



BRITISH GUIANA

**REPORT ON THE GEOLOGICAL
SURVEY DEPARTMENT FOR
THE YEAR 1962**

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BRITISH GUYANA

Report on the Geological Survey Department
for the year 1962

E R R A T A

- p.11 para 1, line 6
 for U.S. \$652,000, read \$652,500
- p.11 para 3, line 11
 for Fig. 3, read Fig. 2
- p.24 line 4 from bottom
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ILLUSTRATIONS:

- Opposite p.32 Above first plate, insert Plate I (a)
- " second plate, insert Plate II (b)
- 2 pages after p.32 " first plate, insert Plate II (a)
 for Kumerau, read Kumarau
- Above second plate, insert Plate II (b)

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GEOLOGICAL SURVEY DEPARTMENT

ANNUAL REPORT 1962

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GEOLOGICAL SURVEY DEPARTMENT

ANNUAL REPORT 1962

1. INTRODUCTION

The main work of the Geological Survey Department is the investigation of the geology and mineral resources of British Guiana so far as is necessary to forward the progress of the country. These purposes are being pursued along the proven pattern of a systematic mapping programme coupled with detailed or special surveys that may be required for mineralized areas or special problems. Geologic mapping remains the basis for modern methods of prospecting for minerals but in British Guiana is being accorded increasing support by geophysical and geochemical techniques, followed as necessary by diamond drilling.

The Department makes the accumulated data available to the public by the issue of maps and reports. In addition advice is provided to other departments of Government and the public on geological matters. A comprehensive library is maintained and is open to the public. Quite apart from their technical content publications of the Department are frequently found to be substantially the only source of information for certain areas of the interior.

The Department falls within the responsibilities of the Minister of Trade and Industry. Headquarters which contain laboratories, workshops, stores, library and drawing office in addition to the administrative office, are located in Georgetown. A district office is maintained at Bartica.

The Geological Survey is financed partly from Colonial Development and Welfare Funds and partly from local revenue. Expenditure in 1962 amounted to W.I. \$516,998 of which W.I. \$248,389 were derived from local resources. The civil disturbances that occurred in Georgetown in February necessitated some curtailment of expenditure.

II. REVIEW OF THE YEAR

(a) General

It has been abundantly demonstrated that the most effective exploration for minerals is undertaken on the basis of an adequate understanding of regional geology. Several years of intensive regional reconnaissance mapping on a substantial background of earlier work have yielded results which now enable a modification of the field operations of the Department. Although much remains to be accomplished in the completion of the geological map of British Guiana, particularly in the south of the country, emphasis may now be placed more directly in mineral investigations. This change is illustrated in the following table:

Field Expeditions 1960 — 1962

	1960	1961	1962
Reconnaissance Surveys	85%	67%	28%
Special Problem Mapping	5%	20%	39%
Geochemical & Geophysical Surveys	10%	13%	28%
Diamond Drilling	—	—	5%

The conditions that prevail in British Guiana are particularly adverse for prospecting for many types of mineral deposit. The dense rain forest and thick mantle of weathered rocks add further difficulties to the deciphering of the already complicated geology, and either completely conceal or reduce to apparent insignificance evidence for mineralization which might elsewhere and under more favourable circumstances be quite manifest. Demonstration that scientific method and appropriate techniques can overcome these obstacles has been strikingly afforded by the work of the Department in recent months in the vicinity of Haimaralli Falls, Central Cuyuni, as described in greater detail elsewhere in this report. As the result of conclusions drawn from regional mapping, additional surveys were undertaken in this area during the latter part of 1961 and minor indications of copper mineralization were discovered. Geochemical and geophysical investigations were initiated in the first field season of 1962 and the results led later in the year to exploratory drilling which still continues. This is the first occasion on which the Department has engaged in diamond drilling but with the recent acquisition of new equipment from the United Nations under a Special Fund project this will undoubtedly form an important part of the Survey's activities henceforth.

At the beginning of the year the Council of the United Nations approved a project for mineral exploration in selected areas in British Guiana. Jointly financed by British Guiana and the U.N. Special Fund, the scheme which will entail a total expenditure of about U.S. \$1.2 million over three years, includes provision for air and ground-borne geophysical work, together with geological and drillhole investigations. The Aero Service Corporation of Philadelphia was awarded the contract for the airborne surveys and the survey aircraft arrived in the country in October.

The U.N. programme has every prospect of being of the utmost consequence to the future economy of the country in the stimulus that it will certainly impart to the search for new mineral deposits. In combination with the existing knowledge of regional geology which will enable more confident interpretation of the data, the airborne surveys will greatly assist the work of the Geological Survey Department in defining target areas for geological, geophysical, and geochemical field parties.

During the past year about 1370 square miles were mapped or otherwise geologically investigated by 11 separate expeditions as compared with the 4,000 square miles mapped by 14 expeditions in 1961. Incidence of leave and absence of geologists on study courses account for the lower level of field operations, whilst the reduction in area covered on the average by each party reflects the greater detail in which current work must be undertaken. Although the number of expeditions will again resume their normal level next year the large areas covered on a reconnaissance basis in the recent past are unlikely to be repeated at least until further air photography becomes available.

The map publication programme commenced in 1961 concluded its first phase in 1962, a total of 30 quarter degree sheets on a scale of 1:200,000 having been issued (see map Fig 1). With the exception of 4 maps now nearing completion and the mapping of coastal regions for which publication of data in this form may not be warranted, map sheets of all areas for which adequate data are available have now been published. Future issues of this series will now appear at longer intervals than hitherto. A topographic map of the country on a scale of 1:1,000,000 and incorporating all appropriate data accumulated by the Geological Survey and Lands & Mines Departments was also published during the year and has been in considerable demand. This map also forms the base of a new coloured geological map of the country on the same scale submitted to the printers towards the end of 1962.

A welcome visit was received in March from Dr. S. H. Shaw, Director of the Overseas Geological Surveys, London. Various matters concerning the progress and future of the Department were discussed including the services that the Directorate might continue to provide to the country after the attainment of independence.

(b) *Staff*

The Department suffered two particularly severe losses from the geological staff during the year by the retirements of Dr. R. B. McConnell, Director, and Mr. C. G. Dixon, Deputy Director. Dr. McConnell had held the Directorship since 1957 and during his tenure of office the Geological Survey made considerable strides. Instituting a vigorous programme of regional mapping which rendered possible the Quarter Degree Sheet publication programme, such advance was made that the production of a new coloured geological map of British Guiana became practicable. This was drafted by Dr. McConnell before his departure and at the time of preparation of this report (February 1963) has just been issued. Under his guidance numerous improvements were initiated in the headquarters organization and in the field procedures of the Department.

Mr. C. G. Dixon joined the Department in 1946 and from 1950 to 1956 was seconded to British Honduras. On his return he was appointed Deputy Director; he introduced many geologists to the rather specialized type of field work necessary in British Guiana and contributed considerably to the smooth running of the Survey.

Dr. P. H. A. Martin-Kaye and Mr. P. B. H. Bailey, members of the Department since 1950 and 1952 were respectively appointed to succeed Dr. McConnell and Mr. Dixon.

The professional staffing strength was maintained during the year. Of the establishment for 12 geologists and 8 senior professional posts, at the year end there were vacancies for two geologists and for a Deputy Director (Field), the latter post in any event being due to lapse. Mr. F. J. L. Guardia, a newly appointed geologist arrived in the country on 30th October. Mr. G. A. Sampson, Conditional Scholar, continued his B.Sc. studies in geology at Edinburgh University.

A difficult problem that has arisen is the disparity between the salaries of permanent and contract officers. The untenable situation has now been reached wherein permanent officers of several years service are receiving the same or less salary than geologists appointed under contract direct from Universities. The Government has the matter under consideration.

After 31 years service Mr. D. O. Pollard, Scientific Assistant, was unfortunately compelled to request retirement on account of ill health.

Staff availability during 1962 is detailed in Appendix C.

(c) *Higher Degrees*

It is a pleasure to record that three members of the Department acquired Higher Degrees in 1962 whilst a fourth proceeded on vacation and study leave preparatory to submitting a thesis for a Ph.D.

Dr. R. T. Cannon was awarded the Ph.D. degree of London University on the basis of a thesis "The Geology of the Bartica Assemblage" which in modified form will be published in due course as a Bulletin of the Geological Survey of British Guiana. Mr. L. L. Fernandes returned to the country in June after two years study at McGill University where he obtained an M.Sc. degree. An M.Sc. degree of London University was awarded to Mr. J. W. Carter after one year's absence studying at the Imperial College of Science and Technology. All these degrees were awarded on the basis of work carried out in British Guiana.

Mr. S. Singh left British Guiana in November and took up residence at Swansea University having been awarded a post-graduate fellowship for £450 plus fees which will enable him to present a thesis on the geology of the Southern Savannas for his Ph.D. degree in 1963.

Mr. Fernandes, Mr. Carter and Mr. Singh are all Guianese geologists and their success augurs well for the future of the Geological Survey Department in British Guiana.

III. FIELD WORK

(a) *General*

In previous years, in addition to a summary of field work in the body of the Annual Report, abstracts of expedition reports were included as an appendix. This arrangement has been abandoned in order to meet modifications in Government concepts of Departmental annual reports. Compensating advantage arises in that geologists will have more space available to present their results in the "Records" of the Geological Survey where these reports will now be placed. A list of reports prepared during the year is given in Appendix A.

During 1962, as previously mentioned, 11 expeditions investigated areas totalling about 1370 square miles. Regional mapping was undertaken in the Upper Barama, in the Twasinki-Mahdia vicinity and over part of the South Savannas, the latter work entailing two expeditions. Geochemical and geophysical surveys accompanied more detailed geological observation at Deriri in the Upper Demerara and the Haimaralli-Aurora-Akaiwong area of the Central Cuyuni where three Survey expeditions and drilling party were engaged. In addition special investigations were carried out on part of the contact area of the Morabisi Granite with particular reference to the occurrence of columbite; on the distribution of alluvial merumite in the Merume Valley in an endeavour to further track down its source; and on the structure of the Tumatumari basic intrusion. A six week investigation following up a report of the occurrence of gold was also undertaken in the island of Dominica, West Indies.

The allocation of geologists in field operations was as follows (See location in Map Fig. 2):

First Field Season

A	— South Savannas-Kanukus Expedition	— S. Singh
B	— Twasinki-Mahdia	— M. W. Carter.
C	— Mazaruni Traverse	— P. Martin-Kaye, Director. M. G. Allderidge, and P. M. Allen
D	— Haimaralli, Cuyuni	— C. N. Barron M. A. Lee G. Harden (Geochemist) L. Ramsahoye (Geophysicist).
E	— Morabisi and Rumong-rumong	— M. G. Allderidge and P. M. Allen
F	— Tumatumari-Eagle Mountain	D. D. Hawkes
G	— Investigations in Dominica, W.I.	— F. B. H. Bailey.

Second Field Season

H	— Upper Barama area	— P. M. Allen
I	— South Savannas-Kanukus Expedition	— S. Singh
J	— Merume	— M. G. Alderidge
K	— Aurora-Devils Hole, Cuyuni	— J. W. Carter
L	— Deriri, Demerara	— M. A. Lee
M	— Akaiwong, Cuyuni	— L. L. Fernandes
N	— Haimaralli, Cuyuni	— C. N. Barron F. J. L. Guardia

*(b) Regional Mapping**Upper Barama*

A part from a river traverse to the Baramita mouth undertaken in 1938 the area in the Upper Barama-Akarabisi watershed visited by a geological field party during the second field season has not been previously examined by the Geological Survey. The area possesses known gold mineralization and, as was further demonstrated by the expedition itself, prospects of other economic mineral potential. Working southwards towards the Venezuelan border from the Baramita it was established that some two-thirds of the 250 square miles investigated are underlain by gneisses foliated with variable intensity mainly in a NW-SE direction. Amphibolites form an integral part of the gneisses which are strongly banded in two narrow sinuous zones. The regional relationships of these rocks, now termed the Barama Gneiss Complex, are uncertain but they display a close similarity to the gneisses of the Bartica Assemblage and the Devil's Hole Gneiss Complex. Surrounding the gneisses are metasediments and occasional interbedded acid to intermediate lavas of the Barama-Mazaruni Assemblage. Towards the Akarabisi, Cuyuni Formation quartzites appear although it is known that further down the Akarabisi Barama Group metasediments prevail until near the mouth of the river. Cutting the gneisses is a plutonic complex predominantly of quartz diorite but with a wide variety of allied rock types. In addition there are several small bodies of biotite-muscovite granite in the area together with large dikes of the younger Basic Intrusive Suite.

Geochemical sampling demonstrated anomalous concentrations of lead and copper in certain localities, the lead indications appearing to be of the greatest interest and are to be further investigated. Quartz-haematite rocks of "iron formation" aspect were also encountered. This appears to be a similar occurrence to the ironstone bands recorded to the west by North West Guiana Mining Company.

South Savannas

Regional mapping already in progress was continued in both field seasons over sections of the South Savannas Granite and the Kanuku

Group. The work terminated with the linking of the current surveys with those of some years ago in immediately adjacent territory. Good evidence was obtained for the intrusive relationships of the granite to the biotite gneisses of the Kanuku Group. Also of particular interest is the observation that enclaves in the granite fall into northern and southern groups of biotite gneiss and biotite schist respectively, a distribution which correlates with the occurrence of these same rock types in the Kwitaro River sequence to the east.

Twasi-Mahdia

A survey party undertook reconnaissance mapping in the Mowasi-Twasinki Mountain area. The geology consists of rocks of the Mazaruni Group, here predominantly intermediate and basic volcanics, intruded by younger granites and overlain by sandstones regarded as belonging to the Roraima Formation. The sandstones are capped by gabbros of the younger Basic Intrusive Suite.

Mazaruni River

The Director and two geologists traversed up the Mazaruni River from Bartica to Apaïqua during the course of the first field season. A particularly low stage of the river afforded opportunity to examine outcrops only infrequently exposed. The traverse crosses major rock groups of British Guiana geology: the Bartica Assemblage and the Mazaruni Group which includes the Central Cuyuni and the Haimaraka Formations. Particular attention was devoted to the contact region between the Bartica Assemblage and the Mazaruni Group, the relationships of which present an outstanding problem.

(c) Detailed Mapping and Special Projects

Morabisi Granite

Field parties investigated the Morabisi Granite contact regions in the Rumong-rumong River and Robello Creek. Intended continuation in the Kunuballi was prevented by the onset of the wet season, the rising streams covering most of the significant outcrops. The work was in large part aimed at establishing more data on the occurrence of columbite which has been worked from alluvial deposits of the Robello Creek in the past. Although known to occur in pegmatites there is a possibility in the Morabisi area that some may be derived from the granite itself. In the Rumong-rumong the contact was found to be complicated by a series of large basic sills but smaller bodies of granite with definite intrusive relationships were encountered in the surrounding gneisses and amphibolites. Numerous pegmatites examined in the Robello Creek proved to be of a simple variety and could not be demonstrated as the source of columbite. Although beryl, spodumene and other minerals have been recognized in this area workable deposits are not known.

Merume

Further investigations were carried out into the occurrence of the chromium mineral merumite in the Merume River area during the second

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field season. Merumite is at present known only from alluvial sources. About 150 square miles were surveyed and a pitting programme undertaken. The area in which the mineral occurs was further delimited and it has become apparent that it is not, at any event at the present time, being derived from the sills in the sandstones of the nearby escarpments of the Roraima Formation. It appears that the host rock for the merumite occurs in the Haimaraka Formation which in this region consists of well bedded, strongly coloured, fine-grained sediments with some cherty horizons. A field party is being organized to carry out a further pitting and trenching programme in selected areas.

Tumatumari-Eagle Mountain

Detailed examination of the Tumatumari Basic intrusion established a lateral and vertical transition from dike to inclined sheet and finally a sill. It is thought that the observed transition is the result of erosion at various localities to different structural levels and that the phenomenon may be repeatedly represented in its various stages in a large number of the younger basic intrusions of the country. Petrological examination has correlated the occurrence of bronzite cumulates and other special rock types with these structures. Several important faults were also demonstrated and are regarded as of possibly considerable importance in connection with the known mineralization of Eagle Mountain.

Haimaralli-Aurora

Following up minor indications of copper mineralization encountered in 1961 near the Haimaralli Falls of the Cuyuni River, a drainage sediment geochemical sampling programme was conducted during the first season in 1962 over 40 square miles of adjacent country. Five anomalous areas were established, two being deemed of particular interest. Detailed soil sampling and self potential surveys were initiated over the most promising areas with results that encouraged the drilling programme mentioned below. Details of the surveys are recorded in Mineral Resources Pamphlet No. 11 issued in August.

Further operations were instituted in the second field season in order to extend geochemical work from the immediate Haimaralli vicinity and establish in more detail the relationship of the anomalies to the geology. It was shown that at the eastern boundary the Devil's Hole gneisses have a fault contact with the Central Cuyuni Formation; at various points along this boundary a granite apparently associated with the Haimaralli mineralization, has been emplaced. Geochemically anomalous copper values occur in the soils where the two groups are in direct faulted contact and the immediate fault zone is of interest as a possible seat of mineralization. Post granite faulting is also in evidence. The Central Cuyuni Formation in this area is comprised of a series of well bedded metasediments with intercalated volcanics and concordant basic igneous bodies.

In addition to the work above further geochemical surveys were carried out over some 70 square miles of the Aurora-Akaiwong area immediately to the southeast of Haimaralli. One of the aims of this survey was to determine whether there is any direct relationship be-

tween the distribution of geochemical anomalies and the margin of the Aurora Granite. The results, although not conclusive, do not suggest any such control. A broad zone of geochemically anomalous copper values was encountered but these were low by comparison with the Haimaralli anomalies. The zone is parallel to the regional foliation and no promise of worthwhile mineralization is at present ascribed to it. Analytical work continues.

Deriri

Geochemical and self potential surveys were carried out in the old mining area of Deriri in the Upper Demerara, following an early report of the occurrence of chalcopyrite. Geochemical results showed one anomalous region which will be subject to further investigation. Self potential traverses over white sands at another locality produced a 600 mv. anomaly which will be further examined by other geophysical means. The region includes metasediments and volcanics of the Mazaruni Group, intruded by older and younger basic and granites, with a patchy cover of superficial white sands.

Dominica, West Indies

At the request of the Government of Dominica supported by the Federal Government of the West Indies a six week investigation was carried out by a geologist of the Geological Survey of British Guiana accompanied by a prospector into the possibility of the occurrence of gold in the island. The request followed from the purported discovery of a piece of auriferous quartz in a stream gravel. The specimen had previously been confirmed as gold bearing by the department.

Numerous streams were prospected without sign of gold, and geochemical samples yielded no significant result on analysis. It was concluded that original specimen was either introduced to the locality by human agency or represents an isolated fragment ejected from a volcanic vent.

IV. SPECIAL INVESTIGATIONS

(a) *United Nations-British Guiana Air and Ground-borne Geophysics and Mineral Exploration Project.*

A project for speeding the development of British Guiana's mineral resources came into operation in 1962. Jointly financed by the United Nations and Colonial Development and Welfare assisted funds of British Guiana the scheme which will be of three years duration, entails air and ground geophysics, geological surveys and drill hole exploration costing U.S. \$1,244,500. The Special Fund contribution is U.S. \$652,000 and the British Guiana Government counterpart U.S. \$592,000 largely in services already at hand.

Submitted in 1961 the project was approved by the Council of the Special Fund in January 1962, and the Plan of Operations signed on 14th June. Mr. G. Shaw who had already paid a preliminary visit earlier in the year in connection with the scheme was appointed as Project Manager and arrived in British Guiana on 24th August, 1962.

Some modification of the programme has occurred since the inception of the scheme. As originally submitted to the United Nations nine separate areas totalling 5,935 square miles, selected on the basis of known mineralization or geology, were planned for investigation. For the convenience of air survey both now and in the future, eight of the nine areas have been incorporated in two larger regions. It is not thought that the widening of flight line spacing so necessitated will bring unacceptable loss of detail. Flight line spacing was also widened in the previously unmodified ninth of the original areas and the coverage appropriately extended in the other regions. The regions now being flown are indicated in the map Fig. 3. They may be approximately defined as follows:

Area 1 — A belt of country approximately 30 miles wide extending southwest from the Sebai River to the Venezuelan border between the Barima and Barama headwaters.

— 3,840 sq. miles.

Area 2 — A triangular tract bounded by the Pakaraima escarpment, a line somewhat to the north of the Cuyuni, and on the east by a line extending from the Oko-Blue Mountains region of the Cuyuni to the Essequibo near the mouth of the Potaro. This block includes several known areas of mineralization

— 17,800 sq. miles.

Area 3 — Includes the Kanuku Mountains and parts of the Northern and Southern Savannas of the Rupununi District. Lenticular bodies of magnetite are recorded in this area

— 2,400 sq. miles.

A small extension of Area 2 covers the Omai District and Areas 1 and 2 are now to be joined near the Venezuelan border.

An Aero Service Corporation aircraft arrived in British Guiana on 5th October, 1962, and at the end of December had flown 12,100 magnetometer flight line miles in Areas 1 and 2. When magnetometer coverage is completed selected areas will be surveyed with airborne electromagnetic equipment.

Items for the scheme purchased by the United Nations and which

will include 3 diamond drilling rigs, geophysical and other field and headquarters equipment started arriving towards the year end.

(b) *Palynological Investigations*

Professor van der Hammen of Leiden University and consultant palynologist to the Government of British Guiana, having paid a further 15-day visit to the country in February, has now completed his first series of studies on the Quaternary of British Guiana and the results will be published shortly. Mr. T. A. Wymstra, a post-graduate student at Leiden University undertaking palynological investigations for a combination of bauxite producers in the Guianas, also visited the region in the middle of the year. This programme was originally proposed by the Geological Survey of British Guiana which is acting as co-ordinating agency. The scheme includes provision for the sinking of a number of test holes, several of which have now been completed by the companies, and samples from the cores are under examination at Leiden. The combination of Professor van der Hammen's and Mr. Wymstra's work on the younger formations of British, French and Dutch Guianas has already made striking progress in the elucidation of the stratigraphy of the coastal regions.

(c) *Age Determinations*

By arrangement with the Directorate of Overseas Geological Surveys, the Department of Geology and Mineralogy, University Museum, Oxford, continued a programme of absolute age determinations on rocks from British Guiana. The results are proving of utmost interest and value. During 1962 the following additional determinations became available —

Rock Type and Number	Basis of Determination	Method	Age (x 10 ⁶ years)
South Savannas Granite W 390	Biotite	Potassium-Argon	1320 + 50
South Savannas Granite A 116	Whole rock	Rubidium- Strontium	1222 + 200
Kaituma Granite Z 205	Whole rock	Rubidium- Strontium	1466 + 230

The Kaituma Granite determination is provisional. In addition a whole rock Rubidium-Strontium determination of the Kartabu Granite (F 1725) was undertaken giving an age of 1303 + 200 million years. The result is in considerable discrepancy however with an earlier Potassium-Argon determination on muscovite in the same rock, the result of which (1962 + 80 million years) is regarded as probably the more reliable.

V. HEADQUARTERS

(a) *Building Programme*

The new building which houses the Mechanics and Carpenters workshops, rock store and assay laboratory was occupied in 1962. A very substantial amount of work was entailed in reorganizing accumulated rock collections before they could be transferred and this was barely completed at the end of the year. The assay laboratory which has served temporarily as a sorting room is now freed for its original purpose.

Despite the construction programme there was still pressure on space and it was determined not to demolish the old rock store but to refurnish it as a geophysics section. This was particularly suggested by the impending arrival of U.N. geophysical equipment for which it would otherwise have been difficult to provide room.

Darkroom facilities are being transferred to the store room of the former U.K. Atomic Energy building, now to be devoted otherwise to advanced petrological and mineralogical studies.

Work on the improvement of driveways commenced with the construction of concrete curbs.

(b) *Conferences and Tours of Inspection*

Two staff conferences of senior officers were held during the year when technical progress and administrative matters were discussed. The Hon. Senator H. J. M. Hubbard, Minister of Trade and Industry, further displayed his considerable interest in the work of the Department in welcoming the opportunity of the first conference to address the geologists. He was accompanied by Mr. S. N. Selman, Permanent Secretary to the Ministry. Welcome guests at the first conference were Dr. V. V. Fedynsky and Dr. S. N. Simakov of the Soviet Union, and at the second, Mr. G. Shaw, U N. Aerial Survey Project Manager.

The Director attended the Third Caribbean Geological Conference held in Jamaica in April and submitted four papers from members of the Department:

Notes on the Erosion Bevels and Geomorphology of
British Guiana — Dr. R. B. McConnell.

Geological Background of Soil Erosion Problems in
the Scotland District, Barbados — P. Martin-Kaye and J. Badcock*.

Some Aspects of the Geology of the Roraima
Formation in British Guiana — J. H. Bateson.

Notes on the Stratigraphy of the Lower Roraima Formation in the
Potaro-Ewang Area of British Guiana, and on the Discovery of Acid
Intrusives within it. — C. N. Barron.

These Conferences which commenced in 1955 with a meeting in Antigua resulted from the initiative taken by the Geological Survey of British Guiana. Successive increases in attendance have demonstrated the

*Mr. Badcock is Chief Soil Conservation Officer, Dept. of Science and Agriculture, Barbados.

value which the numerous geologists interested in the Caribbean area place upon the proceedings.

On the return journey from Jamaica the Director spent a few days in Dominica introducing Mr. P. B. H. Bailey, also of the Geological Survey of British Guiana, to the geology of the island in connection with the investigation to be carried out into the reported occurrences of gold. The results of this work are mentioned elsewhere in this report. A further few days were spent in Barbados in consequence of a request to the Government of British Guiana from the Barbados Government. Advice on the progress of groundwater investigations and the soil conservation project for the Scotland District were required.

Through the courtesy of Demerara Bauxite Company, Reynolds Metals Company and Manganese Mines (Management) Ltd., visits were made to the mining operations at Mackenzie and Ituni, Kwakwani, and Matthews Ridge.

The Director spent a few days at the Department's drilling operations at Haimaralli in the Cuyuni in order to discuss progress and the future programme on the spot with Mr. C. N. Barron, geologist-in-charge and Acting Deputy Director (Field).

On another occasion advantage was taken of an opportunity to traverse the Mazaruni River from Bartica to Apaiqua in company with two geologists to gain familiarization with the important sequence exposed between these two points.

Later in the year the Director accompanied Dr. Gordon Gross of the Canadian Geological Survey and Mr. J. H. Bateson (of the Department) to the Rupununi Savannas. Dr. Gross was engaged in a study of British Guiana's iron-rich laterites. A visit was made to one of the several occurrences of magnetite in the Southern Savannas and magnetometer traverses were undertaken at the locality.

(c) *Drawing Office*

During the year the Drawing Office was heavily engaged in compiling and drawing maps for publication and records in addition to the preparation of maps for geologists' field expeditions and subsequent reports for which over 150 tracings were made. Over 5,000 dyeline prints were prepared about 25% of which entailed hand colouring.

Nine geological maps of Quarter Degree Squares were drafted and published, bringing the total now issued to thirty.

The compilation of the 1:500,000 Geological map completed by Dr. R. B. McConnell early in the year was drafted for publication in colour on a scale of 1:1,000,000. With the excellent co-operation of the B.G. Lithographic Co. it was possible to run the first coloured proof at the end of November. As has already been mentioned elsewhere, in order to prepare the map, an up to date topographic base was necessary. Using all pertinent information from the records of the Geological Survey and the Department of Lands and Mines a 1:500,000 base was compiled in the Drawing Office. The result had such evident value on its own account

that the Department after consulting the Commissioner of Lands and Mines arranged to have it published separately on a scale of 1:1,000,000.

The entire lithographic work of drawing, separating of colours, etc. of the new coloured geological map and its base right up to the printing stage was performed by the staff of the Geological Survey Drawing Office.

During February a display of maps and photographs illustrating the work of the Department was prepared by the Drawing Office for H.R.H. Prince Philip's visit to the Technical Institute.

The commencement of the United Nations-British Guiana mineral prospecting project has placed further pressure on the Drawing Office. However despite difficulties stemming from shortage of experienced staff the output and quality of work remained at a high level.

(d) *Laboratory.*

Although hampered by staffing problems, re-equipping and re-organization of the laboratory enabled it to keep abreast of a very large volume of work. The very pronounced increase in geochemical determinations which jumped from 550 in 1961 to nearly 13,000 in 1962 reflects the rapidly expanding use of geochemical prospecting techniques by the Department. Facilities now permit the handling of up to about 30,000 such samples per year and this figure may soon be obtained. The work undertaken by the section during the year may be tabulated as follows:

(A) *Petrological*

Thin sections of rocks	1,164
Specific gravity determinations	61
Heavy mineral separations	46
Sieve analyses of sands	21
Mineral identifications	9
	<hr/>
	1,301

(B) *Chemical*

Total rock analyses	14
Partial rock analyses	10
Bauxite analyses	4
Laterite analyses	11
Clay mineral analyses	2
	<hr/>
	41

(C) *Geochemical Determinations*

Copper	7,549
Nickel	2,799
Zinc	1,016
Chromium	364
Iron	185
Manganese	239
Arsenic	12
Molybdenum	12
Lead	238
Cobalt	336
Soil pH	54
	<hr/>
	12,804

Taking the opportunity early in 1962 provided by the construction of a new rock store, complete reorganization of the rock collection was undertaken. Previously classified as collections made by individual geologists they are now mainly stored on a double basis of collector and regions concerned.

New equipment acquired during the year included a torsion balance, an automatic sieve shaking machine, a box furnace, an electrically heated sand bath and a quantity of glass and polythene ware.

(e) *Library*

The books in the Library amount to 9,045, all of which have been indexed. Publications received during the year totalled 700. Loans from the library amounted to 719.

The Library received 42 different periodicals of which 27 were obtained by subscription and 15 received free. 36 were of technical nature and 6 of administrative, commercial or general interest.

The Survey's publications are distributed to approximately 198 Universities, Colleges, Libraries, Geological Surveys, other institutions and individuals.

Publications Cyclostyled and Printed:

	<i>No.</i>
(1) Proceedings of the Fifth Inter-Guiana Geological Conference, 1959	776
(2) Off-prints of papers submitted at the Fifth Inter-Geological Conference	10,000
(3) Bulletin No. 33 — "The Geology of the South Savannas Degree Square", by C. N. Barron	750
(4) Annual Report of the Geological Survey for the year 1960.	500
(5) "The gneisses of the Bartica Assemblage, British Guiana", by R. T. Cannon	300
(6) Mineral Resources Pamphlet No. 11 — "Preliminary prospection for copper, Haimaralli-Aurora Area, British Guiana", by C. N. Barron, G. Harden and M. A. Lee	63
(7) Index Sheet for 1:200,000 Geological Atlas of British Guiana	1,000

Black and White quarter-degree sheets:

Kurupukari SE and SW; Omai NW; Siparuni Head NW; Waini SE; Georgetown NW. Kanuku SW, Puruni NW and SE.	1,000 each
Map of British Guiana Scale 1:1,000,000	2,850

Distribution of Publications, 1962

	Sold	Free	Total
Bulletins	73	405	478
Annual Reports	50	361	411
Mineral Resources Pamphlets	36	129	165
Miscellaneous Reports	6	10	16
Proceedings of the 5th Inter-Guiana Conference	5	278	283
Off-prints — 5th Inter- Guiana Geol. Conference	1,000	1,909	2,909
Free Publications	—	872	872
Maps	528	6,359	6,887
	1,698	10,323	12,021

General

A start was made on the compilation of location cards to enable stock-taking to be carried out.

The Acting Supervisor of Library and Records underwent a course of training at the Public Free Library during August and September.

The Library continued to be of service to many persons, including students of the Government Training College for Teachers, pork-knockers, members of the United Nations Teams and overseas visitors.

(f) Visitors

The Department welcomed numerous visitors during the year, many of whom made use of the Library facilities. Among them were the Hon. H. J. M. Hubbard, Minister of Trade & Industry, Dr. S. H. Shaw, O.B.E., Director of Overseas Geological Surveys, Mr. Jaime Balcazar Aranibar, Deputy Regional Representative, U.N. Technical Assistance Board, Mr. T. B. Williams, Department of Technical Co-operation, London, Mr. W. A. Junor, F.A.O., Rome, Mr. G. Booth, United Kingdom Trade Commissioner for the Eastern Caribbean, Mr. D. A. Hughes, American Vice Consul in British Guiana, Mr. W. Sheridan, Chief Representative, U.S. Agency for International Development, Messrs. V. A. Kamensky, S. S. Erin and V. Ivaniov, U.S.S.R., Messrs. M. L. Macpherson, G. D. Sauer, J. F. Derting, G. R. Suggett and P. A. Bourne, United Nations representatives, Professor T. H. Hills, McGill University and Dr. B. Barnes Professor of Geology, University of Brazil.

Representatives of the following companies also visited the Department during the year:

Manganese Mines (Management) Ltd.

Demerara Bauxite Co. Ltd.

Reynolds Metals Company

Sinclair B.P. Exploration Inc.

Petromina (B.G.) Ltd.

Gulf States Lands & Industries Inc.

Olin Mathieson Chemicals Corp.

Aero Service Corporation

Sir William Halcrow and Partners

Murdock, Macdonald and Partners

VI. MINERAL PRODUCTION AND DEVELOPMENT

(a) *General*

Production of the bauxite industry and manganese mines showed a further increase over previous years. Diamond output declined however, and gold production remains rather low.

	1960		1961		1962	
	Amount	Value \$ W.I.	Amount	Value \$ W.I.	Amount	Value \$ W.I.
Bauxite (Long dry Tons)	2,471,190	—	1,235,556	14,197,888		—
Calcined Bauxite	—	—	370,761	14,277,089		
Alumina	—	—	120,161	12,085,588		
Diamonds (Metric Carats)	101,004	5,202,715	112,680	4,642,415	100,145	
Gold (Oz. Troy)	2,364	—	1,702		1,903	
Manganese (Long Wet Tons)	122,726	5,186,504	212,126	5,373,790	272,103	—
Granite	85,539	130,493				

(b) *Bauxite**Demerara Bauxite Company Ltd.*

The Demerara Bauxite Company Ltd. exported 1,360,000 long tons of bauxite from Mackenzie during 1962, about a million tons of this figure being dried ore for metallurgical use and the remainder, about 360,000 tons, being calcined bauxite of abrasive or refractory grade. Although shipments of calcined bauxite were below the capacity of the plant, nevertheless a new tonnage record was established.

A further quantity of bauxite was utilised in the Company's alumina plant which was opened in 1961. Quality control problems affected production in the first months but in 1962 these were finally overcome and by year end the plant was at full efficiency. 225,000 tons of alumina were shipped during the year. In all 350 vessels carried shipments from Mackenzie to 30 different countries.

Significant additions to production facilities were put into operation during the year. In March a very large piece of earth moving machin-

ery, a bucket wheel excavator built in West Germany, was put into commission. Costing approximately \$4 million the excavator can handle over 1,000 tons of sand overburden per hour.

In June, a new drying kiln capable of handling 1.5 million tons of bauxite a year was put into operation in the bauxite processing plant.

An eleven seat amphibian aircraft was acquired in October. It is being used primarily to fly supplies to the eight river gauging stations that the company maintains and to supply bauxite exploration parties.

Bauxite exploration activities were carried out during the year in the Great Falls area (E. Ps 561, 564, 588) on the west bank of the Demerara River, to the east of the present Mackenzie mines area (E.P. 445). and in the Cuyuni District (E.P. 563). Work in the Great Falls area continued to disclose the presence of extensively lateritized areas but nothing regarded as of importance was found. To the north of Christianburg the work consisted mainly of surveying and drilling, all areas being covered by White Sand sediments. In E.P. 445 preparatory operations were undertaken for a deep drilling programme which it is hoped to undertake shortly. Aimed at defining the structure of the basement the programme will also provide important data on the stratigraphy of the overlying sequence. Notice of abandonment of E.Ps 563 and 446 was submitted at the year end.

Reynolds Metals Company

Production of bauxite by the Reynolds Metals Company for 1962 amounted to 472,908 tons representing a considerable increase on the 326,000 tons produced in 1961. The enhanced output was enabled by a combination of factors, among them being improvements to the Everton drying plant which increased plant efficiency. New records were established in Mining, River Transportation, Drying and Shipping.

The new dredge 'Luckhoo' has eliminated shallow and difficult parts of the river route from Kwakwani and additional earth moving equipment placed into operations of the mine.

In the latter half of 1962 three new ocean-going barges of 6,000 long dry tons capacity have been used to transport ore to the transshipment point in Port-of-Spain, thus eliminating the L.S.T. type carrier previously used.

Of considerable importance to the operations at Kwakwani is the presence of a shallow bar to the Berbice River which severely restricts the tonnage of vessels entering the Berbice River. Under A.I.D. auspices a survey of the bar has commenced in order to assess the prospects of successful dredging.

Petromina (B.G.) Limited

During 1962 Petromina (B.G.) Ltd. carried out exploration for bauxite on E.P. 604 (Mowasi), particularly in the vicinity of the lower Mahdia River and Trail Konawak and Tiger River Trail. No conventional bauxite deposits were encountered although some of the laterites investigated rank fairly high in alumina.

(c) *Manganese**Manganese Mines (Management) Ltd.*

Exports of manganese ore from British Guiana commenced in 1960 when 76,765 long wet tons were shipped from Port Kaituma. In 1961, the first full year of operation, 187,383 tons were exported, followed by 230,162 tons in 1962. Production of ore at Matthews Ridge Mine in 1962 amounted to 270,103 wet long tons and 264,708 tons were rail freighted to Port Kaituma.

During July 1962 and the beginning of August a company geologist spent about six weeks in the U.S.A. on a course of instruction into the use of Induced Polarisation as a geophysical method in the detection of manganese oxides. Under the guidance of consultants trail tests were undertaken at the Matthews Ridge Mines and the work was subsequently extended elsewhere. The results have been sufficiently promising to encourage further use of this geophysical technique in manganese ore exploration.

Geological mapping in the north western part of the Exclusive Permission commenced at the beginning of November and about 45 square miles were completed by the year end. It is hoped that much of the country in the northwest part of the area between the Barima and the Venezuela border will be mapped early in 1963.

(d) *Diamonds*

The production figure for 1962 was 100,145.40 metric carats, a decrease of 11% on the 1961 figure. No new fields were exploited during the year, the bulk of the production coming from the well established Kurupung, Potaro and Upper Mazaruni districts.

The gravel pump installed on a raft has become of increased importance in the winning of diamonds from river beds. Sand and gravel are pumped to the surface and discharged into sluice boxes, in which the heavy minerals are separated from the waste. The diamonds are recovered from the concentrates by the usual sieving method. Other prospectors use low-powered sand pumps to remove the sand overburden from the diamondiferous gravel. The pumps are not powerful enough to lift the gravel to the surface, so this is loaded by divers into sacks and then raised to the surface.

Diamonds recovered average seven per carat. The proportion of gem stones to industrials is estimated at 60 : 40.

(e) *Gold*

In 1962 there was a small increase in gold produced over the previous year. Of the 1903 oz. 04 dwt. 20 grains of gold declared at the Department of Lands and Mines, about 50% was won in the North West District from the working of Mr. Baird on the right bank of the Barama River, where gold is recovered from alluvial gravel and quartz veins.

There has been a marked revival of interest in the Eldorado Mine in the Kaburi District. Over \$20,000 have been spent on development work during last year whilst rich gold quartz is being mined from an open cut about 30 feet deep. Flooding of the workings hampered production considerably, but it is hoped that this problem will be overcome during 1963.

Small quantities of gold are recovered from the diamond workings of most districts, especially from the Upper Kurupung and from the Cuyuni River area near Pigeon Island. There has been renewed activity in the Aranka goldfield, Cuyuni River, which was worked earlier in this century. It is reported that gold is being won from previously unworked alluvial deposits.

(f) Oil

As noted in last year's Annual Report, the results stemming from palynological work (see also p. 11) have displayed British Guiana's oil prospects in a more encouraging light. During Professor Th. van der Hammen's visit to British Guiana in February 1962, he was able to provide provisional stratigraphic determinations on the important water and stratigraphic test hole Shelter Belt No. 3 and on the basis of samples that he had earlier collected from the cores. A Tertiary sequence overlies Cretaceous and possibly older formations. It subsequently transpired that the "shallow horizon" recognized in Standard Oil of California's offshore seismic work probably represented the top of the Cretaceous.

Mr. R. McCall who was appointed under the auspices of the United Nations Technical Assistance Board to advise the Government of British Guiana on leasing policy, concluded his assignment early in 1962 and has submitted his report which, however, has not yet been made public.

A further request to the United Nations resulted in the arrival in June of two petroleum specialists, Dr. V. V. Fedynsky of the U.S.S.R. Ministry of Geology and Conservation of Mineral Resources, and Dr. S. N. Simakov of the All Union Scientific Research Geological Oil Institute (VNIGRI) Leningrad, together with an interpreter, Mr. V. N. Vavilov of the African Institute of the U.S.S.R. Academy of Sciences. The purpose of their month's visit was to assess the oil prospects of the country on the basis of existing data and to advise what exploration should be undertaken. Unfortunately the conclusions of the Soviet geologists have been misreported in the press; the report is to be published shortly. It may be said, however, that they view the occurrence of offshore oil as a possibility warranting further exploration.

A major oil group added an application for a concession to the American company outstanding from 1961. At the year end, however, no concessions had been granted.

VII. ACKNOWLEDGEMENTS

The gratitude of the Geological Survey is once again expressed to Mining Companies as well as small miners for their co-operation during the year. The hospitality afforded to various officers on various occasions by the Demerara Bauxite Company, the Reynolds Metals Company and the North West Guiana Mining Company is greatly appreciated.

The Commissioner of Lands and Mines and members of his staff kindly provided topographic maps, mining information and aerial photographs wherever possible. It is this co-operation which permitted the preparation of the new topographic map of the Geological Survey in the accuracy and detail attained. The District Officers of the Department of the Interior continued their regular and valued assistance to geologists passing through or operating within their districts.

Pilots and other staff of B.G. Airways Corporation deserve particular thanks for their co-operation and assistance.

Appreciation is also expressed for the help afforded in many varied directions by the Director and Staff of the Overseas Geological Surveys in the United Kingdom.

The Department receives many complimentary copies of publications on geology largely on an exchange basis. Special mention must be made of the valuable gift of a number of bound copies of standard works on the Geology of the Soviet Union and of a copy of the new Geological Map of the U.S.S.R. presented by Dr. V. V. Fedynsky and Dr. S.N. Simakov during their visit to British Guiana in the middle of the year.

APPENDIX A.

GEOLOGICAL SURVEY REPORTS & MAPS — 1962

P. M. Allen — Geologist

The Geology of Devil's Hole, Cuyuni River, PMA.1/62.

Maps: 1. Geology of Devil's Hole, Cuyuni River — 1/50,000. P3/F3/37.

2. Location of Rock Specimen — Devil's Hole Range, Cuyuni River. 1/50,000. P3/F3/37a.

3. Diagrams: (1) Example of folding in Amphibolites.)
(2) Features in Devil's Hole Gneisses) P3/F3/37b.

4. Diagrams: (3) Folding and Boudinage in Devil's Hole Gneiss.
P3/F3/37c.

(4) Folding seen in Cuyuni Formation Schists.
P3/F3/37c.

Report on an expedition to the Morabisi Area. PMA 2/62

Maps: Diagram to accompany report on Morabisi Expedition.
1"-1" P5/F3/17.

M. G. Alderidge — Geologist

Columbite in British Guiana. MGA. 1/58.

Map: Young Creek Area. 1/2,000. P5/F3/2 a-c.

P. B. H. Bailey — Deputy Director

Gold investigations in Dominica. (Preliminary Report) PBHB. 1/62.

J. H. Bateson — Geologist

Further investigations of the Laterites of the Kopinang Basin, Pakaraima Mountains. JHB. 1/62.

Maps: 1. Map of Kopinang Basin showing Pit localities with analyses.
Fig 1. 1" — 1 mile. P7/F1/21.

2. Map of Kopinang Basin showing:
Fig. 2 (a) Areas with less than 8% SiO — 1/125,000

(b) Position of Pits to compare laterites. P7/F1/21a.

3. Profiles to show position of Pits on (a) Dolerites and (b) Hornfels Ridge. Fig 3. 1" — 10' P7/F1/21b.

4. Vertical section through laterite developed on ().
(a) Dolerites and (b) Hornfels. Fig. 4. P7/F1/21c.

5. Graphical representation of chemical analysis to show variation with depth. Fig. 5. P7/F1/21d.

Some aspects of Geology of the Roraima Formation in British Guiana. JHB.2/62.

- Maps: 1. Map showing distribution of the subdivisions of the Roraima Formation. Fig. 1. P12/F1/10.
2. Configuration of the base of the Roraima Formation Fig. 2. P. 12/F1/10a.
3. Vertical sections from the Pakaraima Mountains showing the stratigraphical subdivisions and major intrusions. Fig. 3. Scale $h \times \frac{1}{4}$. P12/F1/10b.
4. Map showing the distribution of the major sills in the Pakaraima Mountains. Fig. 4. P12/F1/10c.

Comparison of the analyses of rocks of the Hornfels Group and the lower Kopinang Sill Gabbro. JHB. 4/62.

A Note on the Stratigraphy and Geological History of the coastal sediments. JHB. 4/62.

C. N. BARRON — SENIOR GEOLOGIST

Notes on the Stratigraphy of the Lower Roraima Formation in the Potaro-Ewang Area of British Guiana, and on the discovery of Acid Intrusives within it. CNB. B1/62.

Map: Geological sketch map of the Potaro-Ewang Area. 1/125,000. P5/F3/20.

Elevations and superficial deposits in the Bat Creek-Warakabra Rapids Area. CNB. 1/62.

Map: Topographic data and observed superficial deposits in Bat Creek-Kurupukari-Yurora River Area. 1/500,000. P7/F3/24.

Preliminary Review of the Haimaralli Copper Prospection. CNB. 3/62.

Maps: 1. Haimaralli-Aurora Area Regional Geology. 1/40,000. P3/F3/57.

2. Location of Anomalous Copper in Stream Sediments near Haimaralli Falls, Cuyuni River. 1/40,000. P3/F3/38.

M. W. CARTER — GEOLOGIST

Geology of the Potaro-Essequibo-Siparuni area. MWC. 1/62.

Maps: 1. Geological map of the Potaro-Essequibo-Siparuni area. 1/125,000. P6/F1/27.

2. Locations of Rock samples of the Potaro-Essequibo-Siparuni areas. 1/145,000. P6/F1/27a.

Report on the Puruni-Kartuni Survey Watershed. MWC. 2/62.

Maps: 1. Geological Map of the Puruni-Kartuni Watershed.
1/125,000. P3/F3/34.

2. Location of Rock samples in the Puruni-Kartuni Watershed.
1/125,000. P3/F3/34a.

Report of Appraisal of Wild West Quarry, Dalli, Essequibo River.
MWC. 3/62.

Map: Map of Wild West Quarry. 1/125,000. P4/F1/37.

South of Mahdia Survey. MWC. 4/62.

Maps: 1. South of Mahdia Survey (March-May). 1/125,000. P6/F1/29.
2. Location of Rock Samples, South of Mahdia Survey, 1/125,000.
P6/F1/29a.

R. T. CANNON — SENIOR GEOLOGIST

A Preliminary Report on the Geology of the Blue Mountains-Okoko Mountain area. RTC: 1/62.

Maps: 1. Geological map of the Oko-Blue Mountains area. 1/50,000.
P4/F1/35.

2. Location of rock samples in the Oko-Blue Mountains Area.
P4/F1/35a.

D. D. HAWKES — GEOLOGIST

A Note on the Profile and Composition of No. 63 Beach, Corentyne.
DDH. 1/62.

M. A. LEE — GEOLOGIST

Report on Peter's Mine area. MAL. 1/62.

Maps: 1. Map showing Geology of Peter's Mine area.
1/125,000. P3/F3/35.

2. Location of Rock samples at Peter's Mine area.
1/125,000. P3/F3/35a.

P. H. A. MARTIN-KAYE — DIRECTOR

Geological background to Soil Conservation and Land Rehabilitation Measures in Barbados, W.I. PHAM-K. 2/62.

R. B. McCONNELL — DIRECTOR

Notes on the Erosion Bevels and Geomorphology of British Guiana.
RBMcC. 3/62.

Maps: 1. Erosion Bevels of British Guiana. P.13/F1/24.
2. Outline map of the Guiana Shield. P13/F1/25.

U.N. Reports

- V. V. Fedensky and S. N. Simakov. Report on the Prospection for Oil in British Guiana.
- R. J. McCall. Report on (a) The Oil Prospects of British Guiana,
(b) Recommendations pertaining to the granting of Oil Licences.
- G. A. Gross. Examination of the Iron Ore Potential in British Guiana.

APPENDIX B.

GEOLOGICAL SURVEY OF BRITISH GUIANA

SENIOR STAFF AT 31/12/62

Director	.....	.....	P. H. A. Martin-Kaye, B.Sc., Ph.D., M.I.M.M., A.R.C.Sc.
2 Deputy Directors	.....	.....	P. B. H. Bailey, M.A., A.M.I.M.M., F.G.S. Vacant
3 Senior Geologists	.....	.....	C. N. Barron, B.A., F.G.S. R. T. Cannon, B.Sc., Ph.D., A.M.I.M.M., F.G.S. Vacant
12 Geologists & Asst. Geologists			J. H. Bateson, B.Sc., F.G.S. D. D. Hawkes, M.Sc., F.G.S. S. Singh, B.Sc. M. W. Carter, B.Sc. L. L. Fernandes, M.Sc., A.R.S.M. J. W. Carter, M.Sc., A.R.S.M. D.I.C. M. G. Alderidge, M.A. P. M. Allen, B.Sc. M. A. Lee, B.Sc. A.R.S.M., D.I.C. F. J. L. Guardia, B.Sc. Vacant Vacant
Chemist-Petrologist	.....	.....	G. Harden, B.Sc., Ph.D., D.I.C.
Geophysicist-Hydrologist	.....	.....	L. E. Ramsahoye, B.Sc., D.I.C., Ph.D.
2 Scientific Assistants	.....	.....	O. St. John Vacant

Chief Draughtsman T. M. Rahaman, Graduate of Technical Institute, Trinidad.

Draughtsman K. Lall (Acting)

Chief Clerk P. Francois (Acting)

Supervisor of Library and
Records Miss R. E. Harry (Acting).

Senior Accounting Officer C. L. A. Mittelholzer (Acting)

APPENDIX C.

Staff Availability during 1962

Name	Designation	Period on Duty	REMARKS
R. B. McConnell	Director	1.1.62 — 10.2.62	On leave 11.2.63; pending retirement 21.5.62
C. G. Dixon	Deputy Director		On leave 1.1.62 — 8.1.62; pending re- tirement 9.1.62
P. H. A. Martin- Kaye	Director	1.1.62 — 31.12.62	Supernumerary Director 1.1.62 — 21.5.62; appointed Director 22.5.62
P. B. H. Bailey	Deputy Director	1.3.62 — 31.12.62	On leave 1.1.62 — 28.2.62; Appointed Deputy Director 1.2.62.
C. N. Barron	Senior Geologist	1.1.62 — 31.12.62	Appointed Senior Geologist 2.2.62; Appointed to act Deputy Director (Field) 22.2.62.
E. Williams	Senior Geologist	—	On leave 1.1.62 — 31.1.62; Termination of contract 1.2.62.
G. Harden	Chemist/ Petrologist	18.1.62 — 31.12.62	Appointed Chemist/ Petrologist 18.1.62
L. E. Ramsahoye	Geophysicist/ Hydrologist	1.1.62 — 31.5.62	On Secondment P.W.D. On leave 1.6.62
J. H. Bateson	Geologist	1.1.62 — 6.5.62 28.9.62 — 31.12.63	Appointed to act Senior Geologist 1.3.62; 6.5.62 and 28.9.62 — 31.12.62. On leave 1.5.62 — 27.9.62
D. D. Hawkes	Geologist	1.1.62 — 2.9.62	On leave 3.9.62 — 12.12.62.
S. Singh	Geologist	1.1.62 — 10.11.62	Appointed to act Senior Geologist 22.2.62 — 10.11.62. On leave 11.11.62 — 12.12.63
M. W. Carter	Geologist	1.1.62 — 5.6.62 10.12.62 — 31.12.62	On leave 26.6.62 — 9.12.62.

Name	Designation	Period on Duty	REMARKS
L. L. Fernandes	Geologist	.... 23.6.62 — 31.12.62	Appointed to act Snr. Geologist 12.11.62.
J. W. Carter	.... Geologist	.... 25.9.62 — 31.12.62	On leave 1.1.62 — 24.9.62
M. G. Allderidge	Geologist	.... 1.1.62 — 31.12.62	—
P. M. Allen	.... Geologist	.... 1.1.62 — 31.12.62	—
M. A. Lee	.... Geologist	.... 1.1.62 — 31.12.62	Assistant geologist 1.1.62 — 25.5.62 Appointed Geologist 25.5.62.
F. J. L. Guardia	.... Geologist	.... 21.10.62—31.12.62	Appointed Geologist 21.10.62.
T. M. Rahaman	.... Chief Draughtsman	.... 1.1.62 — 31.12.62	—
D. O. Pollard	.... Scientific Assistant	.... 1.1.62 — 23.12.62	Retired — 24.12.62
O. St. John	.... Scientific Assistant	.... 1.1.62 — 31.12.62	—
M. A. Shariff	.... Assayer	.... 6.7.62 — 31.12.62	On leave 1.1.62 — 5.7.62. Appointed to act Scientific Assistant 27.12.62
A. O. Edwards	.... Field Observer	.... 1.1.62 — 31.8.62 24.9.62 — 31.12.62	On leave 1.9.62 — 22.9.62.
S. Narain	.... Field Observer	.... 1.1.62 — 31.12.62	Field Assistant 1.1.62 — 31.1.62. Appointed Field Observer 1.2.62.
J. R. Briggs	.... Field Observer	.... 1.1.62 — 31.12.62	
Miss I. V. Lowe	Senior Asst. Draughtsman	.... 1.1.62 — 31.12.62	On secondment to U.N. Soil Survey
K. Lall	.... Senior Asst. Draughtsman	.... 1.1.62 — 31.12.62	Appointed to act Draughtsman 1.1.62 — 31.12.62.
R. Narain	.... Asst. Draughtsman	.... 1.1.62 — 31.12.62	—
Mohan Persaud	.... Apprentice Draughtsman	.... 1.1.62 — 31.12.62	Temporary Apprentice Draughtsman. Appointed Apprentice Draughtsman 1.6.62.
J. Rambali	.... Apprentice Draughtsman	.... 1.1.62 — 31.12.62	Temporary Apprentice Draughtsman. Appointed Apprentice Draughtsman 1.6.62.
O. Sankar	.... Apprentice Draughtsman	.... 1.1.62 — 31.12.62	Temporary Apprentice Draughtsman. Appointed Apprentice Draughtsman 1.6.62.

Name	Designation	Period on Duty	Remarks
M. D. Hope	Technical Asst. Grade I.	1.1.62 — 31.12.62	Appointed Technical Asst. Grade I 1.6.62.
M. Persaud	Technical Asst. Grade II	1.1.62 — 31.7.62	Appointed Technical Asst. Grade II 1.1.62: On leave 1.8.62 — 31.12.62.
R. Rego	Snr. Field Asst.	29.3.62 — 31.12.62	On leave 1.1.62 — 28.3.62.
R. Henry	Snr. Field Asst.	2.7.62 — 12.12.62	On leave 1.1.62 — 1.7.62. Appointed Snr. Field Assistant 1.2.62.
V. A. Agrippa	Field Asst.	1.9.62 — 31.12.62	On study leave 1.1.62 — 31.8.62.
S. O'Selmo	Field Asst.	1.1.62 — 31.1.62	On leave 1.2.62 — 30.7.62.
S. Jagai	Field Asst.	1.8.62 — 31.12.62	—
C. R. Rambali	Field Asst.	1.1.62 — 31.12.62	—
F. Khan	Field Asst.	1.1.62 — 31.12.62	Temporary Apprentice Draughtsman. Appointed Field Asst. 1.2.62
D. F. M. Clarke	Field Assistant	1.1.62 — 31.12.62	—
A. Prince	Field Assistant	1.1.62 — 31.12.62	—
E. Johnson	Lapidary	1.1.62 — 31.12.62	—
C. Narain	Foreman/Mechanic	1.1.62 — 31.12.62	—
A. Edwards	Driver/ Mechanic	1.1.62 — 31.12.62	—
B. Singh	Driver/ Mechanic	1.1.62 — 31.12.62	—
R. Edwards	Driver/ Mechanic	1.1.62 — 31.12.62	On leave 20.12.62 — 31.12.62.
S. Paul	Driver/ Mechanic	1.1.62 — 31.12.62	—
C. E. Outridge	Chief Clerk (Acting)	1.1.62 — 4.2.62	Transferred to P.W.D. 5.2.62
P. Francois	Chief Clerk (Acting)	5.2.62 — 31.12.62	On secondment from P.W.D. 5.2.62.
Miss R. E. Harry	Supervisor, Library & Records (Ag.)	1.1.62 — 31.12.62	—
V. H. Campbell	Snr. Accounting Officer	1.1.62 — 31.1.62	On leave 1.2.62.
G. A. Dwarka	Snr. Accounting Officer (Ag.)	1.2.62 — 1.7.62	Transferred to Inland Revenue Dept. 2.7.62.
C. L. A. Mittelholzer	Snr. Accounting Officer (Ag.)	2.4.62 — 31.12.62	On Secondment from Drainage & Irrigation
C. M. Johnson	Secretary (Ag.)	1.1.62 — 31.12.62	—
M. E. McWatt	Stenographer	1.1.62 — 31.12.62	—
C. S. Klass	Class II Clerk	1.1.62 — 31.12.62	—
C. Jessimy	Stenographer (Ag.)	1.1.62 — 19.12.62	—
J. B. Dennison	Clerical Assistant	1.1.62 — 31.12.62	—

ILLUSTRATIONS

Plate I.

- (a) Grumman Goose 6 seater amphibian aircraft of British Guiana Airways at Aurora, Cuyuni River. These aircraft are frequently used by the Geological Survey.
- (b) Camp beside Julian Ross Itabu, Cuyuni River.

Plate II.

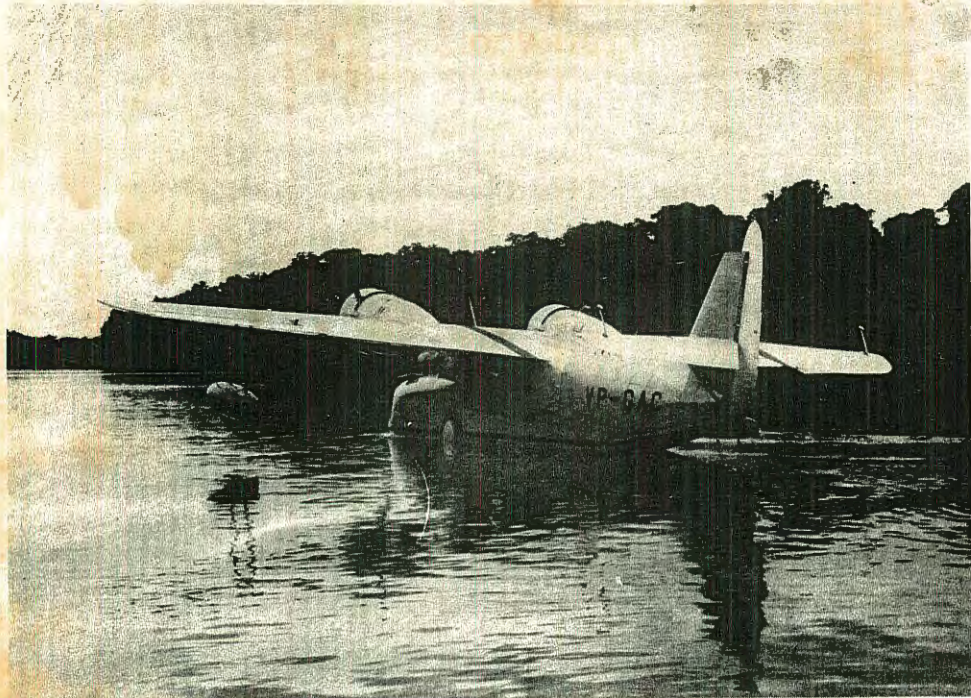
- (a) Kumarau Fall, where the Kurupung River flows over an escarpment of horizontal Roraima Formation beds.
- (b) Hauling a bateau up Pairimap Fall, Mazaruni River.

Map Fig. 1.

Map of British Guiana showing progress of $\frac{1}{4}^{\circ}$ sheet publication programme.

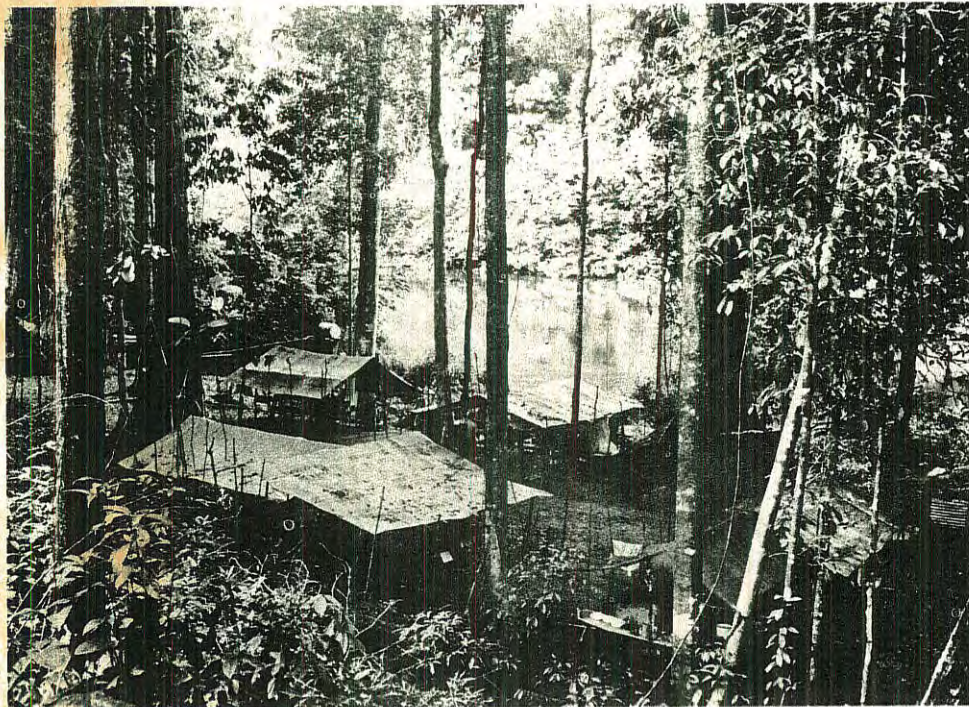
Map Fig. 2.

Map of British Guiana showing areas selected for aeromagnetic surveys and allocation of Geologists during the year 1962.



Grumman Goose 6-seater amphibian aircraft of British Guiana Airways at Aurora, Cuyuni River. These aircrafts are frequently used by the Geological Survey.

Photo by P. H. A. Martin-Kaye



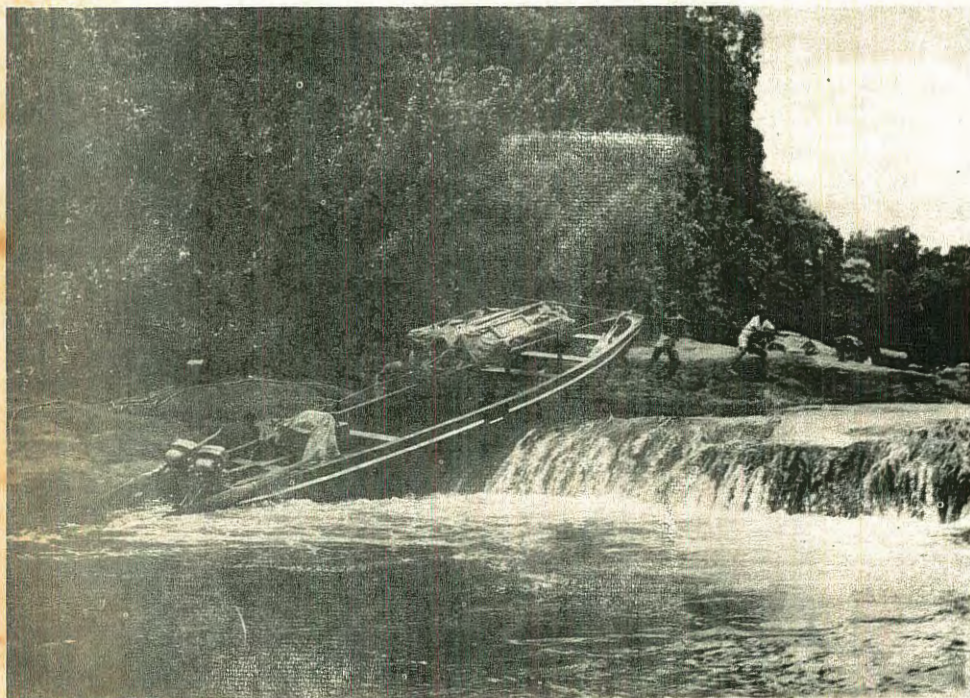
Camp beside Julian Ross Itabu, Cuyuni River.

Photo by P. H. A. Martin-Kaye.



Kumerau Fall, where the Kurupung River flows over an escarpment of horizontal Roraima Formation beds.

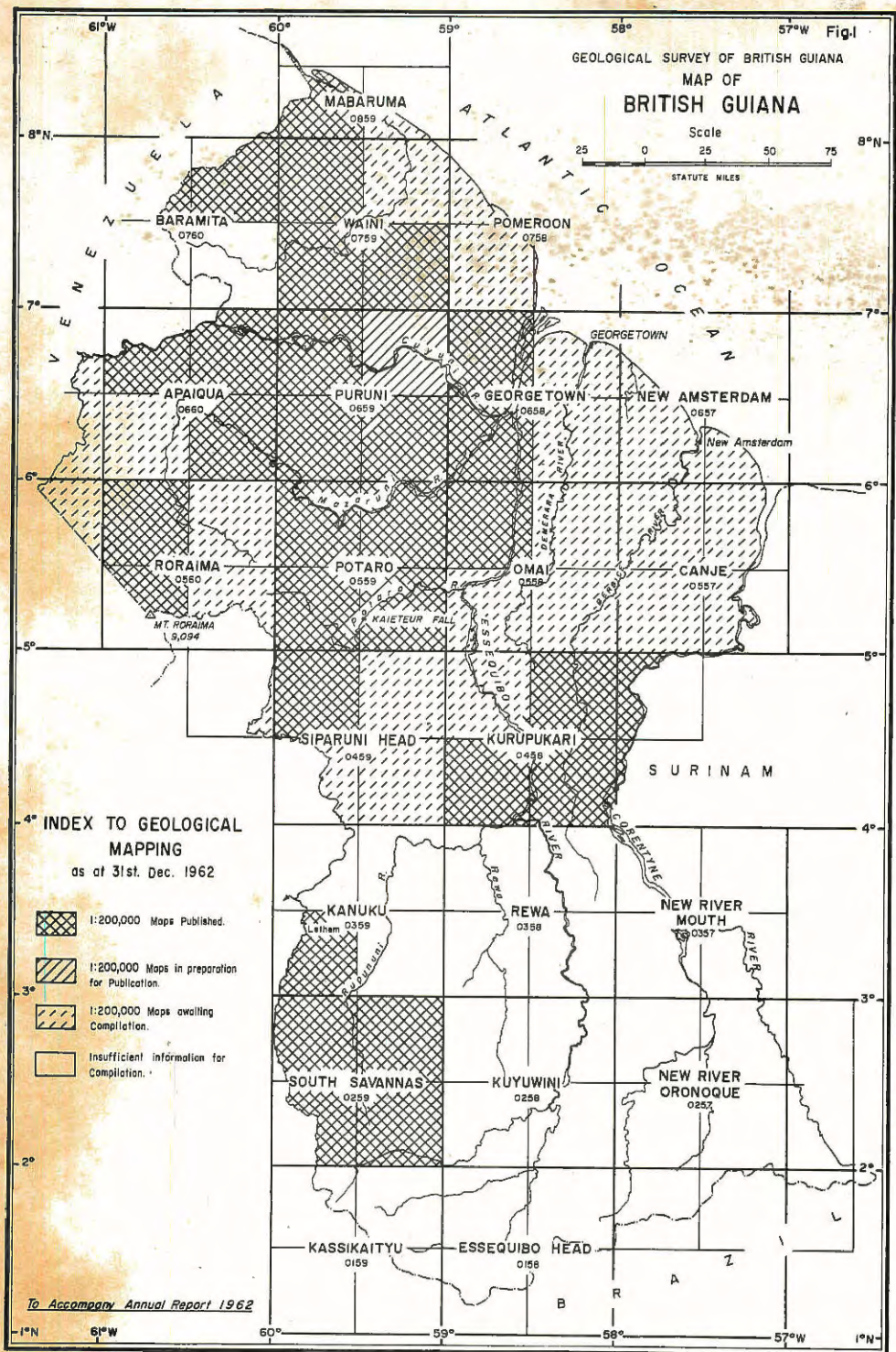
Photo by M. G. Allderidge.



Hauling a bateau up Pairimap Fall, Mazaruni River.

Photo by M. G. Allderidge.

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4th INDEX TO GEOLOGICAL MAPPING
as of 31st. Dec. 1962

- 1:200,000 Maps Published.
- 1:200,000 Maps in preparation for Publication.
- 1:200,000 Maps awaiting Completion.
- Insufficient information for Completion.

To Accompany Annual Report 1962

