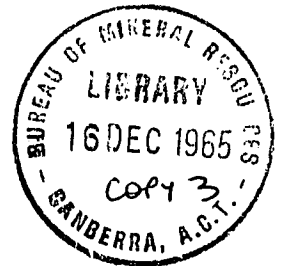


COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS

RECORDS:



1965/199

SUMMARY OF ACTIVITIES - 1963

compiled by P.M. STOTT

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

SUMMARY OF ACTIVITIES, 1963

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PREFACE

The Bureau of Mineral Resources compiles an Annual Summary of Activities which has been included in a printed Summary of Activities of the National Development. The last issue of this was for 1962; it is intended to resume publication in a different form at some future time, but meanwhile, the Bureau contribution for 1963 is presented as this Record.

The summary was compiled from Branch reports prepared for the programme meeting in November, 1963 (Records 1963/142, 1963/146, 1963/149) together with later information.

BUREAU OF MINERAL RESOURCES

GEOLOGY AND GEOPHYSICS

FUNCTIONS

The functions of the Bureau are -

To explore for, investigate, and encourage the development of mineral deposits.

To survey and assess the mineral resources of the Commonwealth and its Territories and to initiate and investigate proposals for their development.

To interpret the results of completed surveys and recommend ways of remedying or meeting mineral deficiencies that may become apparent, and to advise the best utilization of mineral resources in the national interest.

To carry out geological and geophysical surveys and investigations, and advise on all aspects of applied geology and geophysics.

To discharge these functions the Bureau is required to -

Make geological surveys and investigations (both regional and detailed) and carry out research relating thereto.

Make geophysical surveys and investigations (including airborne, regional gravity, and magnetic surveys) and carry out research related thereto.

Supplement geological and geophysical investigations by drilling or other means.

Make basic investigations of earth magnetism, vulcanology, and seismology and operate observatories for this purpose.

Make technical and technological surveys of the mineral industry, carry out investigations, and undertake research into mining, petroleum technology, and related matters.

Undertake economic investigations into the mineral industry, including production, consumption, prices, and trade trends, and maintain statistics relating thereto.

Provide technical and technological advice to the mineral industry.

Advise the Commonwealth Government on the scientific, technical, and administrative aspects of the mineral industry.

Administer Commonwealth Government schemes for the assistance of individual mineral industries.

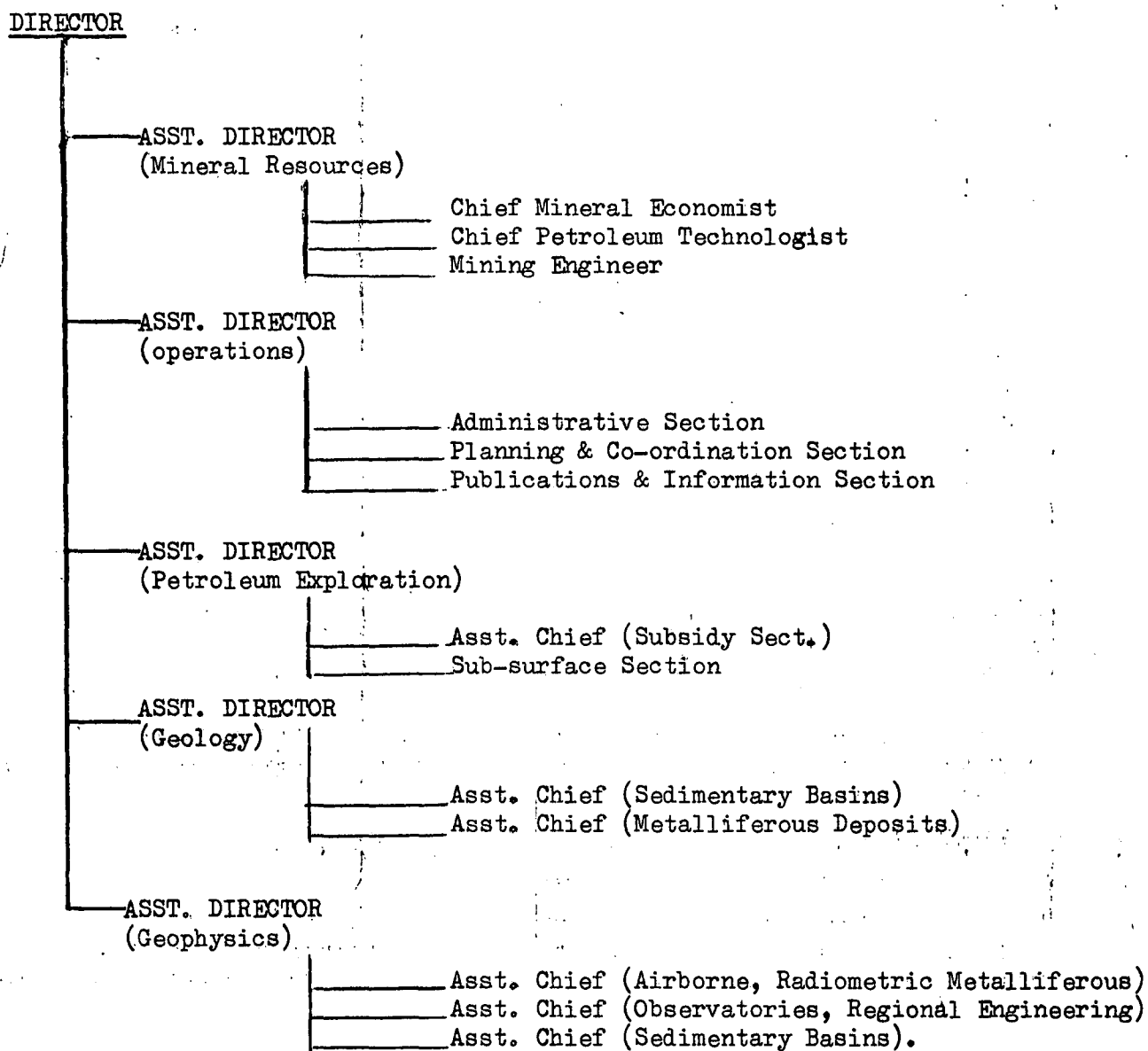
When specifically directed by Cabinet, undertake the mining, treatment, purchase, sale, or control of any mineral.

Maintain necessary libraries, equipment, laboratories, museums, and workshops.

Prepare and publish reports, maps, and plans relating to the above functions.

ORGANIZATION

The Bureau is divided into five branches, illustrated in the chart below:



HEAD OFFICE ACTIVITIES

(Directorate, Operations Branch, and Mineral Resources Branch)
(Numbers in brackets refer to locations on Maps 1 & 2 (at back)).

The Director of the Bureau, and the Operations and Mineral Resources Branches, have responsibilities in connexion with the preparation of advice on Government policy in matters such as the mineral industry in general, the search for oil in Australia and its Territories, Government assistance to mining projects, effects of taxation in the mineral industry, and the preparation of briefs for Government representatives attending overseas conferences.

The Bureau provides the four members of the Oil Advisory Committee, with the Director as Chairman, set up under the Petroleum Ordinances of the Territory of Papua and New Guinea and the Northern Territory. This Committee examines the technical aspects of applications for oil permits, licences, and leases in the Territories, and examines reports of activities of companies to ensure that conditions of permits have been fulfilled.

The Director of the Bureau is co-ordinator for the preparation of the Geological Map of Australia and Oceania, one of the series of maps being prepared under the auspices of the Commission for the Geological Map of the World. Compilation of the geology of the four sheets covering Australia and the Territory of Papua and New Guinea has been completed by the Geological Branch, and work on the remaining sheets is proceeding.

The Bureau is called on, from time to time, to supply experts to assist in Colombo Plan work. The Bureau advises the Government about training programmes and itineraries for visitors wishing to obtain a comprehensive view of the mineral industry. An engineering geologist was a member of a technical mission sent to U.S.A. by the Australian Atomic Energy Commission to study the peaceful uses of nuclear explosions.

The Director was one of the official Australian members of the United Nations Conference on the Application of Science and Technology for the benefit of the less developed areas (UNSCAT), held in Geneva from the 4th to the 20th February.

The Bureau advises the Policy Secretariat, as required, regarding export controls on minerals and metals for which the Department is responsible, and carries out special investigations in connexion with the operation of these controls.

Operations Branch

The Operations Branch carried out central office functions in connexion with the Bureau's scientific work, including planning and control of programme, assessment of results, co-ordination of activities, liaison, and distribution of information. It also provided administrative services for the whole Bureau.

The Planning and Co-ordination Section carried out duties in connexion with the programme of the Bureau, and maintained liaison with State Authorities and companies on matters related to the field activities of the Bureau. The Section acts as Secretariat to the Technical Committee on Underground Water of the Australian Water Resources Council which has succeeded the Underground Water Conference of Australia. A Pictorial Index of Activities of the Bureau to 31st December, 1963 was prepared.

The Publications and Information Section supplied information on Australia's mineral resources and geology in response to numerous enquiries. Articles on various aspects of the mineral industry and statements on Bureau activities and publications were prepared.

The Administration Section provided services in the fields of finance, staff, accommodation, stores, transport and other forms of assistance needed in the furtherance of Bureau activities.

Mineral Resources Branch

The Mineral Resources Branch is concerned largely with those aspects of the Bureau's work which involve study of the mineral industry as a whole or by sectors, the collection of relevant information, and the preparation of advice and reviews for the Government, the industry, and the public. The Petroleum Technology Section and the Mining Engineering Section also undertake field operations.

The broad function of the Mineral Economics Section is the study and investigation of resources, mining, transport, treatment, marketing and utilization of minerals and metals, for the purpose of appraising national and international mineral resources and developing and recommending policies thereon.

Field work in the programme of commodity studies was concerned with beach sands, tin, industrial minerals, and iron and steel. Discussions were also held with copper and antimony producers and with the Australian Atomic Energy Commission on uranium and the rare earths. Other matters with which the Section was involved include phosphate search; mining taxation; petroleum taxation; and restrictive trade practices. Papers were also prepared for the Committee of Economic Inquiry.

International commodity problems with which the Section was involved concerned meetings of the International Lead and Zinc Study Group and investigations carried out for the International Tin Council, the United Nations ad hoc Committee on Tungsten, and the International Monetary Fund.

The 1962 Annual Review of the Australian Mineral Industry was prepared and four issues of the Quarterly Review - Vol. 15 Nos. 2, 3 and 4, Vol. 16 No.1 - were published; Vol. 16 No.2 was prepared.

Articles appeared in the Quarterly Reviews on the following topics:

"Australian Minerals and Metals 1962, Preliminary Review",

"Some notes on the importance of Underground Water".

"General Review".

Work continued as opportunity offered an extension of the volume of mineral statistics. The Section provided information for the volume on mineral deposits being prepared by the Geological Branch. In association with the Commonwealth Bureau of Census and Statistics, the compilation of statistical data concerning all aspects of the mining and mineral industry was continued.

During the year the Petroleum Technology Section dealt with various technical and scientific matters in connexion with the administration of the petroleum ordinances of the Northern Territory and the Territory of Papua and New Guinea. The Chief Petroleum Technologist is a member of the Oil Advisory Committee appointed under these ordinances, and has been Convenor/Secretary since October 1962. Draft regulations relating mainly to safety aspects of exploration for, and exploitation of petroleum were prepared. The draft was accepted as a basis of model Regulations at a meeting of State and Territory Inspectors of Mines in Melbourne on 23rd May, 1963 at which the Chief Petroleum Technologist represented the Department.

The Section dealt with matters of general petroleum policy and, as the need arose, advised the government on specific problems related to such policy.

The Section is responsible for shot-hole drilling for B.M.R. seismic parties and supervises contract stratigraphic and core-hole drilling for B.M.R. The Section operated three Mayhew "1000" and three Carey shot-hole drilling rigs.

No.1 shot-hole drilling party operated in the south-east Georgina Basin, Queensland (6) from April to September, and then moved to the Thargomindah area, Queensland (10). The total footage drilled was 135,958. The No.2 party operated from April to October in Western Australia. The total footage drilled amounted to 121,908.

A programme of stratigraphic drilling in the Georgina Basin N.T.; involving three holes: B.M.R. No. 11 (Cattle Creek); No. 12 (Cockroach); No. 13 (Sandoval R.); commenced in July. B.M.R. No. 11 encountered considerable problems in drilling, but was successfully completed at a depth of 1501 feet in November, 1963.

Particulars subjects dealt with by the Mining Engineering Section during the year included the operation of the Gold Mining Industry Assistance Act and processing of applications for permission to export iron ore and manganese ore.

The Section also co-ordinated the sponsorship of research projects at the Australian Mineral Development Laboratory by interested Commonwealth Departments and Authorities in connexion with the Commonwealth Government's guarantee to the Laboratory. As part of this programme, work on the recovery of bismuth from tailings dumps in the Tennant Creek district, N.T. (41) was completed. Experimental work on an electrolytic refining cell for crude bismuth was finished. Work on a survey of mineral resources in tailings dumps in Australia continued, the sampling in Tasmania being completed. The laboratory work for this survey is also being carried out at the Australian Mineral Development Laboratory. Arrangements have been made with the Mines Inspectors, for sampling to take place in Queensland during 1964.

Petroleum Exploration Branch

The Petroleum Exploration Branch is concerned mainly with the Bureau's responsibilities in matters relating to petroleum exploration and associated activities in Australia, and Papua and New Guinea. These are: The administration of the Petroleum Search Subsidy Act 1959-1961; the preparation of advice on and reviews of petroleum exploration in Australia, and Papua and New Guinea for the Government; the collection, collation and publication of all available data on the sedimentary basins of Australia, and Papua and New Guinea.

During the year, the Subsidy Group handled 187 applications for subsidy, together with 68 applications for additional subsidy. A technical assessment of the applications was undertaken. The Minister approved 158 of the new applications for additional subsidy were refused. The assessment of the remainder of the applications was still in progress at the end of the year.

The more noteworthy results of subsidized operations during the year included the discovery of oil in Richmond No.1 Well, gas in Bony Creek No. 1 (N. Roma) and in Rolleston No.1 (all in Queensland), indications of oil in Alice No. 1 and of gas in Ooraminna No.1 both in the Amadeus Basin (N.T.). A large closed anticline was found by seismic survey in the western Surat Basin (Qld) and the first well on this structure, Wunger No.1 found oil, tested at 10 barrels per day. Other seismic surveys have given important structural information about the Great Artesian Basin, the South Canning Basin, and Bass Strait.

The Sedimentary Basins Study Group completed the preliminary compilation of seismic surveys in the Surat Basin, and almost completed studies on the Bonaparte Gulf Basin and the New Guinea Basin.

The Core and Cuttings Laboratory continued the storage and cataloguing of cores and cuttings and began examination of material from selected wells.

FIELD ACTIVITIES

Geological and Geophysical Branches

The principal field activities of the Bureau consist of geological and geophysical surveys in the search for oil and metals, engineering geology and geophysics, and hydrology.

Australia-wide Surveys

Age Determination

During the year, the Bureau continued to co-operate in age determination projects with the Australian National University. Three Bureau geologists worked at the University assisting with potassium/argon and rubidium/strontium determinations, and a fourth worked full time on this work in the Acton Laboratory of the Bureau (petrology and mineral separation).

In 1963, two of the geologists were attached to field groups in the Bowen Basin (9) and Kimberley regions, (17,38) the concept being to use their skills in the same manner in which palaeontologists are employed. This has worked well and will be continued in 1964. Another member of the group collected from the Pine Creek Geosyncline and the Carpentaria region.

Eighty samples were collected from the Bowen Basin, mostly from high-level granites intrusive into Middle and Upper Palaeozoic Sediments and 71 samples came from the Kimberley region. Other field parties collected samples for age determination and altogether, 202 samples were collected.

Eight one samples were examined in detail for suitability, 27 were rejected, and the fate of eight was still undecided. They came from:-

Rum Jungle (12); Carpentaria and Darwin - Katherine region (23); Bowen Basin (21); Tasmania (8); N.G. (3); W.A., basement (3); Oil Wells - basement (6); Amadeus Basin (3); and Q'ld (2).

Mineral concentrates from 58 samples (some of those mentioned above and other collected previously) were prepared in the Bureau laboratory and sent to the University for K-Ar and Rb-Sr age determinations. Another 300 or so samples were crushed, preparatory to concentration.

Regional Gravity Surveys

Gravity meter connexions were made between pendulum stations at Cloncurry (Q) and Tennant Creek (N.T.) (23). Other traverses were made at the request of the Geological Branch:

Mount Molloy to Wrotham Park, Q (21) (130 miles).
Tied to Pendulum Station at Cairns;

Ewan to Einasleigh, Q (180 miles (22) tied to
Townsville PS;

Barkly Tableland, Frewena to McArthur River, N.T. (300 miles) (23) - only about half could be completed before the wet season forced the party to cease operations;

Stations at intervals of 5 miles were read along the traverse.

Stations were added to the '1 degree square files' of the Gravity Map of Australia. Data were obtained from either regional surveys or from the reduction of Bureau and subsidized sedimentary work to density 2.67 g/cc. No additional analysis of this data was made.

The observations for the tie: Melbourne-Tokyo, using the new G.S.I. pendulums, was almost completed. Earth-tide recording was attempted using the North America underwater gravity meter and a modified Heiland meter installed at the old Melbourne Observatory. Good results were obtained, but some record was lost because of faults in the equipment.

Programmes for the automatic reduction and adjustment of elevation and gravity data were completed and reorganization of the filing system preparatory to getting all the data on to punched tape was well advanced.

(See also: Queensland - Oil)

Regional Magnetic Surveys

Five first-order stations were read in the south of Western Australia (44) and two in Papua and New Guinea; their main purpose is to furnish accurate field measurements for the determination of secular variation. Four second order magnetic stations were established in Papua and New Guinea and third order declination stations read every five miles, along 750 miles of traverse in New South Wales (28), and 750 miles of traverse in South Australia. (37).

A declination map for 1965.0 was prepared.

Regional Oil Studies

A group of oil specialists from the French Petroleum Institute (IFP) have undertaken, under contract, a study of the oil potential of the sedimentary basins of Australia. The original contract was completed in June but has been extended into 1964. Geologists of the Bureau have been attached to the group, and have been working with the French photogeologists on the production of photo-geological maps at a scale of 1:250,000.

Some geologists of the IFP visited Bowen Basin (9) parties in June-July and Bonaparte Gulf (17) in August-September.

Queensland

Oil

Geological mapping of the Bowen Basin was continued as a joint project with the Geological Survey of Queensland.

Three parties mapped the Taroom, Springsure, and Baralaba 1:250,000 Sheet areas, the western third of the Mundubbera Sheet area, and adjacent corners of the Duaringa, Rockhampton, and Monto Sheet area (9). This extends the regional mapping of the Bowen Basin to south of latitude 24°S. In addition, further work was carried out in the Duaringa and St. Lawrence Sheet areas as a follow-up to mapping during 1962, and a shallow drilling and coring programme was completed during October, in the area mapped during 1963 (31 holes, 4415 feet drilled, 187 feet cored). These holes were located to give cuttings and cores from important parts of the Lower Permian-Mesozoic section, where outcrops are rare. Aerial reconnaissance of the Eddystone Sheet area was made, in preparation for regional mapping in 1964.

The aeromagnetic survey of the Bowen Basin was completed in 1963 by surveys of those parts of the Taroom, Roma, Mitchell, and Eddystone 1:250,000 Sheet area (8) lying between 148 and 149 degrees of east longitude.

Geological mapping in the Laura Basin completed the systematic reconnaissance of this area (1).

Field mapping in the Great Artesian Basin continued as a joint operation with the Queensland Geological Survey; the Winton, Muttaborra, and Tangorin 1:250,000 Sheet areas were mapped, together with the sedimentary part of the Hughenden Sheet area (2); helicopters were used for access to rugged country on the Hughenden sheet.

Preliminary editions of the Manuka and Richmond 1:250,000 sheets, mapped in 1962, were prepared.

Core drilling was done approximately 25 miles west of Hughenden (Richmond Sheet) to obtain fresh samples for palynological and macropalaeontological study, and to provide foraminiferal control in the Lower Cretaceous.

In the Great Artesian Basin, a gravity survey by helicopter was made of the area between longitude 147°E and the coast, and latitudes 20°S and 24°S (3). A basic grid of stations was established by road, using a La Coste gravity meter for the main ties between stations at Rockhampton, Clermont, Longreach, Hughenden, Cloncurry, and Townsville, and a World-Wide meter for most of the others. Part of the area was surveyed in cooperation with Division of National Mapping; the average station density was 1 per 50 sq. miles.

About 4400 gravity readings have been made along seismic traverses in the Great Artesian Basin (4, 40, and 10) (Boulia, Thargomindah, and Galilee areas) and in the Surat Basin (11) (Moonie and Cabawin).

(Note: The figure of 4400 includes some work near Singleton, N.S.W. - see N.S.W. - Oil).

In the Queensland part of the Georgina Basin, (15) aeromagnetic surveys were made of the Mount Isa, Urandangi, and Glenormiston Sheet areas (see also: N.T. - Oil). An aeromagnetic traverse: Roma-Boulia-Cloncurry (7), was made when the aeroplane was travelling to a new base.

Seismic reflexion and refraction work was carried out in the south-east Georgina Basin, in the area covered by the Springvale Mount Whelan, and Bedourie 1:250,000 sheets (6). The main work was a 30 mile reflexion traverse from Yarrandilla Yard south-west to beyond Pulchera Waterhole across a trough indicated by earlier gravity surveys. The results show an asymmetric trough with an axis west of that of the gravity anomaly and a gentle slope on the north-east side. The traverse crosses a postulated major fault on the south-west side, near Pulchera Waterhole but shorter supplementary traverses in this area failed to reveal the exact nature of this fault. The main reflecting horizon is at 10,000 feet near the synclinal axis, with indications of more sediments below; to the north-east, this horizon was traced until it is only about 300 feet below the surface, and drilling showed it to be Lower Ordovician dolomite.

Reflexion and refraction work on a traverse perpendicular to the main traverse showed that the thickness of sediments increases slowly to the south-east and that the main reflecting horizon at over 10,000 feet has a seismic velocity of 19,000 ft/sec.

In the Thargomindah area (10), reflexion and refraction surveys were made to complete work commenced in 1962.

Metals

Regional geological mapping in North Queensland continued (26). One party led by an officer from Q.G.S. mapped the Townsville 1:250,000 Sheet area, most of the Charters Towers Sheet area, and the north-east portion of the Hughenden Sheet area (the part not mapped by the Great Artesian Basin - see under 'Oil', above). Another party (including one member from Q.G.S.) completed mapping of the Ingham Sheet area and more mapping took place in the Laura Basin (1) (see under 'Oil', above).

Detailed field investigations were completed at Mount Garnet (48) (mapping of the Mount Garnet one-mile sheet area and drilling of alluvial tin prospects). This work was directed toward locating and assessing possible sources of alluvial cassiterite and the nature of lode tin prospects. About 100 stream sediment samples were collected for geochemical testing, from the Gurrumba, California Ck, and Return Ck, areas.

At Mount Isa, (25) an experimental geochemical survey was begun in conjunction with geologists from Mount Isa Mines Ltd. Surface samples were collected using an auger from a depth of 5', to avoid possible contamination, and other samples came from underground workings and diamond drill holes to allow a three-dimensional picture to be obtained. The samples are from the Urquhart Shale, and will be examined in the new spectrograph for trace elements - preliminary tests show that 33 trace elements are detectable.

A detailed aeromagnetic survey using a proton precession magnetometer in the Cessna aeroplane VH-GEO, was carried out over an area about 12 miles from east to west, 36 miles from north to south, centred on Mount Isa, (25) during the months of June, July, and August. Flight line spacing ranged from 1/10th to 1 mile and the detector was at a nominal altitude of 250 feet. The township and environs were not surveyed because of DCA restrictions.

Also at Mount Isa, a test gravity survey was carried out in the Leichhardt Valley to see whether this could help in the investigation of the deeper regions of the area surrounding the mine.

The geophysical work in the Mount Cuthbert-Dobbyn area (24) began with a semi-regional gravity survey over an area of about 1250 sq. miles from Kamileroi in the north, to Kajabbi in the south. Later, electrical and electromagnetic methods were used in the area of the Dobbyn and Orphan mines.

In the period September-November, an area of 1500 sq. miles was surveyed around Dobbyn (14). Traverses at $\frac{1}{2}$ mile spacing cover the whole area, and a small part of the area, about 12 miles by 2 miles over the Dobbyn mine was covered in more detail, with traverses 1/10th mile apart. The smaller area includes that surveyed by ground parties using electrical and electromagnetic methods.

Engineering Geophysics

Geophysical work in the Burdekin River Delta continued from 1962. This involves gravity surveys, resistivity depth probes, seismic depth probes, and gamma ray logging of drill holes. The aim is to discover the position and movements of the fresh and saline water in this area of about 100 sq. miles in which sugar worth £15m annually is produced.

Similar methods, for the same purpose, were used in the Giru area, Haughton River.

New South Wales

Oil Oil

Gravity readings were made along seismic traverses in the Singleton area (12).

Metals

The Canberra 1:250,000 Sheet area (A.C.T. & N.S.W.) (30) was mapped by a party of Bureau and New South Wales Geological Survey geologists, to produce a second edition of the map in time for the 1964 meeting of ANZAAS. New South Wales geologists mapped the eastern third of the area and work previously carried out by the Bureau and the Survey at Captains Flat, by the Bureau in the A.C.T., and by Universities and others, is incorporated.

A geophysical survey of three areas in the Gibsonvale Alluvial tinfield was made, using gravity, seismic, and resistivity methods to search for extensions of the known Gibsonvale and Kikoira leads. (29).

An experimental aeromagnetic survey, using a proton procession magnetometer in the Cessna VH-GEO, took place over the Cobar area (27) in March and April. Eight small areas, known to have magnetic anomalies of widely differing types, were investigated to test the equipment in the field, to develop flying techniques and data reduction procedures, and to estimate the accuracy attainable. The results showed that the Cessna is able to survey with such detail and accuracy that it would be possible to replace many ground magnetic surveys.

Engineering Geophysics

A gravity survey was continued to study the Lake George Fault (31).

Australian Capital Territory

A second edition of the Canberra 1:250,000 geological map was prepared for the 1964 ANZAAS Meeting (See N.S.W.).

Engineering Geology

Engineering geologists provided services in the investigation of damsites, building and bridge foundations, and in the Canberra Lake Scheme (30). This work included investigations of the new Bureau building site and the Yarralumla Creek area now being developed. Considerable time was spent on the search for and testing of sources of construction materials - brick, clay and shale, concrete aggregate, building stone, and building sand and gravel.

The systematic study of groundwater in and around the Australian Capital Territory was maintained and seven bore sites selected at Hall (A.C.T.), A.B.M. Quarry, Murrumbateman, Collector and Orroral Valley (all in N.S.W.). Advice was given on possible sources of water at Murrumbateman and Queanbeyan (N.S.W.), and Hall (A.C.T.). Seven bore-holes were drilled to find the effect on the piezometric surface, of filling Lake Burley Griffin.

Victoria

Metals

A geophysical survey was carried out during the first three months of the year, in the Oonah Hill-Queen Hill area (34), at the request of the Tasmanian Mines Department. Electrical and electromagnetic methods were used, and anomalies were recorded over extensions of the Stanthite and Bradshaws Lodes; three holes have been drilled and firm these results. Bradshaws Lode was intersected at about 300 feet and showed 1% copper and 0.4% over about 20 feet.

Magnetic and SP surveys north-east of Mount Cleveland (36) extended previous work in 1953 and 1954. No evidence of any ore-bodies was found.

Engineering Geophysics

Seismic refraction surveys were carried out at four possible dam-sites being considered along the Gordon River (33) on the west coast, and at the Meadowbanks damsite (35) - this latter survey was to determine the elastic constants of the Triassic mudstone and sandstone.

South Australia

Oil

An aeromagnetic survey in the Great Artesian Basin covered the area of the Maree, Callabonna, and Frome 1:250,000 Sheets, and the southern halves of the Kopperamanna and Strzelecki Sheets (14). Traverses were spaced 2 miles apart at 1500 feet nominal altitude and total distance was about 14,500 miles. The field work was carried out under contract, and reduction and publication of results will be done by South Australian Department of Mines.

Western Australia

Oil

A party was engaged in geological mapping in that part of the Bonaparte Gulf Basin south of Queens Channel (17); this includes about half of the Cambridge Gulf, and a small part of the Medusa Banks 1:250,000 Sheet areas in W.A., and of the Auvergne Sheet area in the N.T. Close liaison was maintained with a party from an oil company and the two parties jointly aimed at solving several problems left as a result of geological and geophysical activities since the reconnaissance survey by Traves (B.M.R. Bull. 27 published in 1955). (See also under Metals, below).

A seismic refraction traverse was made across the widest point of the Carnarvon Basin, at about latitude 26° 45' S (15). Reflexion work was tried without success.

Metals

Field parties mapped that part of the Cambridge Gulf Sheet area outside the Bonaparte Gulf Basin (see under Oil, above) and the Lissadell 1:250,000 Sheet area, and completed mapping in the Dixon Range Sheet area, started in 1962. Two geologists from the Geological Survey of Western Australia joined Bureau parties for this work in the Kimberley region (38).

Northern Territory

Oil

Geological mapping continued in the Amadeus Basin (16); the Ayers Rock, Charlotte waters, Henbury, and Kulgera 1:250,000 Sheet areas were completed, together with about half of the Petermann Ranges and a small part of the Scott Sheet areas, and some reconnaissance by helicopter of parts of the Hale River, Rodinga, and Hermannsburg Sheet areas. (See also, Non-metallic Minerals, below).

For the N.T. Part of the Bonaparte Gulf Basin, see Western Australia - Oil.

In the Georgina Basin, (20) the Sandover River, Frew River (excluding Davenport Ranges - mapped previously), and about a quarter of the Bonney Well 1:250,000 Sheet areas were mapped. Reconnaissance mapping by helicopter was done on the Tennant Creek and Green Swamp Well Sheet areas (18). Results of the water supply study show that the regional piezometric surface indicates two sub-basins: the Georgina Basin proper; and the Barkly Basin.

Core from B.M.R. Core hole Grg 14 was studied and the stratigraphic hole B.M.R. 11 was logged.

Aeromagnetic surveys were made over the Elkedra, Sandover River, and Tobermory 1:250,000 Sheet areas (5) of the Georgina Basin (at the same time as adjacent areas in Queensland). (See Qld-Oil). The survey was made flying along east-west lines, two miles apart, at 2000 feet above sea level. The area surveyed lies north of the Simpson Desert survey, made under contract in 1962, for which the final contour maps were received in March of this year.

Metals

Compilation of the last six Arnhem Land 1:250,000 regional geological maps in the Carpentaria region was completed during 1963.

The Rum Jungle (39) geochemical survey, started in 1961, was completed, in the Area 55 - Browns West area. (See also: Special Mineral Survey, below).

At Tennant Creek (41) samples for geochemical analysis were collected by the Resident Geologist, from Explorer Mine (Ivanhoe), Golden Forty, and Mary Lane. These provided useful information for an intensive geochemical survey, planned for 1964.

Test IP surveys were made over several areas in the Rum Jungle area, in which strong EM anomalies had been discovered previously. Other electromagnetic and magnetic surveys were done in this area, mainly west of the railway line between Castlemaine Hill and Mount Fitch.

A magnetic survey was made over a broad aeromagnetic anomaly in the Quart Bowl area, about 14 miles west of Tennant Creek, also, a single traverse over Red Bluff Anomaly some 22 miles west of Tennant Creek.

The Darwin Uranium Group continued quarterly inspections of uranium mines in the South Alligator River area, assisted geological, geochemical, and geophysical parties in the area, generally supervised drilling at Union Reefs and provided drafting and plan printing facilities.

A programme of core drilling was completed in the Amadeus Basin (16) to test the Ordovician Stairway Sandstone for bedded phosphate rock; phosphatic beds were found in outcrop by Bureau field parties. Although many thin phosphate rich beds were found, the grade and thickness seems too low to be of economic size, however, an oil-saturated core was recovered from a depth of 650 feet in hole No.1, Johnny Creek area.

Auger drilling (about 16,000 feet) for geochemical samples, in the Mount Fitch area outlined the copper anomaly (discovered in 1958) in more detail. Ratios: copper/nickel; and copper/cobalt have also been measured. Diamond drilling intersected a zone containing chalcopyrite, giving 2.3% copper in the Coomalie Dolomite is interesting, and will lead to more prospecting of this bed, elsewhere in the region (39).

One diamond drill hole was drilled to about 300 feet in Area 55 and intersected minor copper and lead mineralization.

Rotary, percussion and diamond drilling in the Hundred of Goyder (39) was undertaken, to test for new deposits of phosphate and to evaluate the known deposits. About 9000 feet of rotary percussion and 1000 feet of diamond drilling showed that about 2M tons of phosphate rock are present; the grade is not known, but the total reserves are not likely to be large. Several hundredweight of ground phosphate rock was sent to the C.S.I.R.O. research station at Katherine, for testing.

Detailed geological mapping was undertaken at the Union Reefs Goldfield, (40) on a scale of 40 feet to 1 inch. Eight diamond drill holes were sited and five were completed. Some 1100 feet of experimental waggon drilling was tried as a cheaper alternative for examining veins at shallow depth, but was not successful in obtaining adequate samples.

Auger drilling for geochemical samples showed lead and lead/zinc anomalies in the Homestead area, adjacent to H.Y.C. area, McArthur River, and lead/zinc anomalies in the Teena/W-Fold area, adjacent to Reward. Diamond drilling is needed to test these anomalies.

An aeromagnetic survey in the Darwin-Pine Creek area (40) (Burrundie and Mount Bunday 1 mile Sheet areas, and parts of Ban Ban, Batchelor, Marrakai, and Wool Wonga) was done under contract. Traverses were $\frac{1}{2}$ mile apart at 500 feet above ground level and total distance flown was about 6000 miles. The results show several anomalous areas which warrant more detailed investigation.

A similar survey by the same contractors was done in the McArthur River (23) area ($16^{\circ}16'40''S$; $135^{\circ}25'10''E$) and total distance flown was about 6200 miles. Field work was completed in November, but the results will not be available until 1964.

Electromagnetic and electrical ground surveys were done in the Union Reefs and McArthur River areas, under contract. Field work was completed at the end of October and the reports are expected early in 1964; to date only preliminary inspection of field data has been possible. At Union Reefs, an area 13,000 feet x 2000 feet was surveyed along traverses 200 feet apart; in the McArthur River area, 88 miles of traverse at 400 feet intervals in three areas was carried out.

Engineering Geology and Geophysics

Geological mapping, seismic surveys, and drilling were carried out at possible damsites on the Darwin River (39); seismic surveys were made also, at possible observatory sites at Winnellie and Manton Dam (39).

Resident Geologists

The resident geologists at Darwin, Alice Springs, and Tennant Creek provide geological services for the Northern Territory Administration. Water supply investigations made up a large proportion of the work; this consists of advice regarding bore sites to provide water for human and animal use, and for irrigation, and investigation of possible damsites and catchments.

Mineral deposits are examined, generally at the request of prospectors and leaseholders. Some of the principal minerals studied were iron and manganese ores, gold, and bauxite and deposits of building materials were examined in the Darwin area.

Information obtained by companies and by Bureau field parties working in the Territory is recorded and background information on regional geology is supplied whenever possible.

Some recent projects have been: Town Water Supply, Alice Springs and Tennant Creek; proposed damsites near Darwin; irrigation water at Willowra; Mount Bunday (iron ore); Tennant Creek (gold and copper). Close liaison has been maintained with companies investigating manganese deposits on Groote Eylandt and bauxite at Gove, in eastern Arnhem Land. Low grade lignite has been reported by seismic parties working south of Alice Springs and proposals for further investigation have been sent to the Mines Branch, N.T.A.

Territory of Papua and New Guinea

A field party engaged in regional geological mapping of the Wabag and Lagaip Sub-Districts of the Western Highlands. The area mapped is about 1/3rd of the Wabag 1:250,000 Sheet area in New Guinea, immediately north of the boundary with Papua, bounded by longitudes 143° and 144° E and latitudes 5 $\frac{1}{4}$ ° and 5 $\frac{3}{4}$ °S. A helicopter was used in the more inaccessible parts of the region.

Engineering Geology and Geophysics

Geological mapping was completed and a design investigation report compiled preparatory to calling tenders for the construction of an underground hydro-electric power station and associated works at Port Moresby.

In the Upper Ramu Valley, (47) geological mapping, geophysical surveys (seismic, magnetic, and resistivity), and test drilling continued, in connexion with the proposed hydro-electric scheme.

Preliminary reports on field work completed in 1962 suggest that the Toriu River scheme is preferable to the Townokoko-Pondo hydroelectric scheme in New Britain (50), on the grounds of access and geological conditions, although the water flow is less.

Resident Geologists

The Bureau maintains resident geologists at Port Moresby, Wau and Rabaul, to provide geological services to the Administration of the Territory. The staff at Rabaul operates the Vulcanological Observatory (see below).

Apart from geological work connected with the hydro-electric schemes, the staff was engaged mainly on detailed investigations of specific mineral prospects.

Antarctica

Seismic and magnetic observations were made continuously during the year, at Macquarie Island (49), Mawson (46), and Wilkes (45). Seismic observations were made in the autumn along a traverse which extended to 100 miles south-east of Wilkes. Four gravity stations were established during this traverse.

OBSERVATORIES

The Bureau maintains a vulcanological observatory at Rabaul (N.G.), and geophysical observatories at Toolangi (Vict.), Mundaring (W.A.), Darwin (N.T.), Port Moresby (Papua), Mawson and Wilkes (Antarctica), and Macquarie Island.

Geophysical Observatories

The Creed verifier and comparator for punched paper tape were received at the Melbourne Office. All previously punched geomagnetic data were checked on these machines in preparation for processing by EOP equipment. Punching and checking of Watheroo magnetic data were completed. Computer programmes for the reduction of magnetic data were written.

Routine observations continued at the various observatories. The Milne-Shaw siesmograph and the Press-Ewing type long period seismograph were installed in the Toolangi vault. The latter had been in use at the Perth Observatory and is on permanent loan from Columbia University.

At Mundaring, a micropulsation recorder was constructed and put into operation during the year. A network of three temporary seismic stations was established between April and June, with one station at Mundaring itself; the purpose of the network is partly to record surface wave dispersion for crustal thickness determination, and partly to improve knowledge of local seismicity. Seismic waves from six depth charges exploded from H.M.A.S. Diamantina were successfully recorded.

Palaeomagnetic measurements were carried out in co-operation with the National University.

The Terrella model was completed during the year and a fairly complete set of measurements made. These were reported at a symposium on the upper mantle at the I.U.G.G. Meeting at Berkeley, California.

Rabaul Vulcanological Observatory

Vulcanological observations continued at Rabaul, Manam Island, Rapindik, and Wanigela during the year.

Weekly provisional seismic bulletins of the analysis of the seismograph records at Rabaul were distributed to international stations.

Tiltmeters were operated at Rabaul, Rapindik, Manam and Wanigela. A tide gauge and depth markers were used in Rabaul Harbour, and temperature measurements made in thermal areas around Blanche Bay.

Visits were made to Cape Gloucester area, Mount Balbi, Manam Island, Uluwan, and Mount Lamington.

LABORATORIES

Laboratories are maintained in the Bureau to provide ancillary services for field investigations, to carry out basic research work, and to provide services to the public where appropriate. In recent years these laboratories have undertaken an increasing number of research projects designed both to acquire basic information and to develop more efficient techniques and equipment for field work.

Geological Laboratories

The Geological Laboratories in Canberra carry a staff of petrologists, palaeontologists, and chemists. Numerous examinations, analyses, and assays are made throughout the year, and specialist interpretative work is undertaken to assist in the final conclusions drawn from surveys. Original research is also carried out, particularly in those fields which will assist the interpretation of Australian mineralogenesis and stratigraphy.

Petrology and Mineralogy Laboratory

The Petrology and Mineralogy Laboratory reported on the geological and geochemical survey of the Captains Flat area and a paper on this was prepared for the meeting of ANZAAS in January 1964.

Two members of the petrological staff carried out field assignments during the year. These were the study of the petrology of the igneous rocks of the Petermann Ranges N.T., the study of the porphyries of the Tennant Creek area N.T., and the mapping and petrology of the Rum Jungle Complex. Results to date indicate that most of the porphyries at Tennant Creek are actually turbidites, and that the Rum Jungle Complex consists of seven separate rock types, overlain unconformably by the Batchelor Group.

A start was made on the setting up of a group for the study and testing of building stones, and examinations were made of some white sandstones from the Mittagong Area, N.S.W., which were to be used for several buildings in the A.C.T. These were not recommended for use as facing stones and lintels.

Detail sedimentary petrology was carried out on outcrop and well samples from the Bowen-Surat Basin and from the Georgina Basin; work is continuing in these areas and a start made on sediments from the Amadeus Basin.

Work continued on the formation of sulphides at low temperatures and the work was extended to the study of movement of sulphides in rock-forming minerals. Mixtures of sulphides in clays were subjected to high pressures at temperatures between 100°C and 160°C, and were found to segregate into their respective mineral types and to move considerable distance through the reconstituted clay.

The establishment of facilities for the direct reading emission spectrography were completed and enquiries as to the availability of standard rock, ore, and mineral samples were commenced and a collection of standards made. Experimental work on the programme for this instrument has been carried out, with the assistance of Dr. Ross Taylor, on the large grating spectrograph at the A.N.U. The work has been directed towards line selections for elements at difference concentrations in a variety of matrices, and is aimed at establishing 'working curves' for the 'direct reader programme'.

Sundry mineragraphic investigations were carried out on samples submitted by field parties, and a detailed investigation of the origin of the tin in the North Queensland tinfields was commenced.

Beside routine chemical investigations on the X-Ray spectrograph, curves were constructed for the analysis of tin, using cadmium as an internal standard, and for the analysis of niobium and tantalum by the bisulphate fusion method.

A programme of silicate analyses by X-Ray fluorescence was commenced and curves constructed for the analyses of calcium and potassium using a thin film technique plus internal standard, which was found to give good sensitivity with very low background.

Routine mineral determinations were carried out by X-Ray diffraction, and ratio analyses of Rb/Sr were made for the age determination group.

Chemistry

The analytical activities of the Chemistry Laboratory include: geochemical prospecting, phosphate investigations, water analyses and miscellaneous analyses. The following work was completed:

Geochemical prospecting - spectrochemical analysis of 4800 stream sediment, soil and rock samples from surveys at Rum Jungle and Macarthur River, N.T., Papua and New Guinea, and Ingham district, Queensland. This work includes the estimation of copper, lead, zinc, cobalt, nickel, molybdenum, vanadium, tin, beryllium and phosphorus;

Phosphate investigations - chemical analysis of 474 drill cuttings, core and rock samples for phosphate content from Rum Jungle and Amadeus Basin, Northern Territory and Bowen Basin, Queensland;

Water analyses - 44 water samples from the A.C.T. and 21 brine samples from Antarctica for complete or partial chemical analysis;

Miscellaneous analyses - a total of 97 samples of various rock and minerals requiring partial analysis for alkali metals, base metals etc. or full silicate analysis.

Other chemical activities included participation in the bio-geochemical investigations carried out by Dr. K.L. Temple of C.S.I.R.O., Canberra. The toxicity of copper to Desulphovibrio desulphuricans, the common sulphate-reducing bacterium was investigated. A concentration of 32 p.p.m. Cu allowed full growth of cultures while 300 p.p.m. Cu was found to be toxic.

A study was also made of the release and subsequent fixation (as sulphides) of metal ions adsorbed on clay and hydrous ferric oxide when separated from active precipitates were formed in the agar gel.

Following earlier work on the chemical pollution of the Molonglo River and the behaviour of zinc in this river a joint programme with the Zoology Department, A.N.U., was started to study the effects of zinc on fish, a subject of interest in relation to the stocking of Lake Burley Griffin. This work was completed and a joint paper begun. During this work it was found that some fish can concentrate zinc from the very low levels of less than 1 p.p.m. in the water to 100 to 250 p.p.m. Zn in the dehydrated fish. This could have application in the syngenetic formation of ore deposits.

The Palaeontological staff is divided into two groups, one dealing with macrofossils and the other with microfossils. Both groups carry out studies of material submitted by Bureau field parties, oil companies, and others.

The work of the Macropalaeontology group was concerned with several matters. Cambrian fossils were examined during a visit to the United States and Canada. New localities for Cambrian fossils were found during a field excursion to the Amadeus Basin, N.T. and Middle Cambrian fossils recovered from bores in the Tennant Creek area. Others were collected in the Daly River Basin and a previously unknown Upper Cambrian fossil in the Comet Shale, from near Dundas, Tas., was investigated.

Many new localities for shelly Ordovician fossils were discovered in the Amadeus Basin and the known extent of Ordovician sediments has been greatly enlarged.

The faunal subdivisions of the Permian Middle Bowen beds were further elaborated and extended, and fossils were examined from the Bowen, Carnarvon, Perth, Canning, Bonaparte, and Sydney Basins.

More work was done on the Mesozoic of the Northern Territory and New Guinea.

Foraminiferal, ostracod, condonont, and palynological work was continued by the Micropalaeontology group, on oil well samples and outcrop samples from throughout Australia and New Guinea; over 2,000 samples were processed during the year.

Geophysical Laboratories

The Geophysical Laboratories at Footscray (Vic.) undertake basic research in geophysics, research into new geophysical field techniques, and the design, development and construction of new instruments. Routine determinations of the physical properties of rock samples are made.

The Design and Development Group continued its work in devising new geophysical techniques and equipment and modifying existing ones. Problems submitted by various groups were attacked, and assistance and supervision were provided for staff from these groups temporarily working with the Development Group.

An advisory service in electronics was provided for all Sections of the Branch and on occasions, assistance was given to the Geological Branch.

Schematic and layout circuit diagrams prepared by the Group are used for construction by the Branch and by contractors, and are included in equipment operating and maintenance handbooks. Over 200 drawings were completed during the year and over 200 coils, chokes, and transformers were designed and wound during the year.

Design work continued on proton precession and fluxgate magnetometers. The basic proton magnetometer was used for the design of a survey unit for airborne use in the Cessna aircraft. A reading frequency of 2 per second with an accuracy of ± 1 gamma has been achieved. The first field tests were made during the Cobar experimental survey in 1963.

A transistorized fluxgate magnetometer for ground monitoring the airborne magnetometer in the DC. 3 aircraft VH-MIN was designed and built. The fluxgate magnetometer in the aircraft was redesigned and rebuilt during the first half of the year.

Designs already completed were used to develop crystal clocks for timing in field seismology including the proposed tripartite network for crustal thickness studies in Papua. They were used also for a time mark programming unit for Wilkes Observatory.

Other work included: a calibrated time delay for the Seismic Variable Intensity Plotter equipment to delay the shot instant trigger 0.001 to 10 seconds; testing shielding for gamma ray density probes; studies in measuring rock conductivity by inductive means; telluric fluxgate investigations; gamma ray density meter design.

The Maintenance and Testing group did maintenance, repair, and modification of geophysical equipment throughout 1963. Several major projects were undertaken and others commenced in 1962 were completed.

For the Seismic Group, reinstallation of a set of seismic amplifiers and associated equipment was completed. Installation and checkout of the continuous velocity logging equipment were commenced. The logger was still in the prototype stage and several modifications were required to achieve reliable operation.

Routine measurements of magnetic susceptibility and elastic constants of rocks were made as requested.

The workshops did routine maintenance and testing of geophysical instruments and equipment, made major modifications to equipment and constructed new equipment. Some samples are: major modification to an elevation meter and its installation in a 4-wheel drive vehicle; the integration of a Failing logger and Widco logger into a 10,000 foot logger combining the best features of both; installation of the continuous velocity logger on vehicles; and rebuilding the Cessna magnetometer towed bird and the construction of a spare bird.

The rebuilding of a 35 mm strip camera for use in the DC3 aircraft was completed and the camera was installed and used during the year.

An astatic magnetometer with field coils was completed for use in studies of palaeomagnetism in conjunction with A.N.U.

Six high temperature compression chambers for sulphide experiments were built for the geological Branch.

A prototype 35 mm strip film viewer was designed and built for the drawing office.

The design of a parallel guidance mechanism for use with a stereoscope in the examination of airphotos was completed.

Many small jobs kept all sections of the workshop fully employed.

COMMON SERVICES

In order to keep its various field parties and laboratories properly equipped and supplied, the Bureau maintains services which are common to all groups. The specialized services included the drawing offices, libraries, geophysical workshop, and stores.

The Geophysical and Geological Drawing Offices provide maps, the main media by which the results of field investigations undertaken by the Bureau are conveyed to organizations such as State Mines Departments, oil companies and mining companies, and to the general public. Both offices prepare all the necessary plates and maps required to illustrate the publications issued by the Branches.

The usual library facilities were provided in Head Office and the Geological and Geophysical Branches, and the Central Register of Stratigraphic Names was maintained in the Geological Branch.

APPENDIX

PUBLICATION OF THE BUREAU

A complete list of publications issued by the Bureau may be obtained on application from the Director, Bureau of Mineral Resources, P.O. Box 378, Canberra City, A.C.T. A brief description of the types of publications issued by the Bureau follows.

The publications of the Bureau are primarily of a specialist nature and are designed for three purposes:-

- (1) To record the results of geological and geophysical field, laboratory and observatory investigations.
- (2) To provide easily accessible general information on minerals to assist those connected with development of the mining and mineral industries.
- (3) To provide a continuous review of the mineral industry in Australia.

The scope of the various types of publications is given below.

Bulletins are confined to reports on major investigations, or on particular phases of investigations regarded as complete, or reports on comprehensive investigations that may not be complete but are not likely to be continued at an early date.

Reports include the results of important preliminary investigations, or some phase of a major investigation, the results of which it is desirable to publish as soon as possible, either because of its immediate interest or because the investigation of which it forms a part may not be completed for several years.

Petroleum Search Subsidy Acts Publications embody results of operations subsidized under the Petroleum Search Subsidy Acts 1957-58 and 1959-61. Publications in this series are reports on drilling operations, geophysical surveys, and bore hole surveys.

The Australian Mineral Industry, Quarterly Review is prepared and issued in conjunction with the Commonwealth Bureau of Census and Statistics. Part 1 of the Review contains feature articles concerning some aspect of the mineral industry, a current review on metals and minerals, and current metal and mineral prices. Part 2 includes production, import, and export statistics.

The Australian Mineral Industry, Annual Review presents information on the mineral industry in three parts - general review, review by metals and minerals, and statistics by States.

Summary Reports provide a summary of information concerning individual minerals or metals, giving sources, uses, production, consumption, prices, and trade.

Pamphlets provide information of use to prospectors and miners on prospecting, treatment, marketing of minerals.

Maps published by the Bureau include:

The standard series of geological maps at a scale of 1:250,000 (Previously 1:253,440); geological maps at other scales;

Geophysical maps, which do not constitute a formal series and are published in format appropriate to the different surveys;

A Petroleum Tenements Map of Australia and the Territory of Papua and New Guinea, accompanied by a list of tenement holders, is revised and published twice yearly to give the position at 30th June and 31st December.

The publications outlined above may be purchased from: the offices of the Bureau in Canberra; the Department of National Development in Melbourne and Sydney; or through the State Controllers, Department of Supply in the other capital cities.

Publications issued or reprinted in 1963 are listed below:

Bulletins

- No. 63 Permian pelecypods and gastropods from Western Australia; by J.M. Dickins.
- No. 64 Early Upper Cambrian fossils from Queensland; by A.A. Opik.
- No. 65 Chemical analyses of Australia rocks, Part 1 -
- Igneous and metamorphic rocks; by Germaine A. Joplin.
- No. 66 Lower Cretaceous arenaceous Foraminifera of Australia; by Irene Crespin.
- No. 67 Australian Mesozoic Trigonids; by S.K. Skwarko.

Reports

- No. 52 The geology of the Musa River area, Papua; by J.W. Smith and D.H. Green, with appendix by N.H. Ludbrook.
- No. 57 Misima Island - geology and gold mineralization; by F. de Keyser.

Petroleum Search Subsidy Acts Publications

- No. 15 Queensland American The Overflow No. 1, Queensland, of Queensland American Oil Co.
- No. 23 Conorada Ooroonoo No.1, Queensland, of Conorada Petroleum Corporation.
- No. 35 East Roma Seismic Survey, Queensland, 1959-60, by Associated Australian Oilfields N.L.
- No. 36 Blue Hills-Logue Seismic Survey, Western Australia 1959-1960, by West Australian Petroleum Pty Limited.
- No. 39 Longreach-Silsoe Seismic Survey, Queensland, 1960, by Cree Oil of Canada Limited.

- No. 41 Phillips-Sunray Buckabie No.1, Queensland, of Phillips Petroleum Co. and Sunray-Mid-Continental Oil Co.
- No. 42 O.D.N.L. Penola No.1 well, South Australia, by Oil Development, N.L.

Summary Reports

- No. 42 Salt.

The Australian Mineral Industry Reviews

Quarterly Review Vol.15 Nos. 2, 3, and 4.

Quarterly Review Vol.16 No. 1.

Annual Review for 1962.

Observatory Reports

Monthly issues throughout the year.

Geological Maps

Standard 1:250,000 series

Queensland: Atherton, Clarke River, Einasleigh, Georgetown, Gilberton, Mossman.

Western Australia: Stansmore (4 miles to 1 inch)

Northern Territory: Alligator River, Hay River, Katherine, Mount Evelyn, Pine Creek.

(Each map is accompanied by Explanatory Notes, not necessarily available immediately).

Preliminary editions 1:250,000 (uncoloured)

Queensland: Boulia, Cairns, Duaringa, Innisfail, Machattie, Mackay, Manuka, Proserpine (s. half), Richmond, St. Lawrence.

Western Australia: Gordon Downs.

Northern Territory: Alroy, Bloods Range, Brunette Downs, Junction Bay, Lake Amadeus, Milingimbi, Wallhallow, Wessel Islands and Truant Island.

Standard 1 mi. to 1 inch (coloured)

Northern Territory: Batchelor, Burnside, Daly River, Katherine, Lewin Springs, Mount Gold, Mount Tolmer, Muldiva Creek, Reynolds River.

Other geological maps (coloured)

(1:500,000 maps)

Queensland: Georgetown - Clarke River.Western Australia: Carnarvon Basin (2 sheets).Northern Territory: Katherine - Darwin Region.

(1 mi. to 1 inch map)

South Alligator River Area, N.T.

Geophysical MapsGravity Maps: standard 1:250,000 Sheet areas, at scale 1:500,000Western Australia: Bentley, Cambridge Gulf, Geraldton -
Yalgoo, Helena, Medusa Banks, Minilya -
Winning Pool, Mount Bannerman, Ningaloo -
Yanrey, Onslow, Stansmore.Northern Territory: Auvergne, Bloods Range, Cape Scott,
Elkedra, Henbury, Hermannsburg,
Huckitta, Kulgera, Port Keats,
Sandover River, Tobermory.

(Gravity contours do not cover entire sheet in some cases).

Magnetic and Radiometric Maps: Standard 1:250,000 Sheet areasQueensland: Clermont, Duaringa, Emerald.Western Australia: Byro, Eder, Edmund, Glenburg, Kennedy
Range, Minilya - Winning Pool, Mount
Phillips, Ningaloo - Yanrey, Onslow,
Quobba, Shark Bay, Wooramel, Yaringa.Maps covering 1:250,000 Sheet areas, at 2 mi. to 1 inch (each in 4 sheets)Western Australia: Lake Johnston.Northern Territory: Tennant Creek.also: Narrandera - Cootamundra, N.S.W. at
same scale, but on one sheet, covering
part of these sheet areas only.Radiometric Map, 8 mi. to 1 inch, with marginal photographs

Mount Isa region, Queensland (G181-22)

MiscellaneousPetroleum Tenements Map of Australia, and the Territory of Papua and New
Guinea; for 31 December, 1962 and 30 June, 1963.

