BRITISH GUIANA

REPORT ON THE GEOLOGICAL SURVEY DEPARTMENT FOR THE YEAR 1961

Geological Survey Department
P.O. Box 789
Georgetown, British Guiana.

Price $1.00

The "B.G. Lithographic" Co., Ltd,, Printers to the Government of British Guiana,
La Penitence, E.B., Demerara.

1964

GEOLOGICAL SURVEY, BRITISH GUIANA

Report on the Geological Survey Department for the year 1961.

ERRATA

P. 17	Place heading BAUXITE before para. 6
P. 18	Para 3, for "capable of 5 million--" read "capable of moving 5 million--"
P. 18	Para 3 Line 3, for "to further equipment--" read "to purchase further equipment"
P. 19	Para 1 Line 1, for "maganese" read "manganese" for "Commenced" read "commenced"
P. 22	Line 14 from top, for "on Ferruginous of Pakaraima Mountains" read "on Ferruginous Bauxites of Pakaraima Mountains"
P. 24	Line 5 from top, for "the potential" read "their potential"
P. 24	Line 3 from bottom, for "Karasabai" read "Karasabai
P. 33	Line 1 from top, for "variables" read "variable"
P. 33	Para 4 line 5, for "to 115 feet" read "to 1115 feet"
P. 34	Line 3 line from top, for "Al_2O_2" read "Al_2O_3"
P. 41	Para 4, line 4, for "whilstin" read "whilst in"
P. 41	Last para, line 1, for "Genisses" read "Gneisses"

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REPORT ON THE GEOLOGICAL SURVEY DEPARTMENT FOR THE YEAR 1961

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I. INTRODUCTION

The Geological Survey of British Guiana is financed partly under free grant from the United Kingdom out of Colonial Development and Welfare funds, and partly out of local revenue. Under the C.D. & W. Scheme D 4333, which came into effect on 1 April 1960 and will run until 31 March 1963, 40% of the recurrent expenditure was provided out of local revenue in 1961 whilst the remainder, together with capital expenditure was provided from the scheme. Expenditure for 1961 was as follows:

C.D. & W.	W.I. $ 283,699	£ 59,103.19s. 2d.
Local Funds	179,039	37,299.15s.10d.
TOTAL	$ 462,738	£96,403.15s. 0d.

ACKNOWLEDGEMENTS

The gratitude of the Geological Survey is once again expressed to mining companies as well as the small miners for their co-operation during the year.

The Commissioner of Lands and Mines and members of his staff kindly provided topographic maps, mining information and aerial photographs wherever possible, and the Director of Civil Aviation helped in making a helicopter available for chartering. The District Commissioners of the Interior Department provided a great deal of help to geologists in making arrangements in connection with expeditions.

Thanks are also due to the Director and staff of the Overseas Geological Surveys in the United Kingdom for their continued valuable assistance.

II. REVIEW OF THE YEAR

During the year a total of 4,000 square miles were mapped by the department. This is a little over half the area completed in 1960, the reduction being due to the incidence of leave, absence of some geologists on study courses and the diversion of effort to special projects.

The map publication programme mentioned in last year's Annual Report made great strides during the year and 21 Quarter Degree square sheets were published.

A recompilation of all the available geological information was incorporated in a draft 1 : 500,000 geological map. Analysis of this map led to the selection of nine areas totalling 5,935 square miles which can be regarded, on geological and structural grounds, as worthy of prospecting by modern methods. The airborne geophysical survey of these areas will be carried out under a scheme sponsored by the United Nations Special Fund.

The Demerara Bauxite Company opened an alumina plant at Mackenzie in March and over 120,000 tons of alumina were shipped.

During this, the first full calendar year of production, 187,383 tons of manganese ore were shipped from Port Kaituma in the North West District by the Northwest Guiana Mining Company Limited.

Interest in British Guiana's oil prospects was heightened during the year by the results of a programme of pollen analysis of the coastal sediments initiated by the department. The presence of Tertiary and older deposits, in which oil has been found in neighbouring countries, has now been proved. Palynological work also promises to be of considerable value in elucidation of the stratigraphic position of the bauxite deposits. Bauxite companies in British Guiana and Surinam collaborated with the Geological Survey Department in the organization of a programme for pollen analysis.

CENTRALIZATION

As a final stage in the policy of centralization a building containing rock store, laboratory, carpenter's shop and garage workshop was constructed. The lack of proper rock storage facilities has been a serious handicap to the Survey, and the scarcity of specimens makes the reassessment of previous geological results in the light of modern knowledge difficult or impossible.

WATER SUPPLY

Dr. L. E. Ramsahoye, Geophysicist-Hydrologist, was on secondment to the Pure Water Supply branch of the Public Works Department during the whole of the year. The results of his investigations continue to indicate immense reserves of water in the coastal artesian aquifers. During April—May 1961 British Guiana experienced an exceptional drought, but Georgetown escaped serious water shortage owing to a new deep well and the knowledge, derived from the

Geological Survey investigations, that two wells in the shallower "A" Sands could be pumped to capacity. These three wells were being pumped continuously at an average rate of 2,050 gallons per minute.

STAFF

Appointments and Promotions

Dr. P. H. A. Martin-Kaye, Senior Geologist, who had been on secondment to the Federal Government of the West Indies was appointed Deputy Director *vice* Dr. D. Bleackley and returned to the Colony on 28 September 1961, and on the 1 December 1961 was further appointed Supernumerary Director.

Mr. M. G. Allderidge was appointed a Geologist on contract for two years and returned to the Colony on 29 July 1961.

Mr. P. M. Allen, Geologist, who had been appointed on contract for two years, arrived in the Colony and assumed duty on 8 August 1961.

Mr. F. Johnson, Chief Clerk, was seconded to act firstly as Executive Officer, Drainage & Irrigation Department with effect from 16 March 1961 and subsequently as Assistant Secretary, Ministry of Natural Resources. His place in the Department has been taken by Mr. C. E. Outridge, Senior Clerk, Post Office Telecommunications and Electrical Inspectors Branch.

Mr. O. St. John, Field Observer, was promoted to the new post of Scientific Assistant with effect from 1 January 1961. Mr. J. R. Briggs, Senior Field Assistant, was promoted Field Observer *vice* Mr. St. John with effect from 1 June 1961.

Mr. H. K. George, Supervisor of Library & Records, was appointed an Administrative Cadet and left the Survey with effect from 2 May 1961.

Miss R. E. Harry was appointed to act as Supervisor of Library and Records.

Miss C. M. Johnson, Senior Clerical Assistant, Education Department was appointed to act as Secretary with effect from 29 May 1961 *vice* Miss Harry.

Mr. C. S. E. Klass was appointed Class II Clerk with effect from 5 January 1961 *vice* Mr. C. S. Massiah transferred to the Interior Department.

Mr. J. G. Pairaudeau and Mr. S. Jagai were appointed Field Assistants with effect from 15 February 1961.

Mr. D. F. M. Clarke was appointed Field Assistant with effect from 18 December 1961.

Mr. A. Prince was appointed a Field Assistant with effect from 15 December 1961.

Mr. C. R. Rambali, Assistant Draughtsman, was appointed a Field Assistant with effect from 15 December 1961.

Miss I. Lowe, Senior Assistant Draughtsman, was seconded to the post of Cartographer, Agriculture Department, U.N. Soil Survey with effect from 1 May 1961.

Miss C. Jessimy was appointed Temporary Stenographer until further orders with effect from 22 June 1961.

Mr. C. G. Bagot, Messenger left the Department on 18 May 1961 to take up an acting appointment as Bailiff, Magistrates Department.

Leave and Acting Appointments

Mr. C. G. Dixon, Deputy Director, proceeded on vacation leave with effect from 12 July 1961 to be spent in the U.K. Mr. R. T. Cannon, Senior Geologist, was appointed to act as Deputy Director with effect from 13 July 1961.

Dr. E. Williams, Senior Geologist, left the Colony on vacation leave on the termination of his contract on 24 September 1961.

Mr. P. B. H. Bailey, Senior Geologist, was granted 140 days vacation leave with effect from 21 September 1961 to be spent in the U.K.

Mr. J. W. Lloyd, Geologist, proceeded on six months' vacation leave with effect from 18 January 1961 on termination of his contract. He did not renew his contract on the expiry of his leave.

Mr. K. Bramley, Geologist, who proceeded on vacation leave on the termination of his contract on 24 March 1961 had not renewed his contract at the 31 December, 1961.

Mr. C. N. Barron, Geologist, proceeded on 150 days' vacation leave in the U.K. on 28 July 1961.

Mr. J. W. Carter, Assistant Geologist, proceeded on six months' vacation leave with effect from 15 November 1961 to be spent in the U.K. Mr. Carter will be undertaking further studies at the Royal School of Mines during his leave.

Mr. M. A. A. Shariff, Assayer, proceeded on six months and 25 days vacation leave to be spent in the U.K. with effect from 19 August 1961. Mr. Shariff will be undertaking a course of instruction at Overseas Geological Survey Laboratory, and at the Imperial College of Science & Technology.

Mr. W. H. Johnson, Field Observer, was granted six months' vacation leave with effect from 1 February 1961 to be spent in the U.K. He did not resume duty as he tendered his resignation through the Crown Agents.

Mr. A. O. Edwards, Field Observer, was granted six months' vacation leave to be spent in the Colony and the U.K. He resumed duty on the 18 September 1961.

Mr. R. Rego, Senior Field Assistant, resumed duty on 1 November 1961 after six months' vacation leave spent in Canada

Mr. R. V. Yan, Assistant Draughtsman proceeded on six months and 23 days' vacation leave with effect from 1 November, 1961 to be spent in the U.K.

Mr. C. Narain, Foreman/Mechanic, resumed duty on 4 November 1961 after six months' vacation leave spent in the U.K.

Mr. E. Johnson, Lapidary, resumed duty on 2 October 1961 after six months' vacation leave spent in the Colony and the West Indies.

Mr. V. A. Agrippa, Field Assistant, resumed duty on 21 June 1961 after spending 6 months 18 days' vacation leave in the West Indies and in the Colony Mr. Agrippa has now been granted leave on half-pay to September 1962 with effect from 12 November 1961, to undertake a Land Surveyor's Course at the Government Technical Institute.

Mr. J. L. Fredericks, Technical Assistant, proceeded on 144 days' vacation leave with effect from 1 December 1961, to be spent in the Colony. Mr. Fredericks has been granted permission to resign at the expiry of his leave.

Mr. R. Edwards, Driver/Mechanic, who was on three months' vacation leave to be spent in the Colony with effect from 1 July 1961, was recalled to duty on 16 August 1961 after 46 days to undertake a field expedition.

Miss J. Gomes, Stenographer, proceeded on 84 days' vacation leave with effect from 22 June 1961 to be spent in Canada. Miss Gomes subsequently resigned from the Service.

Resignations

Dr. D. Bleackley, Deputy Director (Field), resigned from the Service on 31 March 1961 at the termination of his contract, and subsequently joined the staff of the Directorate of Overseas Geological Surveys in the United Kingdom.

Mr. C. J. W. Roth, Field Assistant, resigned from the Service w.e.f. 22 February 1961.

Mr. J. E. Holder, Field Assistant, resigned w.e.f. 1 April 1961.

Miss Y. Mayers, Clerical Assistant, resigned from the Public Service w.e.f 8 March, 1961, on account of her marriage in the U.S.A.

Mr. J. G. Pairaudeau, Field Assistant, resigned from the Service on July 31 and is pursuing studies in the U.K. leading to a degree in Geology.

Miss J. Gomes, Stenographer, resigned from the Service w.e.f. 18 September 1961, to take up permanent residence in Canada.

Mr. G. A. Young and Mr. R. Robeiro, Temporary Apprentice Draughtsmen resigned from the Service w.e.f. 4 November 1961 and 1 November 1961 respectively.

Scholarships

Mr. A. S. Persram, Conditional Scholar, was unfortunately forced through illness to give up his studies at Glasgow University; he returned to the colony on 4 December 1961 and resumed duty.

Mr. L. L. Fernandes continued reading for the M.Sc. degree at McGill University, Montreal, Canada, under the auspices of the Canadian Technical Assistance Scheme.

Special Assignments

Dr. L. E. Ramsahoye, Geophysicist/Hydrologist, continued on secondment to the Pure Water Supply section of the Public Works Department during 1961.

Mr. D. D. Hawkes continued to act as Chemist-Petrologist pending the appointment and arrrival in the colony of Dr. G. Harden, Chemist-Petrologist designate.

III. GEOLOGICAL SURVEY

SUMMARY OF FIELD WORK

The total area mapped in 1961 was approximately 4,000 square miles. The completion of 21 Quarter Degree Sheets of the new 1 : 200,000 map series is a considerable achievement and places maps and reports of a large area of British Guiana at the disposal of any interested parties. The stratigraphy of British Guiana is now on a sound basis and future mapping will be concentrated in possible economic areas.

The discovery of a secondary copper mineralization in the Haimaralli Falls area of the Cuyuni River by Messrs. R. T. Cannon and P. M. Allen in late 1961 is particularly noteworthy. A geological, geophysical and geochemical investigation of this area is to be instituted in 1962.

The joint expedition with the *Direccion de Geologia* of Venezuela is discussed elsewhere in this report and was useful in establishing the validity of the new map sheets in relation to Venezuela. Mr. R. T. Cannon completed an examination of the Devil's Hole area (with Mr. P. M. Allen) and also an area in the Blue Mountains-Oko Mountains region. Both areas contain similar gneiss complexes which have been provisionally assigned to the Bartica Assemblage and both areas are also noteworthy for marginal basic rocks (amphibolites and subordinate quartzites) which are probably related to the emplacement of the gneiss complexes. Mr. P. M. Allen continued in the adjoining area to Devil's Hole to complete a study of the regional geology.

Mr. P. B. H. Bailey continued his work in the Wenamu River area providing further information on the Cuyuni and Roraima formations and gold and diamond occurrences.

Mr. C. N. Barron mapped in the Potaro-Kuribrong area and distinguished a sandstone sequence underlying the Roraima Formation. He also confirmed the presence of minor acid intrusions in the Roraima Formation.

Mr. J. H. Bateson continued the investigation of aluminous laterites in the Kopinang valley as noted on page 33. He later mapped in the Merume River area establishing the sequence of greywacke sediments of the Haimaraka Formation above the First Falls. Mr. Bateson also mapped the area between Pott Falls and Itanime extending the outcrop area of the Muruwa Formation.

Mr. D. D. Hawkes continued to act as Chemist-Petrologist and demonstrated an interesting gold-arsenic association in Marudi Mountain which may have wider implication in British Guiana.

Mr. S. Singh was occupied both seasons last year with a detailed examination of the South Savanna Granite and the adjacent gneisses of the Kanuku Group. The intrusive nature of the South Savanna Granite was confirmed.

In the first field season Mr. M. W. Carter mapped the Muruwa Formation in the Potaro Essequibo-Siparuni area. The second season was spent mapp-

ing a remote area in the Puruni-Kartuni watershed. An area of gneisses with later Younger Granites and Younger Basic Intrusives was mapped and an area of porphyries of unknown extent. probably within the Mazaruni Group.

Mr. M. G. Allderidge mapped the Lion Mountain area. He suggests that the large, dominantly amphibolitic mass of Lion Mountain and similar adjacent masses are derived from the Cuyuni Formation.

Mapping during both seasons in the Marudi Mountain area Mr. J. W. Carter has shown the presence of an acid intrusive younger than the South Savanna Granite, and has also given greater precision to the pattern of veins and shears with which the gold mineralization is associated. The detailed results obtained by this geologist at Marudi should be useful in other auriferous areas of British Guiana.

Mr. M. A. Lee mapped the important gold area around Peter's Mine which is apparently located within a shear zone.

Mr. O. St. John was concerned last year with trail construction in the Wakawakapu area of the Mazaruni River and also between the Kurupung and Merume Rivers. These trail location surveys greatly helped pork-knockers in the nearby areas in addition to providing more information about diamond distribution.

MAP PUBLICATION PROGRAMME

The field mapping campaign at a scale of 1:125,000 commenced in 1957 and by late 1960 advanced sufficiently to verify the new stratigraphic subdivisions and make it possible to commence publication of a new series of maps as described in last year's report. In order to produce as many maps as possible with the means and funds available the sheets are published in black and white arranged for hand colouring. Each sheet covers one quarter of a degree square at a scale of 1:200,000 with about 1200 words of geological notes included. The style of publication has been adapted from the practice of the Geological Survey of Canada. modified by Dr. E. Williams. Twenty-one sheets were published during 1961 and about the same number are in draft; the maps are being produced and edited by Dr. E. Williams and Mr. R. T. Cannon.

Compilation commenced late in 1961 of a new 1:500,000 geological map of British Guiana which will be published in colour late in 1962 at a scale of 1:1,000,000.

AIRBORNE GEOPHYSICAL SURVEYS

Prospecting is notoriously difficult under the Amazonian rain-forest conditions of British Guiana, and the principal object of the current geological mapping programme was to ascertain whether any regions favourable for mineral recovery could be selected on the basis of geological and structural criteria. Analysis of the newly compiled geological map enabled nine areas totalling 5,935 square miles to be selected as worthy of close prospecting by modern methods. A scheme covering the airborne geophysical survey of these areas was accepted

by the United Nations Special Fund and will entail an expenditure of £270,937. A counterpart expenditure of £259,250 on a three-year programme of ground follow-up exploration and diamond drilling has been undertaken by the Geological Survey. The planning was greatly assisted by the advice of commercial contractors for airborne surveys.

Palynological Investigations

A much clearer picture of the succession of the coastal sediments is now emerging as a result of the study of pollen samples being carried out in Holland by Professor Th. van der Hammen for the Government of British Guiana. Samples for pollen analysis were collected from the Shelter Belt test borehole and are yielding most interesting results. As mentioned in the Annual Report of last year, a Palaeocene pollen flora had previously been determined from sediments underlying the bauxites at Kwakwani and the presence of Palaeocene beds below more recent coastal sediments has now been confirmed by the test borehole.

The pollen analysis project was originally initiated to assist the bauxite companies in their exploration. Four principal companies operating in British Guiana and Surinam have agreed to finance further investigation by a graduate student under the direction of Prof. van der Hammen The scheme will include the drilling of test boreholes and the results are to be co-ordinated by the Geological Survey of British Guiana which will publish the results.

Joint Expedition with Venezuelan Geologists

Close contact is being kept with the Geological Surveys of the other countries sharing the Guiana Shield and a combined expedition was arranged in May 1961 with members of the Direccion de Geologia of Venezuela. Dr. E. Williams and Mr. R. T. Cannon were conducted on a two-week tour of Venezuelan Guayana and in turn accompanied two Venezuelan Geologists on a descent of the Cuyuni River, along which most of the important geological formations of British Guiana are visible. Complete agreement was reached on correlations affecting both countries and the mutual problems discussed will be of considerable assistance in the future mapping programme.

Age Determinations

In the 1960 Annual Report it was mentioned that a determination of 2,270 ± 185 million years had been made for specimens of Monazite collected from the South Savanna Granite. Additional age determinations have been undertaken at Oxford University under arrangement with the Directorate of Overseas Geological Surveys. The results which became available during 1961 are as follows:

Rock	Method	Indicated Age (Millions of years)
Morabisi Granite	Rb—Sr	918 ± 60
Kartabu Granite	K—A	1962 ± 80
South Savanna Granite	K—A	1356 ± 54

The wide divergence of determinations between the biotite and monazite of the South Savanna Granite probably reflects the difference between ages of emplacement and later metamorphism.

Helicopter Flights

A small helicopter was chartered for several flights in October-November 1961 and made it possible for the Director to visit the aluminous laterite deposits in the Kopinang area. The expense of such flights may be compensated by the time saved in reaching remote camps, improving the mobility of geologists, and providing the most effective form of reconnaissance flight over rain-forest areas. The particular machine available proved, however, of inadequate capacity to be of wide use for Geological Survey purposes in British Guiana.

Building Construction

Pursuing the policy of centralization of the Geological Survey at the headquarters in Georgetown, construction was completed during 1961 of a new building containing the Assay Laboratory, Rock Store, Carpenter's Shop and Garage Workshop.

A new boat house to accommodate Geological Survey river craft has been constructed at Makouria near Bartica.

Staff Conferences

Two staff conferences of senior officers were held during the year. These conferences afford opportunity for round table discussions of field work and of administrative matters connected with the field expeditions.

In addition a number of conferences of junior staff were held and lectures were given by geologists as part of a programme of in-service training.

Laboratory

Mr. D. D. Hawkes acted in the post of Chemist-Petrologist in charge of the Geological Survey Laboratory.

New equipment received during the year included a flame photometer and a spectrophotometer. Analytical work by these instruments has since been considerably speeded up.

Analysis of bauxites and laterites formed the bulk of work during the first half of the year, but emphasis later swung to geochemical determinations.

The following work was carried out:

Bauxite analyses	649
Geochemical analyses	550
Other analyses	28
Thin sections prepared	1124

In addition a number of mineral identifications and heavy mineral separations were undertaken.

The total number of chemical analyses performed amounted to 1227, almost exactly the same as the previous year but a great advance on 1959. The number of thin sections increased by about 200 on the figure for 1960 and included 41 thin sections of soils prepared for the Agriculture Department.

The work of the laboratory was highly satisfactory but with the new equipment now available and the completion of reorganization and rearrangement still in progress this section of the Department will be able to attain considerably greater output.

Drawing Office

Despite the fact that there were numerous staff changes the Drawing Office attained a record output of work, mainly involving the compiling and drawing of maps for publication and records, together with the preparation of maps for geologists' expedition reports.

Over 200 maps were drawn including 21 geological Quarter Degree squares compiled at 1/125,000 and published at 1/200,000. These published maps on record were reduced and the geological base map was compiled on a scale of 1:500,000 by pantographic and photographic reductions. During the course of the operation over 300 negatives were processed. The Controller of Govt. Printing and the B.G. Lithographic Company afforded valuable assistance in permitting the use of their cameras for negative reductions.

Over 3000 dyeline prints were made and over 300 maps were hand coloured.

High commendation is due to the Chief Draughtsman, Mr. T. M. Rahaman, and his staff for the admirable performance of the Drawing Office.

Library

The books in the library at year end amount to 8,308 all of which have been indexed.

The Department subscribed to and received on an exchange basis 44 different periodicals, thirty-six (36) being of a technical nature and 8 of administrative, commercial or general interest.

Books loaned amounted to 526 of which approximately ninety (90) are permanently on loan to the laboratory.

The following number of publications were loaned, catalogued and received:

Publications loaned	526
Publications catalogued	871
New Publications	768

A wide distribution of the publications of the department was maintained to more than 190 universities and college libraries, Geological Surveys, other institutions and individuals in 49 different countries. Many of these institutions send publications in exchange.

Publications cyclostyled for sale and free distribution

Bulletin No. 16	101 copies
Bulletin No. 19	99 copies
Mineral Resources Pamphlet No. 10	365 copies

Publications distributed during 1961:

	Sold	Free	Total
Bulletins	57	209	266
Annual Reports	39	133	172
Mineral Resources Pamphlets	10	391	401
Miscellaneous	11	19	30
Free Publications	—	756	756
Maps	55	2,171	2,226
	172	3,679	3,851

The compilation of the bibliography of the geology and mining of British Guiana by Mr. C. G. Dixon, Deputy Director, was completed and will be published in 1963.

Work on the compilation of the mineral index continued.

Forty-six (46) volumes were bound during the period under review.

Students of the Government Training College for Teachers continued to make use of the material in the library for compiling geographical and geological information to be used in various school projects.

Visitors

The Department welcomed numerous visitors during the year, many of whom made use of the library facilities. Amongst the visitors were the Hon. H. J. M. Hubbard, Minister of Trade and Industry, Mr. James Keen, Regional Representative of the United Nations Technical Assistance Board, Mr. A. E. Vargas, Consul General for Venezuela, Mr. Trafford Smith of the Colonial Office, London, Mr. H. Picking, Adviser on Banking and Currency to the West Indies Federal Government, Mr. T. H. Day, Dr. C. H. Robinson and Mr. E. Braun of the U.N.—British Guiana Soil Survey Project, Mr. Brian O'Brien, Pottery Consultant, I.C.A., Mr. R. Diephus, Hydrological Laboratories, Delft, Professor Theo H. Hills, McGill University, Professor Charles Bettelheim and Mr. Adolfe Dorfman, U.N. Economic Commission for Latin America.

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

Aero-Service Corporation
Alumina Jamaica Ltd.
Aluminium Laboratories, Ltd.
Colmar Surinam Oil Company
Demerara Bauxite Company Ltd.
Grupo Del Conte
Gulf States Lands & Industries, Inc.
Harvey Aluminum Inc.
Helicopter Sales (Caribbean) Ltd.
Huntings, Canada
Metcalf & Eddy International Inc.
Petromina (B.G.) Ltd.
Revere Copper & Brass Inc.
Reynolds Metals Co.
Roraima Mining Ltd.
Texaco Trinidad, Inc.

IV. MINERAL DEVELOPMENT

BAUXITE

The Demerara Bauxite Company opened its new alumina plant at Mackenzie in March and also continued exporting bauxite at a rate comparable with last year's high figures. Exploration for bauxite by this company and three others was energetically maintained.

1961 was the first full year for manganese exports from the North West District.

Diamond production from small workings was further increased.

As a result of the completion of the current Geological Survey mapping programme nine areas totalling 5,935 square miles were selected as promising for mineral exploration and a scheme for prospecting them by modern airborne methods will be sponsored by the United Nations Special Fund. Indications of secondary copper have already been discovered in one of these areas.

The oil prospects of the coastal and offshore regions of British Guiana were greatly enhanced by the results of pollen analysis studies.

British Guiana continues as one of the world's largest producers of bauxite. the f.o.b. value of ore and alumina in 1961 exceeding W.I. $40.5 million. Exports of all grades of bauxite in 1960 had an f.o.b. value of W.I. $26.3 million.

Exports — 1961

	Quantity (Long Tons)	Value (W.I.$ f.o.b.)
Alumina	120,161	12,083,588
Calcined bauxite	370,761	14,277,089
Bauxite	1,235,556	14,197,888
		$ 40,558,565

The largest producer is the Demerara Bauxite Company, a subsidiary of the Aluminium Company of Canada Ltd., followed by Reynolds Company which is increasing production. Harvey Aluminum of America and Petromina (B.G.) Ltd. continued exploration during the year.

Demerara Bauxite Company Limited

In March 1961 the Demerara Bauxite Co. opened an alumina plant at Mackenzie, the first in British Guiana and a major event in the history of the Company. Construction of the plant entailed an expenditure of W.I. $65 million. During the year over 120, 000 tons of alumina were shipped to Canada and Scandinavia. Production of calcined bauxite rose to 370,760 long tons as compared with the 1960 figures of 317,542 tons. Shipments were made to 22 countries, 37% going to North America and the remainder to Europe, Far and Middle East, South and

Central America, and Africa, 910,000 tons of dried bauxite were exported, 759,000 of which went to Canada for the manufacture of aluminium.

Additional investment of over W.I. $5 million included the purchase of a third walking dragline and the rebuilding of a drying kiln to produce calcined bauxite.

A bucket wheel excavator which will be capable of 5 million cubic yards of sand overburden annually was under construction during the year.

The Demerara Bauxite Company and the Reynolds Metals Company are collaborating with the Geological Survey of British Guiana and other bauxite companies in a palynological research scheme which should elucidate the stratigraphy of the sequence in which the bauxites occur and hence aid future exploration.

Reynolds Metals Company

During 1961 the Reynolds Metals Company exported approximately 325,000 tons of ore as compared with 200,000 tons in 1960. The increase was rendered possible by the investment of over a million U.S. dollars to further equipment including a new dragline excavator. Practically all production was consigned to the U.S. Government stockpile.

Development drilling was undertaken over the 18 Mombaka deposit and sampling of the N.W. block on a 200 ft. grid completed. Exploratory drilling was stepped up and five rigs were kept in operation during the year.

Petromina (B.G.) Limited

Exploration for bauxite was undertaken within E.P. 604 (Mowasi), an area bounded by the Potaro, Siparuni and Essequibo Rivers, and the Kurungiku Mountains. Laterites on the slopes of Mount Mahdiana were found to rise to 200 metres and resemble the partly detrital bench deposits round the Ebini Hills examined in 1959—1961. Investigations continue on residual laterites encountered elsewhere in the E.P.

Harvey Aluminum of America

The Harvey Aluminum of America Company held Exclusive permissions adjacent to the Essequibo and Corentyne Rivers, and in the Supenaam and Pomeroon Districts. A drill hole exploration programme was carried out continuously during the year under the direction of two geologists, but unfortunately did not encounter worthwhile bodies of bauxite.

Geological Survey

The Geological Survey pursued its investigations into the aluminous laterites of the Pakaraima Mountains. Surveys in 1961 were restricted to the Kopinang Basin; an area of approximately 300 square miles is now covered by reconnaissance pitting. It was shown that the higher values for Al_2O_3 were found in laterites overlying the hornfels member of the Roraima Formation. It now appears, however, that the prospect is slight of discovering deposits commercially exploitable by present standards.

MANGANESE

Northwest Guiana Mining Company Ltd.

Exports of maganese ore from British Guiana Commenced in 1960, 76,765 long wet tons being shipped from Port Kaituma. During 1961, 187,383 tons possessing an f.o.b. value of W.I. $5,373,790 were exported to Scandinavia and the U.S.A. Over 500 persons are now employed at the Matthews Ridge mines and Port Kaituma.

The grade of ore produced is somewhat lower than generally quoted on the world markets and careful control is required to ensure economic mining and to maintain an acceptable product. Despite rather adverse marketing conditions the company has been successful in obtaining purchasers.

During 1961 two new excavators were introduced. Modifications in the washing plant led to increased efficiency.

The geological staff varied between two and three geologists occupied in exploration and exploitation geology and geological mapping continued within the company's exclusive permission. Experiments were undertaken with geophysical (resistivity) methods in exploration for further ore.

DIAMONDS

General

In 1961 diamonds production increased by 11,676 metric carats (over the 1960 figure) to 112,680 carats. This increase was due mainly to activity in the Ekereku River area and a revival of the Upper Potaro diamond field. Most of the diamonds were produced from stream channels within the Pakaraima Mountains using diving and 'water-dogging' methods. Reports have been received of the successful use of gravel pumps in the Upper Kurupung River area. The amount of gravel recovered is said to be several times greater than that obtained by a crew of the same size using the usual hand methods. It is expected that such equipment will be widely used in the future.

Mazaruni District

Production in the Mazaruni District in 1961 showed a fall of more than 12,000 carats on the 1960 figure of 81,526 carats. This decrease is believed to be due to the departure from the district of many small miners attracted by the 'shout' in the Ekereku area, Cuyuni District. The Upper Kurupung area again yielded most of the diamonds of the district, with lesser amounts from the Upper Eping and Imbaimadai-Chi-Chi area.

In September and October 1961, an officer of the Department attempted to cut a trail from the Upper Kurupung area to the Upper Merume, but because of the rugged topography the attempt was not successful. However the existing trails in these areas were much improved by this field party, and the many new lines cut will be useful access routes to new ground for prospectors in the district.

Cuyuni District

Production in this district was 32,663 carats for the year, an increase of more than 100% over the 1960 output. This was mainly due to rich finds in the Ekereku River area within the Pakaraima Mountains. However output was decreasing towards the year-end as workable ground became exhausted.

Potaro District

The Potaro district produced 9,449 carats for the year, about three times the 1960 output. Most of these diamonds were won from the Potaro river and its tributaries above Kaieteur Falls. In October 1961 the Kaieteur National Park was thrown open to prospectors. It is hoped that with the increase of available working ground, production would increase further in the coming year.

GOLD

There are very few small miners engaged in the winning of gold due to the present boom in the diamond industry. Small quantities of gold are recovered with diamonds in most of the diamond fields of the colony.

The North West District continues to produce about 50% of the colony's output, most of it coming from W. A. Baird's workings on the right bank of the Barama River.

British Guiana Consolidated Goldfields Ltd. tried without success to find a purchaser for their property in the Potaro District. The colony's gold production is now less than 10% of the average during the years when this company operated. It is unlikely that production will show an appreciable increase unless a large scale operation is undertaken in one of the goldfields.

Petromina (B.G.) Limited

This Company decided to abandon their exclusive permissions 600 and 601 in the lower part of the Puruni Valley. This area was prospected with a view to ascertaining its potentialities for gold dredging. The results were disappointing but three gold claims were registered in the vicinity of Peter's Mine.

OIL

The results stemming from progress in the pollen analysis project have shown the presence of Tertiary and older formations and have placed British Guiana's oil prospects in a more encouraging light. During 1961 an American Company made an application for a large concession on British Guiana's Atlantic shelf, but at year end this had not yet been granted by Government.

Mr. R. McCall was appointed under the auspices of the United Nations Technical Assistance Board to advise the Government of British Guiana on petroleum leasing policy. He arrived in the country in December, 1961 and was based in the Geological Survey Department.

BASE METALS

Reference was made on page 12 to the selection of areas for airborne geophysical survey. A more detailed ground survey of one of these areas near Devil's Hole, Cuyuni River, has shown copper staining associated with a fracture zone. This indication that base metals may be present will be followed up by further exploration by geological, geochemical and geophysical methods.

V. PUBLICATIONS and REPORTS

The following were published during the year:

"The Buganda Group, Uganda, East Africa" by R. B. McConnell, Congr. Geol. Int. Mexico, Session. 1956 — 300 copies

"The Precambrian rocks of British Guiana" by R. B. McConnell, *Timehri*, J. Roy. Agric. Comm. Soc. British Guiana, No. 40 — 300 copies

"Flow folding in rocks", by Emyr Williams Nature, Lond. vol. 189, No. 4763, Feb. 11, 1961 — 300 copies

"The deformation of confined incompetent layers in folding" by Emyr Williams, Geol. Mag., Vol. 98, No. 4, July-August 1961 — 300 copies

"Index to 1:200,000 Geological Atlas of British Guiana — 1000 copies

"Mineral Resources Pamphlet No. 10 "Preliminary report on Ferruginous of the Pakaraima Mountains (Cyclostyled) by J. H. Bateson — 365 copies

The following unpublished maps and reports were prepared:

R. B. Mc Connell, Director

Report on the 21st Session of the International Geological Congress held in Scandinavia, August-September, 1960, RBM 1/61.

Report on a visit to Venezuela from 19 to 27 January, 1960 — Summary of Geological Results, RBM 2/61.

Memorandum on the underground water resources of the Coastal area of British Guiana, RBM 3/61.

Memorandum on the Precambrian Rocks of British Guiana, RBM, 4/61.

Report on the Surveys for Economic Mineral Deposits in the Northern Range, Trinidad, and in Tobago with particular reference to Iron Ore, RBM 5/61.

Exploration for Oil in British Guiana, RBM 6/61.

C. G. Dixon, Deputy Director and P. I. Morris, Geologist

Geology of the area between Omai Landing and Demerara River, CGD 1/61.

Map of a portion of the Demerara and Essequibo Rivers 1:125,000.

R. T. Cannon, Senior Geologist

A Preliminary Report on the Geology of the Omai (NW) Quarter Degree Square, RTC 1/61.

Notes on a short visit to the South Savannas, Rupununi District, RTC 2/61

Geological Map of the Kaburi-Rockstone Area 1:125,000: P6/F1/26
Geological Map of the Kaburi-Rockstone Area 1:125,000: P6/F1/26(a)

Map showing locations of Rock Specimens of the Kaburi-Rockstone Area: 1:125,000: P6/F1/26(b)

R. T. Cannon, Senior Geologist and P. M. Allen, Geologist

A Preliminary Report on the Geology of the Devil's Hole Range, Cuyuni River, RTC 3/61.

Map of the Geology of the Devil's Hole Range Cuyuni River P3/F3/30: 1:40,000 (Approx).

E. Williams, Senior Geologist

Notes on the Peaima Falls-Merume River Area, Mazaruni Expedition, EW 1/61.

E. Williams and R. T. Cannon, Senior Geologists

Report on a visit to Venezuela, EW 2/61.

Map of part of the Cuyuni, Wenamu River Mouth — Eldorado, Venezuela showing locality of samples 1:250,000 P9F/F4/35.

E. Williams and P. B. H. Bailey, Senior Geologists

Cuyuni River Traverse (Mukru River Mouth to Torumpang Landing Pool), EW 3/61.

Geological map of Part of the Cuyuni River (Kanaima Itabu—Ankoko Id.) 1:125,000: P3/F1/25.

P. B. H. Bailey, Senior Geologist

Note on Microfossils found in the Roraima Formation of British Guiana, PBHB 1/61.

Map: Fossil locality at Korlumeduwak, Kako River 1:50,000: P5/F1/4(a).

Paruima-Wenamu-Ekereku Area, PBHB 2/61.

Geological Map of the Paruima-Wenamu-Ekereku area 1 : 125,000 with six figures and sections: P5/F1/17.

Wenamu Traverse, PBHB 3/61.
Geological Map of Wenamu Traverse: 1:125,000: P3/F1/27.

J. H. Bateson, Geologist

Geology of the Kopinang Valley, JHB 1/61.

Geological Map of the Kopinang Valley 1:125,000 P7/F1/15 (with rock overlay and 13 figures and sections).

Report on the investigation of the laterites of the Pakaraima Mountains to examine the potential as a source of bauxite, JHB 3/61 (Published as MRP 10).

A note on the Geology of the Essequibo River between Pott Falls and Itanime, JHB 5/61.

Map showing Geology of the Essequibo River between Itanime and Pott Falls 1:30,000 (Approx.) (with two figures) P7/F3/22.

Geological Note on a short traverse of the Merume River above First Falls. JHB 6/61.

Structural Map of the Merume River 1:125,000: P5/F3/8.

J. H. Bateson and M. G. Allderidge, Geologist

Geology of the area bounded by the Mazaruni, Kaburi, Kuribrong and Waiamu Rivers, JHB 2/61.

Map showing structure of Issano-Apanachi Area 1:500,000: P5/F2/8.

Map of the Area bounded by the Mazaruni, Kaburi, Kuribrong and Waiamu Rivers 1:200,000: P5/F2/10.

M. G. Allderidge, Geologist

Geology of the Lion Mountain Area, MGA 1/61.

K. Bramley, Geologist

Barima Head Expedition, Preliminary Field Report KB 1/61.

Localities of rock specimens and soil samples of an area between the Upper Barima River and the Amakura River 1:125,000: P1/F2/16(a).

Map of an area between the Upper Barima River and the Amakura River showing localities of rock specimens and soil samples used in analyses for lead, zinc and copper 1:125,000: P1/F3/16(b).

Geological map of the area between Upper Barima River and the Amakura River 1:125,000: P1/F3/16(c).

M. W. Carter, Geologist

Expedition Report, Karasabai-Annai Survey, MWC 1/61.

Geological Map of Karasabasi-Annai Area 1:100,000: P7/F1/19

Map showing locations of Rock Specimens of Karasabai-Annai Area 1:100,000 P7/F1/19(a).

D. D. Hawkes, Geologist

A Note on the Geochemical Dispersion of Arsenic in relation to Gold Mineralization at Marudi Mountain, DDH 1/61.

Frequency diagram of arsenic content of soils from Marudi Mountains. P9/F3/11 and P9/F3/12.

S. Singh, Geologist

Geology of the area from Monkey Mountain, across the Enwarak, Akorobi and Kurungiku Mountains to Ebini Mountain, SS 1/61.

Geological Map of the Area from Monkey Mountain across the Enwarak Akorobi and Kurungiku Mountains to Ebini Mountains 1:125,000: P7/F1/17.

Rock overlay of map above 1:125,000: P7/F1/17 (a) (including one section).

Preliminary Report-Middle Rupununi River-Upper Rewa Survey Western Sector, SS 2/61.

Provisional Geological Map of Middle Rupununi—Upper Rewa Survey, Western Section 1:50,000: P9/F3/9.

O. St. John, Scientific Assistant

Report on the area between Wakawakapu Landing, Mazaruni River, and Sakaika Landing Ekereku River, OSJ 1/61.

Map of the Area Between Wakawakapu Landing, Mazaruni River and Sakaika Landing Ekereku River showing the trail. 1:25,009 P3/F1/26.

APPENDIX I

PRELIMINARY GEOLOGICAL REPORTS

A. WENAMU TRAVERSE

P. B. H. Bailey, Senior Geologist.

During the first field season the Wenamu River was traversed by boat in a southerly direction from the mouth to a point some 12 miles short of the source. The river drops through several main stages from 950 feet to 320 feet above sea level at its confluence with the Cuyuni. Its valley is bounded by horizontal sandstone scarps (ca. 2570 feet above sea level) to the east and south.

The age relationship of the rocks is:

6) Recent alluvium
5) River terrace deposits
4) Younger Basic Intrusive Group
3) Roraima Formation
2) Younger Granites
1) Mazaruni Group
   - Older Basic Intrusives
   - Amphibolites and Hornblende Schists
   - Haimaraka Formation
   - Cuyuni Formation

The Cuyuni Formation outcrops over much of the middle and lower reaches of the river and comprises sediments, various categories of metamorphic rocks and some igneous rocks which are foliated in a general north-westerly direction. Further south, rocks with recognisable sedimentary characteristics tend to disappear and be replaced by hornfelses and chlorite and hornblende schists. The sedimentary rocks are fine to coarse-grained feldspathic sandstones with siltstones, minor mudstones, pebbly sandstones and conglomerates. The metamorphic rocks include dark grey hornfelses and schists ranging from leucocratic quartz-muscovite schists to dark actinolite-quartz schists. Feldspar porphyries, quartz-feldspar porphyries and some fine-grained rocks, probably lavas, also seem to be interbedded with Cuyuni Formation rocks and are classified with them.

The Haimaraka Formation is generally fine-grained and consists of well-bedded siliceous siltstones, fine to coarse-grained sandstones and mudstones and is best exposed near Eteringbang (Torumpang) on the Cuyuni River. Most sandstones appear to be feldspathic and in general the formation suggests a greywacke suite.

Mapped as amphibolites and hornblende schists are rocks showing considerable development of amphibole, although some may have originated as sediments and others as igneous rocks. The region of amphibolite-rich rock is notable for numerous outcrops of reef quartz, some probably gold bearing.

Intrusive dolerites showing a degree of alteration, indicated by a dull green appearance and blurring of crystal outlines, are mapped as Older Basic Intrusives. The largest exposure appears in the Cuyuni River between the rapids of Mora and Eteringbang.

A large granite mass, typically of biotite granite, was mapped in the upper Wenamu. Several smaller bodies of post-Mazaruni granite were noted lower down the river.

Peneplanation of these rocks was followed by the deposition of the Roraima Formation, probably only represented now in the Wenamu region by its lower member. The dominant rock-type is a thin to thick bedded, medium to coarse-grained sandstone, sometimes with a scattering of small rounded quartz pebbles. Feldspathic sandstones, siltstones and shales also appear. The plane of unconformity at the Roraima Formation base dips north at an angle greater than the present day Wenamu drainage slope. A northerly dip of Roraima Formation bedding is also suggested by the drainage pattern further east.

Dolerites classified as belonging to the Younger Basic Intrusive Group intrude the Roraima Formation and earlier rocks in the form of dykes and sills. Apart from minor dykes, two large dykes cross the Wenamu at Tunapung Fall and Coolie Fall. The 900 feet wide Tunapung dyke cuts the upper Wenamu granite mass and is marked by a ridge some 300 feet above the general valley level. Typically it consists of a fresh looking augite dolerite and contrasts with the more greenish, slightly altered dolerite of the less wide Coolie Fall dyke, the classification of which in the Younger Basic Intrusive Group must remain less certain. A large intrusion of norite, probably in sill form and possibly marking the local base of the Roraima Formation, was noted at the southern boundary of the upper Wenamu granite. Extensive areas of dolerite were noted in the Muruwa-Ekereku trail; at least two sills may be identified, one above and the other below the level of the Ekereku savanna, but a single ground traverse and aerial photographs have not explained some peculiarities in the lower sill.

Fairly extensive terraces at about 100 feet above river level occur in the Tshuau-Korabu area. The most extensive areas of alluvial deposits are above Tunapung Fall.

Alluvial diamonds are considered to be derived from conglomerates of the Roraima Formation and, as these are well represented in the scarps to the east and south, all streams are potentially diamondiferous. Gold may be derived either from Roraima Formation conglomerates, like the diamonds, or from vein quartz emplaced within Mazaruni Group rocks, most probably the amphibolites.

B. REPORT ON A VISIT TO VENEZUELA, APRIL 1961

E. Williams and R. T. Cannon, Senior Geologists.

The writers flew to Eteringbang in the upper Cuyuni River and met Venezuelan delegates of the *Ministerio de Minas e Hidrocarburos* at the mouth of the Wenamu River on the international boundary. The Cuyuni River was then traversed from the mouth of the Wenamu River to El Dorado. From El Dorado the party proceeded by road to the gold-mining district of El Callao. In

this area and on the Cuyuni River occur rocks resembling those of the Cuyuni Formation and Haimaraka Formation in British Guiana. The association of pillow lavas in the El Callao area, so far as is known, is unique. The type area for these rocks (the Pastora Formation) was also examined. They have previously been described as dominantly tuffs but it is suggested now that they are sediments, similar to those of the Cuyuni and Haimaraka Formations[1] and consisting of greywacke sandstones, of turbidity current origin, interbedded with mudstones, and their schistose equivalents.

The party examined the Carichapo Formation (leucocratic gneisses and subordinate amphibolites) in road sections from El Callao to Upata. The party stayed at El Pao and examined the iron mine at this locality where high grade iron ore is being mined by the Bethlehem Steel Corporation.

From El Pao the party proceeded to Puerto Ordaz and were taken on a tour of a large Government steel plant nearing completion. On the Caroni River present and proposed dam sites of a large hydroelectric project were examined.

The party left Pto. Ordaz for Cuidad Bolivar on the Orinoco River.

The Imataca Formation was examined over a wide area — along the roads from Sante Maria to El Pao, from El Pao to San Felix, from Ciudad Bolivar east to La Encrucijada and south to Cerro Bolivar and also at Ciudad Bolivar itself and on the Caroni River near Pto. Ordaz. It consists of dominant biotite gneisses with bands of ferruginous quartzites, charnockites, amphibolites and occasional biotite schists. The large iron deposits at present being worked at El Pao and Cerro Bolivar are derived from the ferruginous quartzites.

From Ciudad Bolivar the party proceeded to Cerro Bolivar to visit the iron mine of the Orinoco Mining Company before returning to the Cuyuni River via El Callao and El Dorado.

Two Venezuelan delegates, Dr. A. Bellizzia and Dr. H. Korol, accompanied the writers on a traverse down the Cuyuni River from the mouth of the Wenamu River to Bartica. Rocks of the Cuyuni and Haimaraka Formations, the Barama Group, the Younger Granites and the Bartica Assemblage were examined enabling the Venezuelan geologists to obtain a comprehensive view of the geology of northern British Guiana.

C. THE GEOLOGY OF THE OKO MOUNTAINS- BLUE MOUNTAINS AREA

By R. T. Cannon. Senior Geologist.

An area in the lower Cuyuni River bounded by the Oko Mountains and the Blue Mountain was mapped during the second field season of 1961. The following rock types were mapped.

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1. Williams, E. Notes on the Peaima Falls-Merume River Area. Geol. Surv. B.G., Ann. Rep. for 1960, App. C, pp. 44-46 (1961).

Laterite		
Undifferentiated sands	Berbice Formation	
Hornblende-biotite granite	Young Granites	
Biotite microgranite Muscovite-biotite granite Biotite gneisses Hornblende-biotite gneisses Amphibolites	Bartica Assemblage	
Amphibolites, quartzites and undifferentiated schists	Blue Mts. Formation	Barama-Mazaruni Assemblage

The gneisses of the Bartica Assemblage are an extension from the east around Bartica[1]. The term Blue Mountains Formation is proposed for the large area of dominant amphibolites with subordinate quartzites and undifferentiated schists forming the Blue Mountains and the Oko Mountains. The various rock types are interbanded and folded. The association of these rock-types at or near the margin of the Bartica Assemblage suggests that they are related to the emplacement of the latter in a similar manner to the small areas of interbanded amphibolites and quartzites on the margin of the Devil's Hole Gneisses[2].

Hornblende-biotite granite occurs in two areas: in the northwest forming a part of the large granite batholith of the Quartzstone-Aremu area and a smaller area between the Oko Mountains and the Blue Mountains. A leucocratic and a melanocratic facies have been mapped. Dykes of the granite intrude the Blue Mountains Formation and a large xenolith (approximately half a mile in extent) of Bartica Assemblage gneisses occurs within the smaller granite area.

Several shear zones occur in both the Blue Mountains Formation and the granite. In the latter schistose granite occurs in well-defined belts trending either east-west to northwest-southeast.

Undifferentiated white and brown sands occur mantling all the above rock types. A well-dissected laterite cap occurs on the Blue Mountains Formation forming a flat-topped surface at approximately 1000 feet above M.S.L. in the Oko Mountains and 800 feet in the Blue Mountains. The surface slopes gently northeast (as do the sand-topped hills of the Bartica Assemblage) towards the Berbice downwarp[1,3]

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1. Cannon, R. T. Geol. Surv. B.G. Quarter Degree Sheet 0658 SW (1961).

2. Cannon, R. T. and Allen, P.M. A Preliminary Report on the Geology of the Devil's Hole Range, Cuyuni R., *Geol. Surv. B.G.*, unpublished report (RTC 3/61).

3. Hardwick, P. and Matthews, P. F. P., Report on the Saxacalli-Blue Mountains-Oko Mountains Area *Geol. Surv. B.G.* Ann. Rep. for 1952, Appendix 111b, pp. 43-59 (1953).

D. POTARO—KURIBRONG EXPEDITION

by C. N. Barron, Geologist.

The area consists of lowlands between 230 and 450 feet above M.S.L. which are underlain by granites and steeply folded rocks of the Mazaruni Group, and largely covered by dissected sandy deposits of the Berbice Formation. Along its western edge the area is overlooked by the high plateaux of the Roraima Formation, composed of almost horizontal sandstones and intruded by a thick sill of norite gabbro. It is drained by the Potaro River along the southern margin and by the Kuribrong River along the northern and western margins; both rivers rise on the Roraima plateaux to the west.

The succession in the area is:

7) Berbice Formation

6) Younger Basic Intrusive
   - (b) Dykes
   - (a) Noritic Gabbro Sill

5) Kanaima Porphyry

4) Roraima Formation

3) Granites { Kuribrong / Kangaruma

2) Patience Creek Formation

1) Mazaruni Group

The Mazaruni Group in this area is generally in the lower greenschist facies of metamorphism and is folded and usually well cleaved. No succession has been established within the Group, but the principal lithological types are distributed as follows. Well bedded quartz greywacke sandstones with laminated mudstones occur at Waratuk and Amatuk Falls and the Kurupaea embayment on the Potaro River, and in the Itawa and Embiparu River areas on the Kuribrong River; load casts and current graded bedding are prominent in the last named vicinity. Ribbed, dark aphanitic igneous rocks are well developed below Ichaura Falls on the Potaro River, and around Bajani Bay on the Kuribrong River, and are locally vesicular. Pebbles of similar material in a poorly sorted matrix occur on the Kuribrong River below Bajani Bay. Muscovite schists form a distinctive northwest-southeast aligned formation on the Kuribrong River above and below Long Portage Falls. On the downstream side they pass into intensely sheared conglomerates which are otherwise similar to those mentioned above.

The foliations of these rocks generally dip very steeply and vary from a regular northwest-southeast strike among the muscovite schists and sheared con-

glomerates in the northeast to a broadly similar but much more variables direction further to the west. Where the bedding is visible it is generally steeply dipping, but with an even more variable orientation than the foliation and frequently oblique to it.

The Kuribrong Portage Granite carries hornblende and often shows marked orientation of minerals and xenoliths, roughly parallel to the foliation of the adjacent muscovite schists. The Kangaruma-Ewang-Curetoma Granite is an xenolithic biotite granite with striking pea-like quartz phenocrysts, often accompanied by large red potash feldspar porphyroblasts. Occasionally the quartz phenocrysts show a marked north-south elongation, parallel to the feldspar porphyroblasts.

The Patience Creek Formation consists of both massive and well-bedded unmetamorphosed quartz sandstones and rare pebble beds, dipping between horizontal and 60°. Near the middle Ewang they appear to rest on schists of the Mazaruni Group, but are distinguished from the Roraima Formation by their local steep dips.

The Roraima Formation in this area comprises up to 1500 feet of coarse, round quartz sandstones, sometimes pebbly and often coarsely bedded with occasional beds of sandstone boulders. Current and festoon bedding and probable convolute folding some 7 feet high, occur locally. The base of the Roraima Formation rises from 235 feet at Amatuk Falls to 115 feet on the south side of the Ewang Gorge, where it lies on a level, eroded surface of granite. There is nowhere a basal conglomerate. The Roraima Formation in this area is intruded by a sill of noritic gabbro some 700 feet thick. A distinctive quartz conglomerate horizon shown by Rust[1] to lie at a fairly constant 1100 feet has now been traced as far as Kite Mountain, on the Itawah-Ewang divide. Here, and elsewhere, it has been lifted by the intrusion of the sill into the Roraima Formation beneath, the difference in elevation being the measured thickness of the sill.

Dyke-like intrusions of dark sericitised porphyry with bi-pyramidal quartz phenocrysts intrude the Roraima Formation at about 1800 feet above the base on Kanaima Mountain, and small chloritised trachyte dykes intrude the base at Amatuk Falls.

E. FURTHER INVESTIGATION OF LATERITES, KOPINANG BASIN

by J. H. Bateson, Geologist.

Further pitting was undertaken in the Kopinang Basin where aluminous laterites have been investigated by previous expeditions. 48 more pits were dug and sampled to a depth of 6 feet.

1. Rust, B, 1959, Prel. Rep. on Geol. work, Oxford Univ. Expdn. Br. Guiana, 1959. Files of Geol. Surv. B.G.

Analyses of the laterites show lower values for the Al_2O_3 and higher values for the Fe_2O_3 and SiO_2 content than were obtained from earlier investigations. Evidence showed, however, that the higher than average Al_2O_2 content was found in the laterites developed on the hornfels member of the Roraima Formation which overlies the dolerites.

Two areas of relatively low SiO_2 (less than 8%) were also found; the reason for this is uncertain but it is thought that it may be due to the lower SiO_2 content of the dolerite in these regions.

The result of the general pitting confirm that the laterites developed on the dolerite are submarginal at best and offer little hope of economically important deposits of bauxite.

F. SHORT TRAVERSE OF THE MERUME RIVER ABOVE FIRST FALLS

by J. H. Bateson, Geologist.

The greywacke sequence of the lower Merume River continues above the First Falls. The commonest lithological type in this part of the river is the well-bedded purple and mauve mudstones, interbedded with which are occasional greywacke sandstones and recrystallized siliceous mudstones.

Folding was demonstrated along northwest-southeast and east-west axes with plunges usually in the order of 20-35 degrees.

G. GEOLOGY OF THE ESSEQUIBO RIVER BETWEEN POTT FALLS AND ITANIME

by J. H. Bateson, Geologist.

The Muruwa Formation in the area consists mainly of sandstones with greywackes and mudstones of lesser importance. Folding along northwest-southeast axes was demonstrated with limbs dipping up to 30 degrees. The folds plunge gently to the northwest.

The presence of a pre-Muruwa Formation, the Allegro Island Formation, is postulated. The Allegro Island Formation typically consists of thin quartzite bands interbedded with thicker schistose bands. Steep dips (over 70 degrees) are common with the formation folded about northeast-southwest axes.

The Muruwa Formation is cut by dolerite dykes and also by acid porphyries thought to be related to, but slightly earlier than, the Younger Granites.

H. A NOTE ON THE GEOCHEMICAL DISPERSION OF ARSENIC IN RELATION TO GOLD MINERALIZATION AT MARUDI MTN.

by D. D. Hawkes, Geologist.

(based on chemical analyses by M. D. Hope)

Two hundred and fourteen soil samples from the Marudi Mountain area have been analysed for arsenic content, against the probable prospect of there being a gold-arsenic association in this region. Examination of the result has shown that there is a high frequency of samples containing between 0-29 p.p.m. arsenic. The mean of these values, which is 10 p.p.m., is taken as the regional background count. The value for the threshold (130 p.p.m.) has been calculated using the mean background count plus twice the standard deviation. Five main and six smaller areas of anomalous arsenic values have been located and in two instances these apparently mark the extension of known gold veins. A maximum to background ratio of 50:1 represented the greatest contrast.

I. PRELIMINARY REPORT — MIDDLE RUPUNUNI RIVER — UPPER REWA RIVER SURVEY — WESTERN SECTOR

by S. Singh, Geologist.

Thirteen weeks of the first field season of the year were spent in the northern sector of the South Savanna (northwest) quarter degree square. The purpose of the survey was to determine by detailed mapping the relationship between the South Savanna granite and the biotite gneisses of the Kanuku Group, and also to determine the relationship to both of the granulites and charnockitic rocks which occur in the biotite gneisses. Any economic mineral deposits were to be reported on.

The writer has found abundant evidence which indicates that the South Savanna granite has an intrusive relationship with the Kanuku gneisses in this sector and is younger than the latter.

The South Savanna granite seen here is strongly porphyritic. Three textural facies can be recognized on the basis of the size of feldspar phenocrysts. Enclaves of biotite gneisses and biotite schists are numerous in addition to smaller rounded to sub-rounded xenoliths. Feldspar phenocrysts and xenoliths show an overall alignment of their long axes.

The biotite gneisses of the Kanuku Group are banded, acid gneisses containing varied assemblages of minerals of the amphibolite facies including biotite, cordierite, garnet, sillimanite, quartz and feldspar.

Granulites and charnockitic rocks occur in the biotite gneisses as concordant dark bands, boudins and larger bodies. There are hypersthene and non-hypersthene bearing rocks varying in composition from acid to basic types. Charnockites, enderbites, alaskites, garnet granulites, pyroxene granulites and various other rock types have been identified.

J. THE MIDDLE RUPUNUNI RIVER-UPPER REWA RIVER SURVEY EASTERN SECTOR-KWITARO-REWA SECTION

by S. Singh, Geologist.

The period September to November, 1961, was spent in a survey of the Kwitaro-Rewa sector containing the eastern fringes of the Kanuku Mountains. The objects of this survey were to ascertain whether the biotite gneisses of the Kanuku Group and the South Savanna Granite continued into these eastern parts of the country, to report on any economic prospects and to compile a geological map of the area.

It was found that the South Savanna Granite continues in the south of the area crossing the Kwitaro just south of Damapau and continuing across the Rewa. As in the South Savannas it shows an intrusive relationship with the country rock. In the north of the area the main mass of the granite dies out but apophyses occur in the biotite gneisses and these contain varying proportions of incorporated material.

The biotite gneisses of the Kanuku Group also continue across the area with a slight swing in the strike of foliation but retain all the structural and mineralogical characteristics displayed by the same types in the savannas to the west.

Between these two large groups occur low grade, strongly schistose rocks very much resembling those forming the great Katiliriwau enclave west of Shea Village, which have been certainly correlated with the Kanuku Group.

K. POTARO-ESSEQUIBO-SIPARUNI SURVEY

by M. W. Carter, Geologist.

The area studied was the country to the west of the Essequibo between Mowasi Landing and Muruwa mouth. The work included the mapping of the Kumuti-Twasinki Mountains and the Konawaruk-Essequibo watershed between Mowasi Landing and Lizard Point. A total area of approximately two hundred square miles was mapped to a scale of 1:125,000.

The rocks may be grouped in probable stratigraphic order, thus:

5. Norite, dolerite and basalt dykes
4. Granite, granitic-granophyre and granite-porphyry
3. Fresh and altered dolerite and gabbro
2. Muruwa Formation
1. ? pre-Muruwa Formation

The rocks of the Pre-Muruwa Formation are considered to be possibly the oldest formation mapped. They are exposed in two areas in the Essequibo: one at Monkey Point near Mowasi Landing, and the other between Itanime and Sloth Falls, and comprise a series of fine grained very dark bluish-green igneous and sedimentary rocks associated with pink feldspathic sandstones of coarser grain and associated quartzites. Feldspar-porphyries and very fine grained trachytic rocks are also included. The series is marked by a well developed foliation which in the Monkey Point area is WNW-ESE and E-W, and in the Itanime-Sloth Falls area is generally N-S. In some cases very complex micro-folding due to shear occurs but this affects only the very fine-grained rocks. This strong deformation is not observed in the Muruwa Formation which may, therefore, be younger.

The Muruwa Formation comprises a series of medium and coarse-grained white and pink sandstones, siltstones, jaspers, argillaceous sandstones and, in the Muruwa River rhyolitic tuffs. A conglomerate band occurs at Pineapple Falls in the Muruwa River. The rocks are folded. In the Kumuti-Twasinki Mountains they dip inwards beneath norite and appear to form a basin structure. An attempt was made to trace the Muruwa Formation westwards into the Konawaruk area but was unsuccessful.

Along the left bank of the Essequibo River on the southern flanks of Twasinki Mountain fresh dolerite and gabbro similar to those of the Younger Basic Intrusive Group occur below the Muruwa sandstone. To the north-west of these and continuing to within one and a half miles of the Konawaruk are altered gabbroic, doleritic and basaltic rocks. Neither flow banding nor pillow structure was observed in the fine-grained basaltic types. Only in one place were these rocks seen to be foliated: in the immediate neighhourhood of a basaltic dyke and near the granite contact region about one and a half miles below the Good Hope-Mowasi confluence. The altered basic rocks are pre-granite, as is shown in the Mowasi Goldfield and are associated with gold mineralization.

Granite rocks occur in the Mowasi-Monkey Point region, the Itanime—Sloth Falls area, and in the Konawaruk near Lizard Point. The Mowasi-Monkey Point granite is a leucocratic, generally massive, only occasionally foliated biotite-granite which becomes markedly hornblendic as the contact with the altered dolerites or the foliated ? pre-Muruwa rocks is approached. The Itanime-Sloth Falls granitic rocks comprise medium-grained biotite granites, granitic-granophyres and granite-porphyries and occur in narrow dyke-like intrusives cutting the Muruwa Formation and altered basic rocks. The Konawaruk granite is a medium to coarse-grained biotite granite and hornblende-biotite granite

associated with feldspar porphyries. The granites are later than the altered basic rocks but were not found cutting the noritic sill above the Muruwa Sandstones. They are classed as Younger Granites.

Norite occurs as a sill above the Muruwa Formation in the Twasinki-Kumuti Mountains. The sill is grouped with the Younger Basic Intrusive Group.

Prospecting in the eastern flanks of the Twasinki-Kumuti Mountains yielded no gold or diamonds associated with the sandstones. Gold has been worked in the Upper Mowasi but the Mowasi Goldfield is now abandoned. Pink-tinged, nickeliferous minerals were commonly seen in the altered dolerites in the Mowasi region.

L. THE PURUNI-KARTUNI WATERSHED

by M. W. Carter, Geologist.

The object of this survey was to check the photo-interpretation of the Puruni-Kartuni watershed between the mouth of the Pashanamu (on the Puruni) and the Tumeno (on the Kartuni). A total area of 400 square miles was mapped and plotted on a scale of 1:125.000. A time and compass traverse was made of the Kartuni River from the northermost limit of the photo-cover to a point about 1 mile below the Kromeparu Creek Mouth.

The rocks may be grouped in probable stratigraphic order. thus :

5) Fresh dolerite

4) Granite

3) Altered dolerite and gabbro

2) Granite-gneiss

1) Feldspar and quartz feldspar porphyries

The porphyries apparently cover a wide area but owing to the paucity of exposures little information was obtained about them. The rocks are pink, grey, dark grey, and cream in colour, some of which are non-porphyritic. In the non-porphyritic types flow structure is locally well developed. Where it is recognizable the strike is northwest-southeast. Well developed cleavage and schistosity is to be seen in the region about one mile below the Pashanamu mouth. The strike of the schistosity is northwest-southeast in accord with the trend along the Puruni River in this area. Associated with these rocks are minor fine-grained, dark blue altered basic rocks. Sediments are rarely seen in this area. Only one exposure of sandstone was found.

Granite-gneiss is exposed in the Puruni River between the Pashanamu and the Rumong-rumong Rivers. A small exposure also occurs in the Puruni about one mile below the mouth of the latter.

A study of the air photographs of the area showed a large outcrop of granitic rocks extending northwards from a point about eight miles north of the Puruni River. Very few exposures were found at the southern boundary of this outcrop, but the rocks exposed include hornblende and hornblende-biotite granite. No megascopic foliation was observed in these rocks and they are therefore separated from the granite-gneisses. The western portion of this mass was not studied. In the Kartuni River between the Kromeparu River and the Kurupara Creek very acid granitic rocks were mapped. These rocks extend southwards and were found to be part of the mass just described. Away from the river the rocks were seen to become basified and are in fact dark, unfoliated hornblendic and biotitic granites. The rocks are very similar to those described in the immediate north and known as the Aurora Granite. The Kartuni Granite is thus considered by the writer to be part of the Aurora batholith.

Fresh dolerite occurs as dykes and irregular bodies cutting the porphyries and the granitic rocks. These are similar to the dolerites of the Younger Basic Intrusive Group.

Exposures of altered dolerite and gabbro which are non-foliated, were found along the Kartuni River about one mile above Marehugi Fall. These rocks also form high ground to the west of the river but do not form as large an outcrop as shown on the map drawn from the photo-interpretation. The rocks are dark green in colour and in some cases large phenocrysts of amphibole can be seen.

The disposition of these rocks has already been mapped along the Puruni and Kartuni Rivers. It was found impossible to establish the distribution away from the rivers owing to the absence of exposures.

Prospecting results in the area were disappointing. Gold colours were found near Camp 7 along the left bank tributary of the Puruni about one mile below the Pashanamu mouth. Pitting showed that there was very little gravel in most of the country in the southern half of the area. The rocks have been deeply weathered and eroded to produce large areas of swampy, muddy country. In the Kartuni area to the north, gold colours were found in the creeks traversing the Kartuni Granite. Gravel was found in the pits and the rock is similar to the Aurora Granite.

M. THE LION MOUNTAIN AREA

by M. G. Allderidge, Geologist.

Lion Mountain and the neighbouring mountain on the west are two prominent features,1300 feet above M.S.L., on a belt of hilly country which stretches southwest from the Blue Mountains to the Takutu Mountains. The area lies between the gneisses of the Bartica Assemblage and the main area of the Cuyuni Formation.

The country immediately surrounding these two mountains is occupied by a hornblende-biotite granite which has marginal intrusive relations. It is gneissose, uniform in composition and texture and carries gold. It is thought to belong to the Younger Granites.

It is tentatively suggested that Lion Mountain and its neighbours are foliated masses, equivalent to the Cuyuni Formation, lying as roof-pendants within the granite. The rocks are predominantly fine-grained, acid and intermediate igneous types with intercalated quartzites and cherts. The latter are considered to be sedimentary in origin. This sequence differs from the rocks of the Cuyuni Formation around Mara-Mara to the northwest in that they are predominantly igneous with few sedimentary intercalations, whereas at Mara-mara the reverse occurs.

The sequence also differs in the abundance of amphibole-rich rocks which can be divided into two categories. Firstly there are local occurrences of amphibole schist at the margins of the mass where it is in contact with the granite; these are considered to be part of the intrusive aureole of the granite. Secondly there are frequent coarse and medium-grained amphibole-feldspar rocks showing alteration, particularly of the amphibole to chlorite. The chlorite often shows a marked orientation, whereas the amphibole does not. These rocks are thought to belong to the Older Basic Intrusive suite.

These rocks have suffered mild metamorphism of a similar character to the regional metamorphism affecting the rest of the Cuyuni Formation. It is manifested as a southwesterly directed cataclastic foliation, varying in intensity, marked by sericite and chlorite in the foliation planes. As a result of this many of the rocks are now represented by chlorite schists. The alteration of the older basic rocks and the presence of oriented chlorite in them is due to the same metamorphism.

The granite lying beneath the rocks of the Cuyuni Formation is in continuity with the granites in the Puriari area, and appears to be of considerable extent although its southern boundary has not been mapped. It is of interest in that it occurs at the margin of the Bartica Assemblage as do the Peter's Mine and possibly the Aremu granites. All are gold bearing and have been centres of considerable gold workings in the past.

N. GEOLOGY AND MINERALIZATION OF THE MARUDI GOLD MINE AREA.

by J. W. Carter, Geologist.

The Marudi Gold Mine is situated in the Rupununi District of British Guiana. A considerable amount of gold has been won from Alluvials, but under ground mining has not been established.

Mineralization is restricted to a zone, approximately four miles long and two miles wide, trending in a N W direction. The distribution of the viens is spatially related to the margins of an intrusive grandiorite.

Auriferous quartz veins are found mainly where hornblende schists have been hydrothermally altered. These schists are associated with amphibolites and meta-sediments and together they form the oldest rocks of the area. In early Pre-Cambrian times low grade regional metamorphism affected all the rocks of the Marudi Mountain area.

A major tectonic period, subsequent to the metamorphism, culminated with the emplacement of the South Savanna Granite. Fracturing and faulting were associated with this period of granite emplacement, but all these events preceded the important mineralization epoch.

At the mine almost all the rocks show evidence of shearing along NW planes. Because of variable resistance to stress, the rock types in the shear zone at the Mine reacted differently to shearing movements, the mica schists being folded whilstin the main adjustments amphibolites were accomplished by fracturing. Displacement along multiple shear planes was initiated by movement of the granodiorite from plutonic associations into a higher level of the crust.

Ore-bearing fluids emanating from the granodiorite, and probably charged with carbon dioxide, sulphur, arsenic and gold, migrated along channel ways in the shear zone. The ensuing reaction between the carbon doixide and the minerals of the hornblende schists resulted in the liberation of silica. This was deposited in open spaces existing in the schists. Gold was afterwards deposited in cracks and fractures in the quartz veins.

O. GEOLOGY OF DEVIL'S HOLE, CUYUNI RIVER

by P. M. Allen, Geologist.

The rocks mapped in the area fall into four groups:

(i) The Cuyuni Formation of bedded sediments and intrusive igneous rocks, all metamorphosed to a low grade within belts of well-foliated green schists, occurs both to the east and west of the following gneisses.

(ii) The Devil's Hole Genisses are a banded series of hornblende gneisses, hornblende-biotite gneisses and biotite gneisses with localised amphibolites and amphibolite-rich gneisses. Both unfoliated and porphyroblastic bands were noticed. The whole sequence is cut by narrow pegmatite veins, quartzo-feldspathic veins, metamorphosed basic dykes, and, in certain bands, numerous epidote veins. There is evidence for both shear and normal folding.

(iii) Younger Granites are to be seen in four places and are demonstrably later than either of the above two groups. There is evidence for contamination of pre-existing basic rocks, producing the diorites seen in the Aurora batholith, and acidic rocks at the margin between granite and the Cuyuni Formation.

Associated pegmatites, aplites, microgranites and granodiorite intrusions also occur.

(iv) Younger basic intrusives are to be seen as small dolerite dykes and large intrusions near the Kartuni River.

Gold and diamonds occur in the area and secondary Copper mineralization[1] was observed in certain rocks of the Cuyuni Formation.

P. THE PETER'S MINE AREA

by M. A. Lee, Assistant Geologist.

The rocks of the area may be grouped as follows:

5.	Dolerites	Younger Basic Intrusive Group
4.	Granitic rocks	Younger Granite Group
3.	Amphibolites and greenschists	Bartica Assemblage?
2.	Gneisses	
1.	Metasediments and lavas	Mazaruni Group

Amphibolites and greenschists were originally basic rocks which have been metamorphosed; the resulting mineralogy ranges from albite-epidote-actinolite-schists to amphibolites. In some areas the schists show a well marked foliation which strikes approximately north-south.

The gneisses are variable in texture and composition. The above amphibolites are intimately associated with these gneisses.

The sediments have been metamorphosed to produce a variety of schists which are normally too decomposed for precise determination. The schists have a vertical foliation striking northwest-southeast. A conglomerate was found and this showed the effect of shearing.

The lavas vary from basaltic to rhyolitic, but are predominantly basic. Some evidence seems to indicate that these rocks have been extruded after the metamorphism of the sediments.

Three types of granitic rocks occur: granodiorite, potassic granite and quartz porphyry. The quartz porphyry occurs at the junction of the metasediments and amphibolite group.

1. Cannon, R. T. and Allen, P. M. A Preliminary Report on the Geology of the Devil's Hole Range, Cuyuni River, *Geol. Surv. B.G.*, unpublished report (RTC 3/61).

Fresh dolerites occur with a composition that consists of labradorite, augite, iron oxide and minor amounts of hypersthene.

Peter's Mine is known to be mineralized with gold. Widespread hydrothermal activity is indicated by abundance of pyrite cubes, introduction of quartz, and other gangue minerals such as calcite and barytes. Peter's Mine is situated on a shear zone.

Q. REPORT ON THE AREA BETWEEN WAKAWAKAPU LANDING, MAZARUNI RIVER, AND SAKAIKA LANDING, EKEREKU RIVER.

by O. St. John, Scientific Assistant.

A trail 28 miles long has been constructed from Wakawakapu Landing, Mazaruni River to Sakaika Landing on the Ekereku River, thus providing access to the diamondiferous creeks between the two points. Prospectors from Apaiqua Village, Mazaruni River, travel by boats to Wakawakapu thence by the new trail to the payable ground in the Ekereku region.

The survey party discovered three creeks which showed good gold and diamond indications and resulted in prospectors applying for claims.

The trail ascends from 300 feet above M.S.L. at Wakawakapu to 2800 feet at a point 3 miles west of Camp 9. However, there are no serious hazards to be encountered, and the steepest part is not more than three hundred feet high with a possible escarpment of about fifty feet.

The rocks traversed are for the most part members of the Roraima Formation with dolerite of the Younger Basic Intrusives Group cutting it. The gold and diamond indications decrease near the dolerite outcrops and are altogether lesser in quantity in the lower country.

Three sites were selected for a proposed airstrip in the savannas near Sakaika Landing on the right bank, Ekereku River. If an airstrip capable of taking Dakota aircraft can be put into operation it would relieve the transport difficulties now experienced and help to reduce the high cost of supplies.

The present trail links with one constructed by the Geological Survey in 1951 from the mouth of the Ekereku River to Sakaika Falls. This provides another approach to the important diamond producing country on the Pakaraima Plateau south and east of Sakaika Falls.

R. REPORT ON THE KURUPUNG-MERUME TRAIL LOCATION SURVEY.

by O. St. John, Scientific Assistant.

Attempts were made to construct a trail from the Upper Kurupung River to the headwaters of the Merume River in order to facilitate prospection in the

Pakaraima Mountains between the two rivers which have yielded considerable quantities of diamonds and gold at lower elevations.

The attempt to ascend the mountains from Mahaica Creek, a tributary of the Kurupunk River, and to build a trail southeast towards the Merume River was unsuccessful. However, workings which yielded many diamonds recently were mapped, and the trail from Two Mouth Landing on the Kurupung was improved for ten miles.

The party transferred rations and equipment to a site at the base of the Pakaraima Mountains in the Eping River. A trail from a shop in that vicinity was also cleared and followed to the top of the plateau to meet another existing trail, constructed by private prospectors from Imbaimadai on the Upper Mazaruni.

Unlike the Kurupung it would be difficult to descend in the direction of the Merume headwaters. Another serious deterrent to trail-building in the Upper Eping River is the fact that after normal rain showers the trail which leads to the Landing becomes impassable.

The alluvial and eluvial workings in the Kurupung and Eping Valleys are shown on the map. Some indication is given of the distribution of the diamonds in the upper levels of the two streams. They have produced large quantities of diamonds in their valleys to the base of the Pakaraima escarpment.

A team of prospectors starting from a suitable point on the Imbaimadai-Eping trail could probably drive a trail at least as far as the headwaters of the Apakai River, a large left bank tributary of the Merume River.

Prospectors are currently engaged in diamond workings in the upper reaches of the Merume River.

S. CUYUNI RIVER TRAVERSE

Mukru River Mouth to Eteringbang Landing Pool

E. Williams and P. B. H. Bailey, Senior Geologists.

A ten-day study of rock exposures was made in the Cuyuni River between Mukru River Mouth and Eteringbang (Torompang) Landing Pool.

Typical sequences of the Cuyuni Formation and of the overlying Haimaraka Formation of the Mazaruni Group are present. The preponderance of fine-grained igneous rock boulders in beds immediately underlying the Haimaraka Formation, as in the Mazaruni River area, is considered significant and may prove an important factor in determining stratigraphical levels within the Cuyuni Formation during future mapping.

The distribution of the rock units of the Mazaruni Group appears to be determined by cross-folding.

A regional foliation associated with mineral assemblages of, in general, the Greenschist Facies grade occurs throughout the Mazaruni Group rocks of the area. This regional metamorphism which is clearly later and independent of the folding, culminates in belts of schists, as near Makapa Hills, enveloped and grading into schistose rocks (schistose conglomerate etc.).

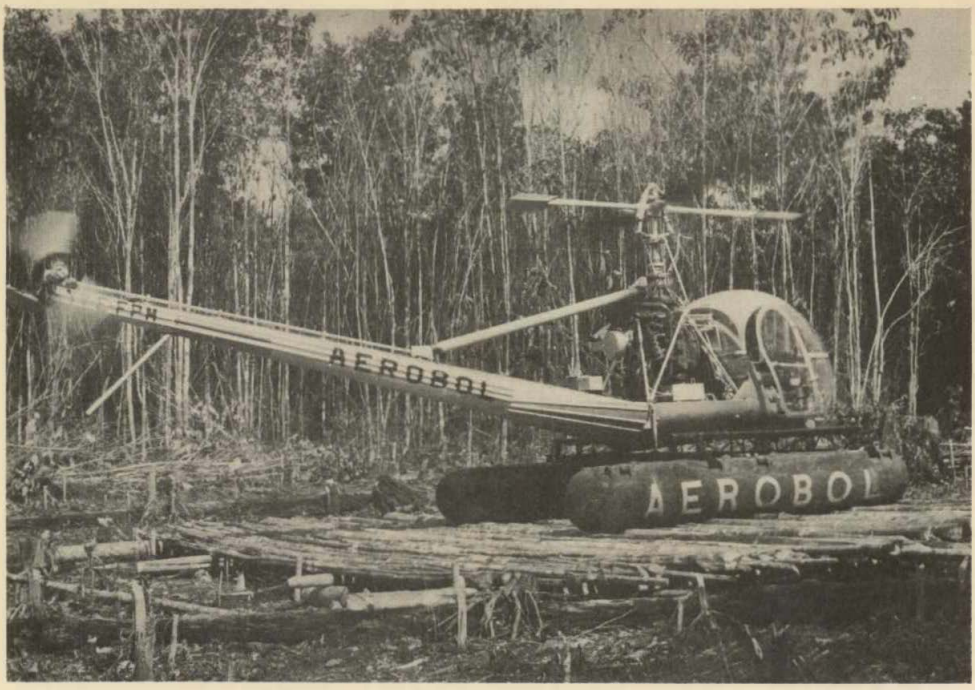
The emplacement of quartz porphyrys above the mouth of the Ekereku River may be later than the regional metamorphism.

The diorite of Urluowra Island appears to be later than the regional metamorphism. The latest event was the intrusion of dolorite — the Younger Basic Intrusives.

APPENDIX II

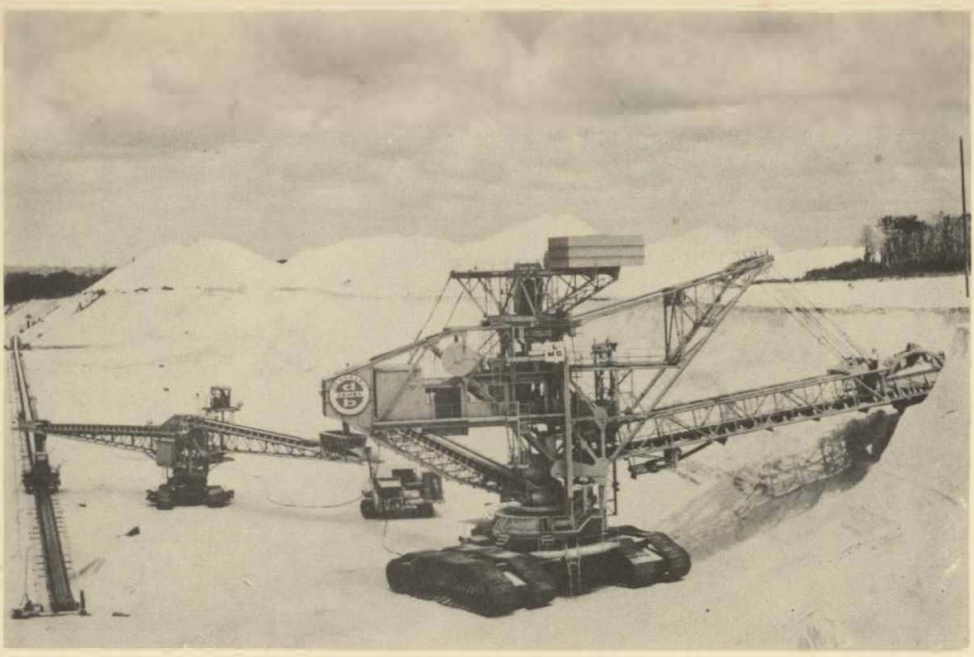
SENIOR STAFF AT 31.12.61

ESTABLISHMENT	*NAME*
Director	R. B. McConnell, C.B.E., M.A., D.es. Sc. (Lausanne), D. Phil., M.I.M.M., F.G.S., F.R.G.S.
Supernumerary Director	P. H. A. Martin-Kaye, B.Sc., Ph.D., A.R.C.S., F.G.S., M.I.M.M.
Deputy Director	C. G. Dixon, B.Sc., F.G.S.
3 Senior Geologists	P. B. H. Bailey, M.A., F.G.S. R. T. Cannon, B.Sc., A.M.I.M.M., F.G.S. E. Williams, B.Sc., Ph.D., F.G.S.
Geophysicist-Hydrologist	L. E. Ramsahoye, B.Sc., D.I.C., Ph.D.
Chemist-Petrologist (designate)	G. E. Harden, B.Sc., Ph.D., D.I.C.
7 Geologists	C. N. Barron, B.A., F.G.S. J. H. Bateson, B.Sc., F.G.S. M. G. Allderidge, M.A. D. D. Hawkes, M.Sc., F.G.S. S. Singh, B.Sc. M. W. Carter, B.Sc., F.G.S. P. M. Allen, B.Sc.
4 Assistant Geologists	J. W. Carter, B.Sc., A.R.S.M. L. L. Fernandes, B.Sc., A.R.S.M. M. A. Lee, B.Sc., A.R.S.M., D.I.C. Vacant
Chief Draughtsman	T. M. Rahaman, Graduate of Technical Institute, Trinidad.
2 Scientific Assistants	D. O. Pollard O. St. John
Chief Clerk (Ag.)	C. E. Outridge
Senior Accounting Officer (Ag.)	C. H. Campbell



Helicopter landing near Geological Survey camp in the Kopinang Valley, Pakaraima Mountains. Photo by F. H. A. Martin-Kaye.

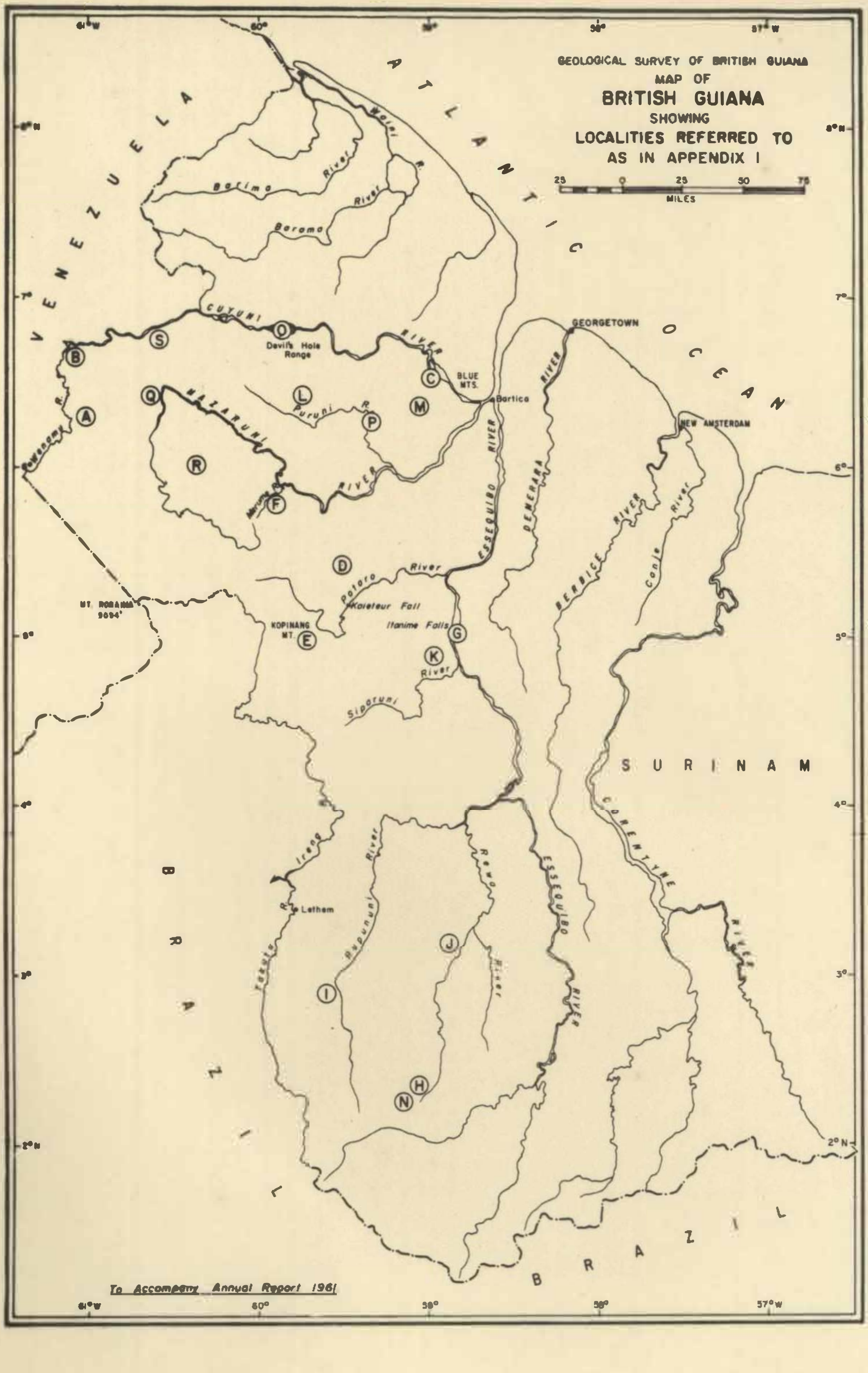
Pabrakash portage below Kaburi Rock, Mazaruni River. Hauling Geological Survey bateau. Photo by M. G. Allderidge.



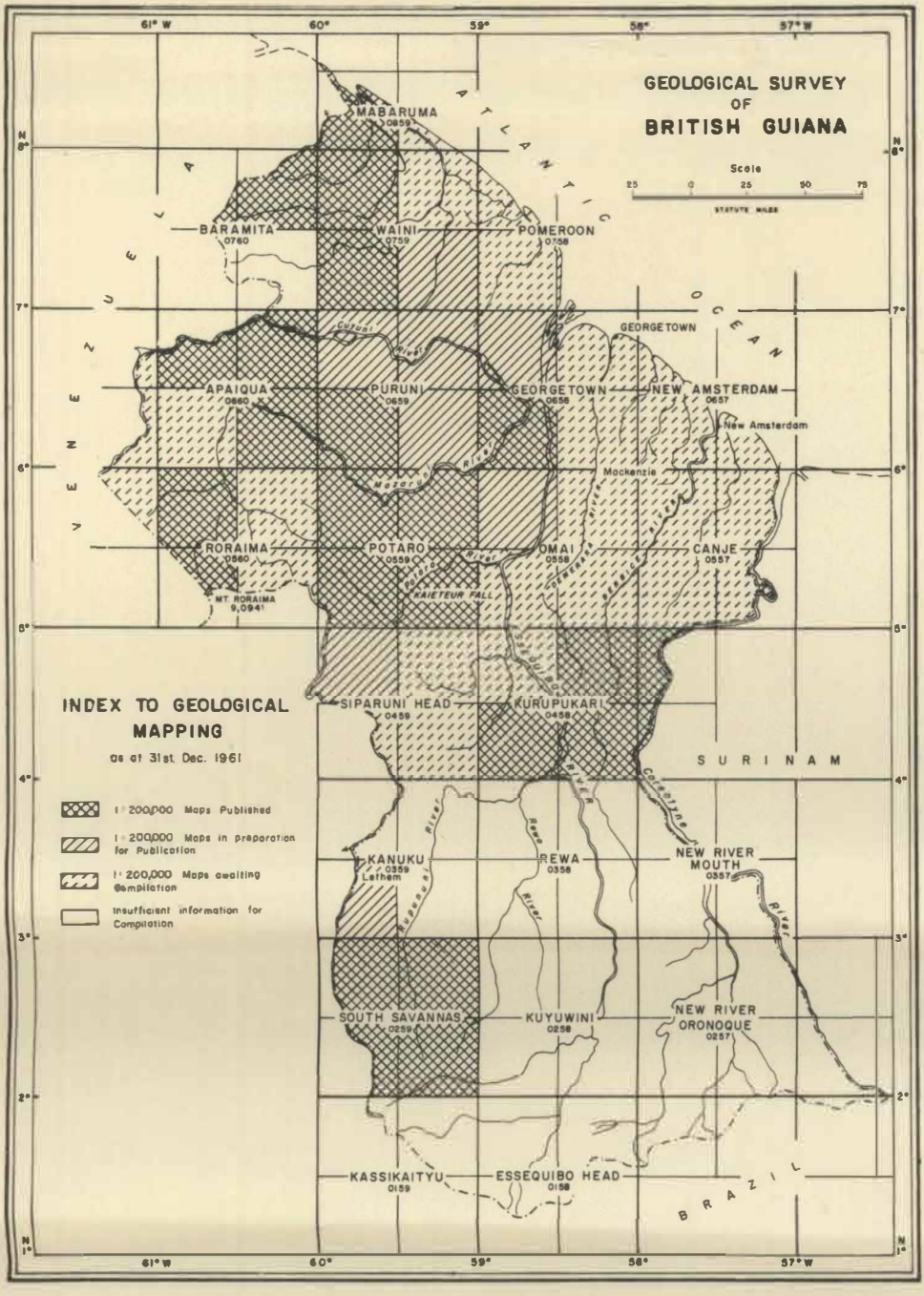
Bucket wheel excavator of the Demerara Bauxite Company in operation at the Arrowcane Mine, Mackenzie. The excavator, which can move 1,000 tons of sand overburden per hour, was under construction during 1961.
Photo by the Demerara Bauxite Company.

Prospecting for diamonds below Arakwatuwe Fall, Kabaik River. The prospector is holding one of a set of three nesting sieves (Brazilian type). Horizontally bedded sandstones of the Roraima Formation are well exposed at low water. Photo by P. B. H. Bailey.

1033



GEOLOGICAL SURVEY OF BRITISH GUIANA
MAP OF
BRITISH GUIANA
SHOWING
LOCALITIES REFERRED TO
AS IN APPENDIX I
MILES
ATLANTIC
OCEAN
VENEZUELA
SURINAM
BRAZIL
GEORGETOWN
NEW AMSTERDAM
Bartica
BLUE MTS.
Devil's Hole Range
MT. RORAIMA 9094'
KOPINANG MT.
Kaieteur Fall
Itanime Falls
Lethem
CUYUNI RIVER
MAZARUNI RIVER
ESSEQUIBO RIVER
DEMERARA RIVER
BERBICE RIVER
CORENTYNE RIVER
Canje River
Potaro River
Puruni R.
Siparuni River
Barima River
Barama
Waini R.
Rupununi River
Rewa River
Ireng R.
Takutu
To Accompany Annual Report 1961


GEOLOGICAL SURVEY
OF
BRITISH GUIANA
Scale
STATUTE MILES
INDEX TO GEOLOGICAL MAPPING
as at 31st Dec. 1961
1 : 200,000 Maps Published
1 : 200,000 Maps in preparation for Publication
1 : 200,000 Maps awaiting Compilation
Insufficient information for Compilation
MABARUMA 0859
BARAMITA 0760
WAINI 0759
POMEROON 0758
APAIQUA 0860
PURUNI 0659
GEORGETOWN 0658
NEW AMSTERDAM 0657
RORAIMA 0560
POTARO 0559
OMAI 0558
CANJE 0557
MT. RORAIMA 9,094'
KAIETEUR FALL
SIPARUNI HEAD 0459
KURUPUKARI 0458
KANUKU 0359
Lethem
REWA 0358
NEW RIVER MOUTH 0357
SOUTH SAVANNAS 0259
KUYUWINI 0258
NEW RIVER ORONOQUE 0257
KASSIKAITYU 0159
ESSEQUIBO HEAD 0158
VENEZUELA
ATLANTIC OCEAN
SURINAM
BRAZIL
GEORGETOWN
New Amsterdam
Mackenzie
61° W
60°
59°
58°
57° W
8° N
7°
6°
5°
4°
3°
2°
1° N