc. (Hons.), M.Sc., F.G.S.	1st Jan.-31st March 1st May-elst Dec. Appointed Geochemist w.e.f. 1st May.
2 Geophysicists	R.N. Chakrabortit M.Sc., F.R.G.S.	1st Jan.-31st Dec.
	Vacant	
1 Petrologist/ Mineralogist	G.A. Sampson*, B.Sc. (Hons.), Ph.D., F.G.S.	1st Jan.-31st Dec.
4 Senior Geologists	C.N. Barron#, B.A. (Hons.), F.G.S.	1st Jan.-31st Dec.
	J.C. Inasi*, B.Sc. (Hons.).	7th August.-31st Dec. M.Sc. at U.N.B. Appointed Snr. Geologist w.e.f. 3.8.73.
	J. Ghansam*, Dip. Geol. Freiberg.	1st Jan.-8th August. Vacation leave Appointed Snr. Geologist w.e.f. 26.2.73.
	Vacant	
14 Geologists	S.S. Mabbula*, B.Sc., M. Tech.	1st Jan.-31st Dec.
	B. Stephenson+, B.Sc. (Hons.)	1st Jan.-31st Dec. British.
	W. Keats, B.A.+ (Hons.)	1st Jan.-31st Dec. British.
	A.W. Fawcett+, B.Sc. (Hons.).	1st Jan.- 1st Contract expired.
	C.A. Pollydore*, B.Sc. (Hons.).	1st Jan.-31st Dec.
	A. Olukoya+, B.Sc. (Hons.).	1st Jan.-31st Dec.
	C. Rodrigues*, B.Sc.	1st Jan.- Sept.
	J.W. Alexander*, B.Sc. (Hons.).	1st Jan.-31st Dec.
	B. Sucre*, B.Sc. (Hons.)	7th May-31st Dec. New Appointment
	G.W. Walrond*, B.Sc. (Hons.)	20th June-31st Dec. New Appointment.

APPENDIX I (Contd.)

		C. Gibson*, B.Sc. (Hons.)	1st Jan.-31st Dec.
		D. Dublin*, B.Sc.	1st Jan.-31st Dec.
		M.A. Patterson*, B.Sc.	1st Jan.- Sept. M.Sc. at McGill University Appointed Geologist w.e.f. 6.10.73.
		K. Narine*, B.Sc.	1st Jan.-31st Dec. Appointed geologist w.e.f. 26.8.73.
1	Chemist	M.A. Baksh*	1st Jan.-31st Dec.
	<u>Mines Division</u>		
1	Chief Inspector of Mines.	E.G. Hopkinson*, A.C.S.M. M.Sc.	1st Jan.-31st Dec.
3	Inspector of Mines.	T.A. Saunders*, B.Sc. (Hons.).	1st Jan.-31st Dec.
		J.V. Loncke*, B. Eng. (Mining).	2nd Jan.-31st Dec.
		W. Swain*, A.C.S.M.	8th Dec.-31st Dec.
3	Mines Officers	E. Henry*	1st Jan.-31st Dec.
		V.A. Agrippa*	1st Jan.-31st Dec.
		Vacant	

*Guyanese

+Expatriates recruited on contract.

#Expatriate on Fixed Establishment.

APPENDIX II. SUMMARY OF EXPENDITURE 1973.

Head 32 - Ministry of Energy & Natural Resources.

Sub-Head:		Expenditure
2.	Transport & Travelling	$26,554.01
3.	Miscellaneous	1,726.38
6.	Library & Publications	4,543.46
8.	Uniforms	3,485.70
10.	Maintenance and Operation of Land & Water Transport.	3,108.66
11.	Drawing Instruments, Material and Equipment.	13,192.60
20.	Sanitary and Fuel	1,883.65
21.	Study Courses	922.94
22.	Labour and Headquarters	981.30
23.	Materials for Survey	2,570.49
24.	Repairs and Maintenance of Scientific Equipment.	3,446.15
25.	Printing Maps and Reports	14,809.37
26.	Special Scientific Research	661.52
27.	Geophysical Surveys	14,291.96
28.	Maintenance and Operation of Mining Stations	31,638.70
		$123,816.97

Capital Expenditure.

Head XVI. Ministry of Energy & Natural Resources.

Sub-Head:

5.	Purchase of Equipment	$ 16,429.50
8.	Geophysical Surveys	1,373,660.11
9.	Canada/Guyana Geophysical Survey	19,012.49
	Total Capital:	$ 1,409,102.09