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BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

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1958/119

SUMMARY OF ACTIVITIES,

METALLIFEROUS SUB-SECTION, 1958

by

D. O'Driscoll

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Contents

SUMMARY

Geological mapping parties, connected primarily with the search for metalliferous deposits, operated in Northern Territory, Queensland, Western Australia, and New Guinea during 1958. Some minor investigations were made in New South Wales and South Australia.

In the Northern Territory all field work for the Katherine-Darwin Bulletin was completed and a start was made in the Urapunga area in the south-east, in a new project which will link this mapping to the Precambrian areas of north-west Queensland. Map production and writing for the Bulletin went on throughout the year. At Tennant Creek, as a sequel to several years of geophysical and geochemical work by the Bureau and of geological mapping, drilling and investigation by company geologists, a start was made in a new programme of detailed mapping of the mineralized areas. This programme may take several years to complete but it is hoped to be another forward step toward the final elucidation of structures which control the deposition of the orebodies. At the Jervois Range copper field, 200 miles north-east of Alice Springs, a small detail survey was undertaken of all known deposits and the surrounding geology.

In Queensland the major field effort was directed to the completion of the four 4-mile sheets of the Einasleigh-Georgetown area begun in previous seasons. A separate party on the adjoining Atherton 4-mile area carried out detailed mapping of the mining areas around Chillagoe and Mungana. In the Constance Range area, near the Northern Territory border, detailed mapping of the Upper Proterozoic basins which contain the sedimentary iron deposits was undertaken. This mapping is to be followed with an extensive drilling programme by which B.H.P. Ltd. propose to evaluate the deposits. West of this area a reconnaissance was made of the adjoining Mt. Drummond 4-mile area in the Northern Territory. Other field work in Queensland included the examination of several radioactive prospects, the collection of granite samples for age and palaeomagnetic determinations, and geochemical surveys described among the activities of the laboratory staff in another record. All field parties were joint ones with the Queensland Geological Survey.

Work on the North-west Queensland Bulletin proceeded in Canberra and is now almost complete.

In Western Australia a comprehensive survey of manganese deposits in the northern part of the State was completed and new reserve estimates are in preparation.

In New Guinea a regional party mapped parts of four 1-mile sheets in the Musa River area 100 miles east of Port Moresby where potentially nickeliferous rocks occur.

The sampling of granites for age determination was carried out in New South Wales, South Australia and Queensland and is now largely complete for these three States.

KATHERINE-DARWIN SURVEY

Most of the work on this project was confined to map compilation and to preparing the introductory chapters of the Bulletin. Previous literature has been examined and listed and a considerable amount of data collected from field note books and other sources in preparation for other chapters.

The following officers were engaged: B. P. Walpole, E. J. Malone, M. A. Randal (Canberra); P. R. Dunn, R. Ruker (Darwin Uranium Group).

Maps compiled during the year are listed below under the different 4-mile sheets.

Alligator River 4-mile Sheet: Photo scale compilations of the twelve component one mile areas were completed and reduced to fit the 4-mile grid. Plotting of the 4-mile compilation is virtually completed and the explanatory notes, legend and sections have been commenced. The Kapolga and Spring Peak 1 mile areas are being compiled for the 1-mile Series maps.

Pine Creek 4-mile Sheet: Control for the remainder of this sheet was received late in the year. The Woolwonga, Batchelor, Mt. Tolmer, Reynolds River, Mt. Hayward and Daly River 1-mile areas have been compiled for the 1-mile Series and photo reduced for the 4-mile map. Additional data were added to the Tabletop and Burrundie 1-mile areas and these have been passed on for fair drawing. A recompilation of the Burnside 1-mile area was completed for the 1-mile Series and also plotted at 4-mile scale. The Douglas and Tipperary 1-mile areas have been plotted at 4-mile scale. A start has been made on compilation of the Peron Island, Anson Bay, Billawock and Hermit Hill 1-mile areas. These are being plotted at 4-mile scale. Additional data is being plotted on the previously compiled Ban Ban 1-mile area by the Northern Territory resident staff.

Fergusson River 4-mile Sheet: Control for this sheet was also received late in the year and good progress has been made in the compilation of the geological map at 4-mile scale. Ten of the twelve component 1-mile areas have been compiled on the controlled bases and photo reduced to 4-mile scale. Of these the Muldiva Creek 1-mile area has also been compiled for the 1-mile Series. The 4-mile map will be completed early in the new year.

Katherine 4-mile Sheet: Control for this sheet was received in November. The Diljin Hill, Black Cap and Waterhouse 1-mile areas are being compiled for the 1-mile Series and will be later reduced to 4-mile scale. Compilation of seven of the remaining one-mile areas has not yet been commenced. Mt. Todd and Katherine 1-mile areas were compiled in draft in previous years.

Mt. Evelyn 4-mile Sheet: Some additional data have been plotted, the sections redrawn and the map given a final check before completion of the fair drawing for the 1-mile Series.

Darwin 4-mile Sheet: Control for most of this sheet is not yet available. The Mt. Bundey 1-mile area has been compiled for the 1-mile Series and passed on for fair drawing.

Special Maps: A map of the Rum Jungle district was compiled at 1-mile scale and is now ready for fair drawing.

URAPUNGA GEOLOGICAL PARTY

Officers of this party were P. R. Dunn (Party Leader), R. A. Ruker and R. Bryan, under the supervision of B. P. Walpole.

The party carried out mapping of the several 1-mile sheets necessary to complete the field work for the Katherine 4-mile sheet - the major task outstanding in the production of the Katherine-Darwin Bulletin. These 1-mile sheets were Diljin Hill, Black Cap, Waterhouse and part of Mataranka.

The party began work on the Urapunga 4-mile sheet immediately east of Katherine, with the ultimate object of extending the mapping of the Precambrian belt from this area down to the Queensland border. The party's original programme was to map the Urapunga, and if time permitted, the Roper River sheet. However, it was realised that before this work could be advanced, the relationships of the different Upper Proterozoic units present in those areas to the units recognized during the Katherine-Darwin survey had to be tied in to previous mapping by Broken Hill Proprietary and Consolidated Zinc Corporation. These factors necessitated mapping at 1" to 1 mile scale and consequently the area attempted had to be reduced.

The 1958 field work has resulted in clarification of the Upper Proterozoic stratigraphy extending well beyond the area first mapped in 1950. It will form a firm basis for future work. One result of the investigation was the discovery of a northerly extension of the oolitic iron ore beds at present being tested by B.H.P. Ltd. in the Roper River area.

The programme for 1959 field season will aim at completing the Urapunga and Roper River Sheets.

TENNANT CREEK PARTY

GENERAL

An area of approximately 115 square miles was mapped at a scale of 1 inch to 1,000 feet, using a set of air photos of this scale made available by Peko Mines N.L. This area lies between grid lines 2,527,000 and 2,544,000 North and between 185,000 and 213,000 East on the Tennant Creek 1-mile map, and includes most of the important mines on the field.

The members of the party and the time spent in the area by each were as follows:

P. Crohn (Party Leader) 22/5/58-25/10/58.
R. Ryan 22/5/58-15/8/58 and 15/9/58-24/10/58.
W. Oldershaw 8/7/58-24/10/58.
R. Mercer 18/9/58-25/10/58.

PHYSIOGRAPHY

Physiographically, the area consists of groups of ridges, generally with an east-south-easterly trend, separated by low-lying areas up to two or three miles across. The maximum relief of the area is of the order of 300 feet, the highest point being Mount Samuel, 1,429 feet above sea level.

These ridges are essentially remnants of an old land surface, characterised by a zone of iron enrichment up to 15 feet thick, underlain by a considerably thicker leached zone. No true laterities are present. The characteristic steep-sided profiles of the ridges are due to the undercutting of this iron enriched zone during the current cycle of erosion.

The remnants of this old land surface now commonly slope at angles of one to two degrees. This can be accounted for either on the assumption of an old peneplain, locally upwarped or block-faulted and tilted in geologically recent times, or on the assumption of an originally undulating land-surface with a relief of at least 300 feet, followed by a change in climatic conditions resulting in pedimentation cutting into the slopes of the former hills.

The low-lying areas between the ridges are now largely occupied by bull-dust, which is essentially wind-borne material of silt-particle size. The thickness of this material probably averages not more than 10 to 15 feet over the greater portion of the area and only exceptionally exceeds 40 to 50 feet.

GEOLOGY

(1) Warramunga Group

The basement over most of the area consists of sediments of the Warramunga Group, comprising greywackes, siltstones and shales with subordinate grits and conglomerates. The thickness of individual beds rarely exceeds 15 or 20 feet, and graded bedding is very commonly developed. Slump structures on a small scale are very widespread, and include mud-pellets, balled structures and sole markings. Probably the conglomerates in the succession are also the products of slumping on a larger scale.

A very distinctive horizon of thin-bedded hematite-rich shales, often with minutely crenulated bedding planes, has been recognised in the Mount Samuel-Eldorado area and in the vicinity of the Burnt Shirt and Lone Star Mines, and is being tentatively used as a marker horizon. Chlorite- and sericite-rich rock types are locally important, and are thought to be derived from normal shales by reconstitution in the vicinity of major shear zones.

At Mount Samuel and Noble's Nob, several beds of the Warramunga Group contain spheroidal bodies, averaging one to three inches in diameter, which are thought to be of organic origin.

These sediments are folded about east-west axes with dips averaging 70 degrees, but occasionally reaching 90 degrees and rarely overturned. Most of the folds are roughly symmetrical, but in the vicinity of the Mount Samuel and Eldorado Mines, a monoclinal structure in an area of dominantly gentle dips has produced a local steepening of dips to the north. Some cross-folding is indicated by rapid pitch changes and by the presence of minor folds pitching down the dip of the limbs of the major folds.

Shearing is widespread, but in the majority of cases the actual displacement on individual shears appears to be of the order of a few feet only. In the north-eastern portion of the area mapped, a rapid increase in the number and size of shears occurs as a major north-west trending zone of disturbance is approached.

(2) Igneous Rocks

In the area mapped, the Warramunga sediments are intruded by two groups of igneous rocks. The more important of these are quartz-felspar porphyries, occupying areas up to two miles by half a mile, notably in the vicinity of the Aerodrome, to the south of the Red Terror Mine and to the east and south-east of Peko. These rocks are commonly strongly sheared and in the hand specimen are not always distinguishable from grits of the Warramunga Group. Mapping in the field, however, usually enables them to be identified beyond doubt. They have produced little contact metamorphism, except for the silicification of favourable beds and brecciated zones, which has given rise to prominent jasper bars in the surrounding sediments. With increasing distance from porphyry contacts, some of these jaspers show transitions to the quartz-hematite lodes described below, and this suggested a genetic relationship of the quartz-hematites to the porphyries. Portions of the porphyries are rich in xenoliths, which are also relatively little altered.

The remaining intrusive rocks are tentatively grouped as lamprophyres, but may include amphibolites, pyroxenites and related types. They generally occur as irregular bodies, not more than 200 feet by 200 feet in extent and are deeply weathered. They intersect the ironstones, but were not seen in contact with the porphyries.

Outside the area mapped, the Warramunga sediments are also intruded by adamellite in the vicinity of the Seven Mile Bore and by granodiorite south-east of Noble's Nob.

(3) Quartz-Hematite Lodes

Numerous quartz-hematite bodies were mapped, ranging from a few inches to more than 40 feet in width and up to several hundred yards in length. Some of these have developed in shear-zones, while others replace favourable beds. Most of these bodies are tabular or lenticular in shape, but some are irregular and one was found to have the shape of an inverted saddle reef. The elongation generally is east-west. Both sharp and gradational contacts with the surrounding sediments have been observed, the latter generally taking the form of a transition zone of country rock traversed by a large number of very small hematite veinlets. The proportions of quartz and hematite vary widely, even within a single body, and many of the lodes are themselves cut by younger quartz veins free from hematite. Mineragraphic evidence indicates that the hematite of these lodes is largely derived from magnetite, and many of the lodes still contain small amounts of magnetite even in the zone of oxidation.

Barren quartz veins are also very common and several sets, respectively striking 30 to 40 degrees, 80 to 100 degrees and 120 to 130 degrees, can be distinguished.

(4) Rising Sun Conglomerate

In the south-eastern portion of the area, the Rising Sun Conglomerate was found to rest on an eroded surface of porphyry and Warramunga sediments. The matrix of the basal pebble beds, regarded as "porphyritised" by previous workers, consists largely of quartz and felspar grains derived from the underlying porphyry, probably without very much transport, but always with a sharp boundary against the porphyry itself.

(5) Gold Deposits

The workable gold deposits in this area occur in a variety of structural and lithological environments, ranging from massive quartz-hematite lodes to brecciated zones in sediments, generally mudstones, which carry only minor amounts of hematite. Since none of the mines except Peko has penetrated below the oxidised portions of the lodes, little is known about the composition of the primary ore, but it seems probably that it is always associated with at least some sulphides.

(6) Copper Deposits

With the emergence of Peko as the largest mine on the field, interest in the exploration for copper is now surpassing that for gold. Since none of the mines other than Peko itself have so far exposed any primary ore, it is difficult at this stage to generalise on the factors responsible for the localization of copper orebodies.

At Peko, massive sulphides, (essentially pyrite, pyrrhotite and chalcopyrite), replace the central portion of a quartz-hematite pipe. At Northern Star, Wheal Doria and Orlando, disseminated sulphides are recorded in diamond drill holes in brecciated sediments, associated with varying amounts of quartz and hematite or magnetite. At Pinnacles and Shamrock, secondary copper minerals have been worked in sheared and brecciated sediments, but none of the workings has so far encountered sulphides. At the Aerodrome locality, a few specks of sulphides (chalcopyrite and pyrite), were found in massive quartz-felspar porphyry, and at several other localities, notably about three quarters of a mile south of the Pinnacles, the weathered porphyries contain cavities partially filled by limonite, which are regarded, at least in part, as box-works due to the leaching of sulphide minerals. Spectrographic analyses of the limonite from two of these specimens have confirmed the presence of small amounts of copper.

(7) Magnetic Anomalies

On the aerial magnetic map of the area, a pattern of regional anomalies with east-south-easterly trends is combined with local anomalies due to individual ironstone bodies. These east-south-east trends appear to represent a compromise direction between the prevailing strike of the sediments (90 degrees), and the two dominant directions of shearing (100 and 120 degrees). Areas of low magnetic relief, as in the vicinity of the Aerodrome and between Peko and Eldorado, correspond to areas where igneous rocks are exposed on the surface or are believed to underlie it at relatively shallow depths.

JERVOIS RANGE MINE MAPPING

GENERAL

A unit of the Jervois Geological party undertook a detailed survey of the numerous copper deposits in the small field at the eastern end of the Jervois Range. Several of them are being actively worked by Mr. K. Johannson who is attempting to produce copper sulphate for sale to South Australian fertilizer manufacturers.

W. Robertson spent 4½ months plane tabling the leases at a scale of 40 feet to 1 inch, examining the workings, and mapping the surrounding area of about 11 square miles at a scale of 1,000 feet to 1 inch.

Plane table sheets were completed for the Marshall, Attutra, Green Parrot, and Cox's Lode deposits; the geology was added to the Bellbird topographic plane table sheet, and additions were made to the Reward plane table sheet, both of which had been started in the previous season.

GEOLOGY

The deposits in the Jervois Range mineral field are in an area of steeply-dipping metamorphosed sediments of the Arunta Complex. The predominant rock type is mica-schist, commonly knotted, probably after andalusite. Lenses of skarn, garnet epidosite, silicified limestone and marble crop out in many places. Quartz tourmaline veins, and to a lesser extent pegmatitic greisen, both of which parallel the strike of the rocks and lodes, are notable features of the area.

The main structure in the area is a steep north-plunging syncline. Mineralization occurs discontinuously along the steep-dipping or vertical limbs of the syncline over a strike length of 7 miles at not less than 5 different stratigraphic horizons. Minor folds are not common, and of those recorded some plunge to the north, others to the south, at angles ranging from 25° to 75° ; they appear to be of only local significance. The area has not been greatly disturbed by faults; those observed appear to die out in the schist. A vertical lineation is widespread in the area and strikes, wherever measured, between 330° and 360°; it is subordinate to the schistosity which is parallel to the bedding.

The lodes occur in ferruginous, garnetiferous, quartz rich lenses, only one of which is more than half a mile long, and in adjacent or included limy bands. In some places, such as the Marshall, Attutra and Green Parrot Lodes, the copper is concentrated along weak shears near the boundary between the garnetiferous rock and the surrounding mica-schist; in others, such as the Bellbird and the Reward, the copper occurs in essentially undisturbed beds although tending to concentrate at minor folds and flexures. Everywhere the lodes parallel the schistosity.

At the surface the predominant copper minerals are carbonates, but small amounts of oxide and silicate may also be seen. In some places no copper minerals are visible in the massive gossan at the surface, particularly in the Reward, Bellbird and Green Parrot Lodes, although they are visible in pits only a few feet deep.

WORKINGS

Many pits and costeans have been sunk to depths ranging from one to thirty feet on all the main lodes.

Shafts on the Reward, Marshall, and Bellbird(2) Lodes have reached, but scarcely penetrated, primary ore.

Crosscuts show the primary mineralization to consist of many thin bands of pyrite and chalcopyrite that follow the strike of the garnetiferous rock. Sampling by Blanchard (1939) excluding the Bellbird, indicates that the carbonate zone is enriched at least 100% relative to the primary zone. Although chalcocite occurs in the Green Parrot shaft and at the Reward, the usual mineral at the surface is a carbonate and there are no indications of any zone of secondary enrichment.

The lead lodes are found mainly in the impure limestone bands, and occur both as continuous lodes and pods, which are characteristically high grade but small. Galena and cerussite are the predominant lead ore minerals; galena persists to the surface. The lead lode in the Green Parrot shaft cuts out at about 90 feet.

Full production figures for the field are not available, but T. T. Hanlon shipped 17 tons of 31% copper ore containing 25 ounces of silver and 5% of lead, 56 tons of 52% lead ore containing 36 ounces of silver and 2% copper, and 41 tons of mixed ore containing 15% copper, 23% lead, and 42 ounces of silver. More recently high grade copper ore has been shipped from the Bellbird, Green Parrot, and Reward Lodes.

K. Johannsen has installed a leaching plant close to the Attutra and Reward Lodes, in which carbonate ore is converted into copper sulphate for agricultural purposes.

CONCLUSIONS

1. Base metal mineralization, copper lead and silver, occurs in at least six lodes in the area; these are of sufficient size and grade at the surface to justify further work in the field.

2. There is sufficient copper carbonate to keep the present leaching plant in operation for many years.

3. Primary mineralization has been inadequately tested in all the deposits up to the present time to evaluate the importance of the deposits at depth.

4. Drilling programme is required to determine the extent and structure of the lodes, and to assess the reserves.

REFERENCE

Blanchard, R., 1939 - "Report on Jervois Range Northern Australia". Anglo-Queensland Mining Pty. Ltd. (unpublished).

EINASLEIGH GEOLOGICAL PARTY, NORTHERN QUEENSLAND

GENERAL

During the year geological mapping was carried out on Precambrian metamorphics in the Robertson River area (Georgetown Four Mile), Siluro-Devonian sediments in the Broken River (Clarke River Four Mile) and the Camel Creek areas (Einasleigh Four Mile), Upper Palaeozoic Ring Dyke Complex in the Glenmoore area (Clarke River Four Mile), and the Tertiary to Recent Basalt Province (Einasleigh Four Mile).

Officers who took part were:

D. A. White, J.G. Best, C.D. Branch, W. Bush (Queensland Geological Survey).

This programme completes the regional geological mapping carried out during the past three years on the Georgetown, Einasleigh, Gilberton and Clarke River Four Mile Sheets.

Granites were sampled for radioactive age determinations on these four sheets and the Atherton Four Mile.

The Burdekin River Lineament along the boundary between the Precambrian and Palaeozoic, the Glenmoore Ring Dyke Complex and the Tertiary to Recent Basalt Province in the Kinrara area were studied with the use of a chartered Cessna aircraft.

PRECAMBRIAN

In the Robertson River area (Georgetown 4-mile sheet) well bedded black quartz siltstone and shale ("Etheridge Formation", White and Hughes, 1957) are contact metamorphosed over a wide aureole by the "Forsayth Batholith" (White and Hughes, 1957), with the formation of quartz-sericite schist andalusite-muscovite schist, garnet-biotite schist and quartzite. The metamorphics are mainly folded along east-west axes, and are intruded by basic igneous rocks. Metamorphics exposed between the basic igneous rocks and the Forsayth Batholith exhibit at least three lineations. The significance of these is not yet fully understood, but they are probably related to (i) folding along east-west axes; (ii) doming by the basic intrusion; and (iii) doming by the granitic intrusion.

In the Gilberton area (Gilberton Four Mile), the boundary between the "Mt. Moran Formation" (White and Hughes, 1957) and metamorphics to the south and east was re-examined. Along their southern margin the sediments of the Mt. Moran Formation are faulted against high grade regional metamorphics consisting of migmatite and gneiss. Further east calc-silicate hornfels of the Mt. Moran Formation is in contact with similar migmatite and gneiss. Here the granite, which has metamorphosed the Mt. Moran Formation, transgresses the migmatite and gneiss. This suggests a metamorphic unconformity between the contact metamorphics of the Mt. Moran Formation and the high grade metamorphics. Similar evidence can be obtained in the Ironhurst, Eveleigh and Einasleigh areas. Hence it appears that there are two ages of metamorphics in the Precambrian, one possibly of Archaean age and the other Proterozoic. This is a revision of ideas as outlined by White and Hughes (1957).

PALAEOZOIC

Following Dr. Maxwell's (Queensland University) determination of a Tournaisian age for a limestone lens in the Bundock Creek Formation, previously thought to be Upper Devonian and conformably above the Devonian limestones in the Broken River, the section in the Broken River area was re-examined. It now appears that there are three folded unconformities in the Palaeozoic succession, viz. between

(i) Lower to Middle(?) Silurian and Upper Silurian.
(ii) Upper Silurian to Lower Devonian and Lower Devonian.
(iii) Middle to Upper(?) Devonian and Lower Carboniferous.

The base of the Palaeozoic is not observed as the succession is faulted against Precambrian metamorphics. The earliest record of fossiliferous Palaeozoic sedimentation is an Upper Ordovician or Lower Silurian limestone in a conformable succession of thinly bedded siltstone, shale and fine grained impure sandstone. The arenaceous sequence contains a rich fauna of trilobites and brachiopods, in Gray Creek about 13 miles north-east of Pandanus Creek Station. Similar sediments are exposed in the Broken River near the Pandanus Creek/Wando Vale Station road crossing, where they contain graptolites of possibly late Lower Silurian age.

In later Silurian time mainly greywackes were deposited. Three greywacke formations have been recognised. The earliest is an irregularly bedded quartz greywacke and siltstone sequence, which is unconformably overlain along its eastern margin by greywacke with rhythmic alternating impure sandstone and siltstone ("Kangaroo Hills Series", Smith, 1922). This later formation is contemporaneous with a third greywacke formation exposed between Gray Creek and Pandanus Creek Station.

Towards the late Upper Silurian or early Lower Devonian, limestone reefs with calcareous sandstone and reef conglomerates were deposited conformably above the greywacke units in the Gray Creek and Christmas Creek areas.

This period was followed by a major orogeny accompanied by serpentinite, gabbro and granitic intrusions.

Sedimentation in the Devonian period was restricted to the Broken River area, where abundant limestones were deposited, containing a rich coral fauna. These limestones ("Broken River Limestone", Etheridge, 1872) unconformably overlie the greywacke beds in Gray Creek. The age of the limestones range from Lower Devonian to Upper Middle Devonian.

Marine sedimentation in the Devonian period was followed by freshwater sedimentation in the Carboniferous. In the Bundock Creek area, coarse grained impure sandstone and plant bearing shales unconformably overlie the "Broken River Limestone". These freshwater sediments range in age from Lower Carboniferous (or Upper Devonian(?)) to Middle Carboniferous. They are correlated with similar sediments exposed along the Clarke River and at Gilberton.

IGNEOUS ROCKS

1. Granite

In the Georgetown/Einasleigh area it is possible to divide the granites intrusions into five types. Their age of emplacement is not known, but it is thought that the relative ages are as follows, commencing with the oldest.

(i) Coarse pink muscovite granite, generally pegmatitic and exposed in the Ninety Mile and Bauhinia Creek areas. (Probably Late Precambrian or early Palaeozoic).

(ii) Coarse porphyritic grey biotite-hornblende granite, generally lineated. Exposed at Forsayth ("Forsayth Batholith", White and Hughes, 1957), Lucky Creek and Lyndhurst areas, and (iia) (Possibly a phase of (ii)). Coarse grey-pink biotite granite. Exposed at Oak Park, Gregory Springs, Gilbert River and Cargoon.

(iii) Medium to coarse grained grey biotite granite generally with porphyry hoods. (Possibly Upper Palaeozoic).

(iv) Pink medium grained granite, generally with porphyry hoods. This is exposed in the Herbert River area and forms a part of the Coastal Ranges along the eastern margin of the Einasleigh Sheet.

2. Glenmoore Ring Dyke Complex

This is situated in the north-western corner of the Clarke River Four Mile. The ring dyke complex has a diameter of 15 miles, the dykes varying in width from 10' to ½ mile and in length from 300 yards to 10 miles.

The igneous activity of the complex was initiated by the intrusion, along an arcuate fracture or close concentric fractures, of at least two dykes of grey quartz feldspar porphyry. Differentiation within the dykes has resulted in a gradation to porphyrite andesite in one dyke, and to trachyte in the other. Possibly synchronous with this but radially disposed outwards is a dyke of porphyritic quartz microsyenite. These dykes are intruded by later concentric porphyry dykes. The final episode of the complex is the intrusion of an elliptical pink granite with an associated ring dyke into the geometric centre of the ring dyke complex.

The age of the ring dyke complex is possibly Upper Palaeozoic.

3. Serpentinite and Gabbro

These rocks crop out discontinuously over a length of 120 miles from Pandanus Creek Station (Clarke River Four Mile) to Gunawarra Station to the north of the Einasleigh Four Mile sheet. The serpentinite and gabbro or doleritic rocks are intruded along the boundary between the Precambrian and Palaeozoic successions. Two ages of intrusion are known; the first possibly took place in late Precambrian or early Palaeozoic time, the second and larger, which is best developed in Grey Creek, took place in the Upper Silurian or early Lower Devonian orogeny.

4. Volcanics

(a) Upper Palaeozoic

A flat lying sequence of rhyolite, agglomerate and tuff was mapped in the Agate Creek area in the southern part of the Georgetown Four Mile Sheet. The volcanics contain a thin basal shale bed from which a rich Glossopteris and Gangamopteris flora was collected.

Plant fragments were collected from the base of similar rhyolites in the Cumberland Range which can be correlated with the "Newcastle Range Porphyries" (Jensen, 1923).

(b) Tertiary and Recent Basalts

The "McBride Province" (Stradale, 1956) which occupies the central portion of the Einasleigh Four Mile was mapped. Volcanic activity possibly commenced in late Tertiary time (some flows overlie Pliocene diatomite deposits) and continued until Recent time. The basalt has an average thickness of 300 feet, with a maximum thickness of about 1,000 feet. There are 22 vents situated mainly in the central portion of the area. The vents can be divided into four types:

(i) Broad Dome - formed by vast extrusion of very fluid basalt. Flanks slope at angles 5° or less.

(ii) Sink-hole Depressions - consist of a jumble of very vesicular basalt blocks. These vents supplied very fluid basalt, which was drained off quickly and did not build up a cone at the orifice. They generally lead into lava tunnels, e.g. near Mt. Surprise.

(iii) Sink-hole Depressions with a surrounding cone. These vents also supplied fluid lava, some of which was drained off along lava tunnels and some overflowed the rim and so built up a cone. Late explosive activity contributed to the build up of the cone.

(iv) Symmetrical cones with a shallow depression in the crest. These were formed mainly by explosive activity.

The various types of vents are present in all stages of preservation, suggesting that the activity has a long history.

The greatest volume of material has been extruded as lava; pyroclastics form a minor portion of the total volcanics. As a result the land surface is rough, particularly in the area of young flows. Fumarole sublimation products are exposed beneath the protective ledges within the Kinrara Crater. This crater has extruded recent flows over the older basalt: the flows extend for about 20 miles to the Valley of Lagoons Station, where they have dammed the Burdekin River and formed lakes. It is believed that Lake Walters, G.W. Swamp and Native Wells Swamp in the Herbert River area were formed by the damming of westerly flowing streams by the basalt.

On the southern and western sides of the McBride Basalt Province, drainage under the basalt assures a continual water supply to the Burdekin and Einasleigh River Systems.

Thermal activity was observed on the western edge of the basalt province at Talaroo Station about 40 miles west of the main concentration of vents. Calcium carbonate terraces formed by this activity are about 15 feet above the surrounding ground level.

STRUCTURE

The site of the Palaeozoic Geosyncline appears to have been controlled by a set of fractures, one trending 20° along the Burdekin River and the other trending at 80° along the Clarke River. This set together with a 340° lineament along the western boundary of the Palaeozoic succession in the Chillagoe area suggests a hexagonal pattern. This has previously been recognised by Walpole as a possible control for the site of geosynclines in the Northern Territory.

The trends of the Precambrian succession vary from circular or concentric about a nucleus in the Archaean metamorphics, to arcuate in the Proterozoic sediments. The trends of the Proterozoic roughly conform to the Archaean trends near the margins of the depositional trough. Likewise the Palaeozoic trends conform to the trends of the Precambrian near the margins.

Some evidence for the rejuvenation of the fracture pattern mentioned above is suggested by the alignment of

Tertiary and Recent volcanoes along 20° and 80° directions in the McBride Basalt Province.

ECONOMIC GEOLOGY

Chromite. Chromite lenses associated with a serpentinite/gabbro mass in the Gray Creek area were investigated by gravitimeter and magnetometer by the Geophysical Section. Geological advice was given to this project, which was plane tabled at a scale of 1 inch to 100 feet by New Consolidated Goldfields Company. As yet no results are to hand of this survey, but it appears that little has been added to the known ore reserves as seen on the surface, i.e. 6,000 tons/vertical foot of 33% Cr_2O_3.

Nickel. In the Gray Creek area nickel mineralization was discovered by New Consolidated Goldfields in a parallel serpentinite intrusion about half a mile to the east of the chromite deposit. The nickel possibly occurs as a chlorite disseminated in a carbonated serpentinite. The origin of the carbonate is probably hydrothermal alteration of the serpentinite.

Diatomite. Diatomite deposits were located at the following four localities under the basalt of the McBride Province:

(i) Conjuboy, in Wyandotte Creek. Approximately 1,000 feet long, 100 feet wide and 50 feet thick.

(ii) Gleneagle Station, Herbert River area. Approximately 100 feet long, 10 feet wide and 12 feet thick.

(iii) Cashmere Station, Herbert River area.

(iv) Princess Hills Station, Flaggy Creek/Herbert River area.

Samples examined by Miss I. Crespin contain abundant Melosira diatoms, probably of Post-Pliocene age.

Possolan. This was examined on the Atherton Tableland about 10 miles south of Ravenshoe, where it is being mined for use in cements for the Koombooloomba Dam Project. It is used to replace cements up to 30%. The deposit is a basaltic tuff.

Numerous gold, wolfram, tin and copper mines and prospects were located in the Etheridge, Woolgar, Gilberton and Oaks Goldfields as well as in the Kangaroo Hills Mineral Field.

GRANITE SAMPLING

Sixty-two granite samples were collected for radioactive age determination from the Croydon, Georgetown, Einasleigh, Gilberton, Clarke River and Atherton Four Mile Sheets, including one from Mt. Carbine (Mossman Four Mile) at special request of the New Consolidated Goldfields Company.

PALAEONTOLOGY

Numerous corals were collected from about 40 localities in the Broken River area for determination by Dr. D. Hill (Queensland University).

Graptolites, trilobites and brachiopods collected in Gray Creek and Bnoken River are being determined by Dr. Opik and Miss J. Tomlinson.

Plants from Carboniferous, Permian and Cretaceous successions were collected for description by Mrs. M. White.

CHILLAGOE GEOLOGICAL PARTY

GENERAL

An area of approximately 2,000 square miles in North Queensland, comprising the Mungana, Chillagoe and Almaden 1-mile sheets (Atherton 4-mile), was mapped by the Bureau of Mineral Resources Chillagoe Party on a scale 1 : 50,000. More detailed work was carried out on the mineralized belt of Chillagoe limestones and cherts (scale 1:12,000).

Officers of the party were F. de Keyser, Party Leader, and M. B. Bayly (Bureau of Mineral Resources); and K. Wolff (Queensland Geological Survey).

GEOLOGY

Broadly, the following geological units were examined and mapped:

Dargalong Metamorphics, occupying the greater part of the Mungana sheet, and of pre-Silurian, probably Precambrian age. They include metamorphosed and in part granitised sediments: mica-schists, quartzites, gneiss and migmatites, and muscovite-granite and -pegmatite. Amphibolites also occur and are taken as metamorphosed basic igneous rocks. The boundaries between the various schists and gneisses are gradational in texture and composition. The grade of metamorphism is probably that of the amphibolite-facies.

Chillagoe Beds occurring mainly in the border-zone of the Chillagoe- and Mungana 1-mile sheets, strike north-west. They comprise interfingering and interbedded fossiliferous limestones, bedded and massive cherts, sub-ordinate horizons of quartz-greywackes, siltstones and conglomerates. The latter contain pebbles and boulders of Dargalong Metamorphics. The presence of Halysites points to a Silurian age.

To the north-east, these beds are gradually overlain conformably by arenaceous sediments of unit (3). The boundary is arbitrary.

Clastic arenaceous and silty sediments occurring in several disconnected areas near Koorboora, Petford-Emuford, and north-east of Rookwood. Their mutual correlation is probable on lithological grounds. Greywackes and quartz-greywackes, sandstones, conglomerates, with interbedded siltstone and shales and subordinate chert-horizons, are the common members, often micaceous and sometimes chloritic.

The Hodgkinson Formation in the north-east corner of the Chillagoe sheet. Its lithology of micaceous greywackes, siltstones and shales bears strong resemblance to parts of

the above-mentioned sediments (3), but plant remnants indicate at least a Devonian age. The formation is perhaps part of the same, continuous, sedimentation cycle.

A biotite-hornblende-granite or -granodiorite covering large areas of the Chillagoe and Almaden sheets, clearly intrusive in the sediments, in which it forms contact-metasomatic and thermal-metamorphic aureoles. Aplitic, pegmatitic, granophyric, monzonitic, and other varieties occur in certain areas, particularly on the Almaden sheet.

Porphyries of acid to intermediate composition forming large masses (e.g. the Featherbed Range) as well as numerous dykes. Intrusion and extrusion of these porphyries have taken place in several, if not many, phases in the course of deposition of the Palaeozoic sediments, and have out-lived the period of granite emplacement. Porphyry dykes intrude all known formations in the area with the exception of the Mesozoic.

Mesozoic sandstones, conglomerates, and sub-ordinate shales form mesas and areas of residual sand in the western part of the Mungana sheet, and are generally believed to be part of the Blythesdale group.

With the exception of the Mesozoic sandstones, all sediments are folded and faulted, with dips generally exceeding 60°. A probable unconformity is present between the Dargalong Metamorphics and the Chillagoe Beds. Part of the porphyries is thought to overlie the arenaceous sediments south of Koorboora unconformity. Fossil and lithological evidence seems to indicate a shallow-water, near-shore depositional environment for most of the sediments.

ECONOMIC GEOLOGY

Mineralization is widespread, except in the Featherbed Range and in the Mesozoic areas, and has been responsible for a great number of mines and prospects. At present practically no mining is being done, except some intermittent work, at the time of mapping, on a few small fluorspar, tin, and molybdenum workings.

The mineral deposits include Cu, Pb, Ag, Zn, Au, W, Mo, Bi, Sn, Fe, ores, which are typical products of a granitic to grano-dioritic igneous environment such as here. The deposits are of contact metasomatic, pneumatolytic and hydrothermal origin.

Some mica has been produced from pegmatities in the Dargalong Metamorphics.

CONSTANCE RANGE PARTY

GENERAL

The main field project was the mapping, at photo scale (one inch to 1700 feet) of the environs of the Constance Range iron deposits. The project was a joint one by the Bureau of Mineral Resources and the Geological Survey of Queensland, and the following officers took part:

E. K. Carter (overall supervision), D. O. Zimmerman, Party Leader, and M. A. Randal (Bureau of Mineral Resources); and C. H. Shipway, (Geological Survey of Queensland).

GEOLOGY

The stratigraphy and lithology of the Constance Range area is set out below:

AGE	UNIT	LITHOLOGY
Jurassic-Lower Cretaceous	Unnamed	Marine and fresh-water sediments, including siltstone, sandstone, "porcellanite".
	Unconformity	
Upper Proterozoic	Tidna Sandstone	Generally medium-grained, well-bedded quartzitic sandstone; some siltstone.
	Mullera Formation	Siltstone, shale and thinly interbedded fine sandstone; several sandstone members, up to 300 ft. thick; an iron-rich zone, up to 320 ft. thick, including economic iron ore. Abundant shallow water sediments.
	Constance Sandstone	Generally medium to coarse grained sandstone, quartzitic in part; some conglomerate; one lens of siltstone.
	Unconformity	
Lower Proterozoic	Lawn Hill Formation	Generally thin-bedded siltstone, shale, dark siliceous and argillaceous limestone; greywacke.

The Constance Sandstone and Mullera Formation both vary considerably in thickness from place to place and in other respects display abundant evidence of extremely shallow water deposition, probably within tidal limits at times; material was in general derived from a land mass to the east, but important modifications to the depositional basin and adjoining land took place during sedimentation. Measured thicknesses for the Constance Sandstone range from 1200 ft. to 3,000 ft. and for the Mullera Formation from 4,000 ft. to 6,000 ft. The Tidna Sandstone has a maximum thickness of 1,100 ft.

Folding of the Upper Proterozoic sediments is moderate, with dips generally less than 40°, except near faults. Open, irregular basins, with the long axes east-west, have been formed. A system of tensional faults, some also with transcurrent movement, which strike at 070° to 110°, has dislocated the strata of the area, particularly in crestal zones. Generally the south block is downthrown; displacement

of 1,500 feet have been measured. Faults appear to die out abruptly in the Mullera Formation.

The zone in which the main sedimentary iron beds occur ranges in thickness from about 150 feet to 320 feet. The iron occurs in two main basins but the variations in thickness, number and grade of iron-rich beds within each basin show that the occurrences were once continuous and were formed contemporaneously.

Throughout the two basins two trends in the iron zone may be observed:

1. From east to west the number of iron beds of groups of iron beds diminishes from a maximum of eight to one. Reduction in number is achieved partly by lensing out of iron beds and partly by lensing out or increase in iron contant, of intervening beds resulting in fewer, but thicker, beds.

2. In the south the bottommost bed is the richest, but tends to become poorer towards the north; north from Deposit 10A the uppermost bed, or zone, becomes progressively richer.

Drilling by B.H.P. Co. Ltd. has shown that the average grade of the ore is roughly 40% Fe which occurs in hematite, siderite and chamosite. Many beds are oolitic, with silica intimately associated with the iron. The high silica content precludes the profitable working, under present economic conditions, of most of the iron, but drilling in Deposit A - the most south-westerly deposit - has indicated the presence of a bed, 10-15 ft. thick, of high-grade low-silica hematitic ore. Further testing will be necessary to establish the tonnage available, but it may exceed 100,000,000 tons.

NORTH-WEST QUEENSLAND MISCELLANEOUS INVESTIGATIONS

In addition to his supervision of the Constance Range mapping, E. K. Carter undertook the following investigations.

1. Collected 36 bulk samples of granite, miaceous metamorphics and pegmatite for age determination and 25 sets of oriented granite specimens for palaeomagnetic work by E. Irving, Australian National University.

2. Examined and reported on the Mary Kathleen uranium mine and the Milo and Eva uranium prospects. Brief summaries of the second two are as follows:

Milo Uranium Prospect, 20 miles west-south-west of Cloncurry. Drilling and shaft sinking to the date of inspection had revealed extensive pyrite mineralization, with some copper and lead, but no significant radioactivity.

Eva Uranium Prospect, Pandanus Creek area, Calvert Hills 4-mile sheet, N.T. This appears to be a rich, but small, vein deposit. So far only a few costeans have been dug and the secondary mineral sklodowskite identified.

3. Mapped the surface area of the Kohinoor copper mine, near Dobbyn. The work revealed a narrow, discontinuous, low-grade copper lode over more than 3,000 ft, in metamorphosed

acid lavas and sediments with numerous basic intrusives. The lode averages less than 4 ft. wide and is of quartz and grey, coarsely crystalline calcite.

4. Photo-interpreted and made brief observations on the ground and from the air of the geology of the Mt. Drummond 4-mile sheet which lies across the Northern Territory border immediately west of the Constance Range area.

Mount Drummond 4-mile Sheet. The north-eastern portion of the sheet, totalling over 2,000 square miles, has outcrops of Upper Proterozoic - mainly Constance Sandstone and Mullera Formation, but including some Wollogorang Formation and a porphyritic acid lava or intrusive. There is extensive Mesozoic cover. In the western half of the sheet there are roughly 600 square miles of moderately folded strata, probably Constance Sandstone. Throughout the remainder of the Sheet Camooweal Dolomite, ?Palaeozoic and Mesozoic sediments form small outcrops in soil and alluvium, including extensive heavy-textured "black" soil.

No outcrops of sedimentary iron, likely to be economic, were observed in the Mullera Formation.

5. Before the field season, Carter was engaged on writing, revising and editing the bulletin on the Precambrian of North-western Queensland, amending andediting the 4-mile geological sheets and general geological maps to accompany the bulletin and writing explanatory notes to be issued with individual 4-mile sheets. Zimmerman was engaged part of the time on producing, under F. de Keyser, geological map sheets of the Paradise Creek area, north-west Queensland, mapped during 1957.

WEST AUSTRALIAN MANGANESE SURVEY

A joint party of geologists from the Bureau and the West Australian Geological Survey completed a comprehensive programme of mapping and sampling, by the end of which almost all known manganese deposits in north-western Australia had been examined. Officers engaged in the work were:

L. de la Hunty (Geological Survey of Western Australia) Party Leader;
D. Forman (Bureau of Mineral Resources); A. T. Wells (BMR) (June-July) and J. Firman (BMR) (August-September).

The deposits examined during 1958 included those at Mt. Fraser, Balfour Downs, Nimingarra, Ripon Hills, Mt. Sydney, Woody Woody and Horseshoe.

The aim of the mapping was to provide accurate estimates of the tonnage and grade of manganse ore and to attempt to determine the structure and depositional control of the deposits. Mapping was done at a scale of 1 inch to 200 ft. and surface contouring of the deposits was included. Channel or chip samples were taken from outcrop faces and from current workings, and were assayed for Mn, Fe and impurities at the Bureau Laboratory in Canberra.

The results of this work, which was contemporary with a vigorous exploration campaign conducted by several groups of mining companies, has made a significant change in the estimated Australian resources of manganese. The estimates are not yet finalised but the present indication is that the known reserve may have increased from 535,000 tons at the end of 1957 to about 4,000,000 tons at the end of 1958. This increase is mainly due to a large number of new peggings in the Ripon Hills area, but other appreciable additions came from Mt. Fraser (219,000 tons) and Nimingarra (58,500 tons). Extensive sampling and mapping of the large manganiferous deposit at Balfour Downs, however, has not yet succeeded in establishing the presence of any real quantity of commercial grade ore.

As the West Australian Government has imposed on the whole area in which these deposits occur a reserve which temporarily prohibits the granting of any new claims, and as almost all of the known have now been assessed, it is not proposed to continue the survey in 1959.

GRANITE SAMPLING PARTY

Sampling of granite intrusions for age determination was carried out in New South Wales, South Australia and Queensland during 1958. The work was done under the supervision, at different times, of the following officers:

B. P. Walpole, J. Arkin, E.K. Carter, C. Branch and others.

Two wages employees were engaged continuously on sampling operations and one wages employee on sample preparation. Sampling operations were carried out under geological supervision. In South Australia this was provided by the State Survey and by the Bureau; in Queensland by Bureau geologists of the Constance Range and Einasleigh parties. The New South Wales sampling was supervised by Bureau geologists from Canberra. Sample localities in New South Wales and South Australian were provided by the State Geological Surveys. Two samples from Tasmania were provided by Rio Tinto Pty. Ltd. and one by the Tasmanian Mines Department. Three samples were provided by the West Australian Geological Survey for experimental purposes. One sample was collected by a Bureau party in Western Australia and one sample was forwarded from the Samphire Marsh bore by West Australian Petroleum Pty. Ltd.

Samples delivered to the Bureau geological laboratory in Canberra during 1958 are as follows:

New South Wales	87
South Australia	23
Queensland	98
Western Australia	5
Tasmania	3
Total	216

Eighty-three mica concentrates were prepared, thirty-five of these were duplicate concentrates, some

being from samples collected in previous years. Concentrates from twenty-two samples were forwarded to the U.S.A. for age determination.

The card index system for sample reference has been kept up to date and a start has been made on modal and chemical analyses of the granite samples.

NEW GUINEA REGIONAL PARTY

GENERAL

From the middle of May to the beginning of October, 1958, the New Guinea Regional Party, consisting of J. W. Smith and D. H Green was engaged in mapping in the Musa River area, Northern District, Papua. This area is covered by the aerial photographs of Dore, Ubo, Moni River, and Namo sheets in the Papua-New Guinea 1-mile Series. During the season the party was supplied by charter aircraft to the strip at Safia and the patrol post there was used as a base camp.

Mapping in the area was mainly centred on the metamorphic rocks and the basic-ultrabasic belt.

GEOLOGY

The metamorphics can be separated into two distinct groups. The older of these - the Goropu Metamorphics (probably correlative with the Owen Stanley Series) - consists of quartz-mica schists, quartz-mica phyllites, sericite-schists, epidotised quartzites and probably marble. These rocks crop out mainly in the Goropu Mountains in the east and south-east of the area, and south of Deme on the western boundary of the area.

The younger rocks, "Urere Creek Metamorphics", consist of thermally metamorphosed fine-grained hornfels, hornfelsed greywacke, basalt, dolerite, slate, altered limestone and a greywacke-conglomerate member and are intruded by diorite. The "Urere Creek Metamorphics" are considered to be probably correlative with the Kemp Welch Series.

Intrusive contacts between the igneous rocks of the basic-ultrabasic belt and rocks of both groups of metamorphics have been observed but the basic-ultrabasic rocks mainly intrude the "Urere Creek Metamorphics" (and fine-grained xenoliths of this group are common in the Didana Range). The belt consists of gabbros, peridotites, dunites and minor pyroxenite, picrite and troctolite. It is largely a banded sequence, compositional banding being observed in all the above mentioned rock types although the end members - gabbro and peridotite,- are sometimes massive. The dip of the banding ranges from 20° to vertical and, although the strike is very variable, the most common dip is to the south or south-east. As a generalization it can be said that gabbros and the interbedded basic and ultrabasic rock types are more common in the northern side of the belt whereas peridotite is more common on the south side.

Unconformably overlying the metamorphics and the ultrabasic belt are 5,000'+ of lake sediments of probable

Pliocene or Pleistocene age. They consist of interbedded and interfingering greywacke and greywacke conglomerate with minor siltstone. Wood fragments and probable freshwster fossils have been observed in several places. The beds are commonly faulted and gently folded with dips averaging 10-40°. Andesitic volcanics are present at several localities and two of these at least are basal.

Faulting of the area, probably resulting in the present downfaulted trough of the Musa Valley was followed by deposition in the eastern part of the area of a sub-horizontal series unconformably overlying the lake sediments and basic-ultrabasic belt. This series consists of sedimentary breccia and conglomerate and at least two horizons of sheet breccia consisting of dunite and peridotite fragments in a very hard matrix of olivine and rare chromite grains or in some cases of serpentine. This breccia is believed to be of explosive volcanic origin. Its source is considered to be found in irregular bodies of similar breccia with matrix ranging from thin silica films, through serpentine to crystalline olivine which occur within massive ultrabasic areas bounding the area of deposition of the sheet breccia. These bodies are believed to be feeder vents.

Two areas of younger volcanics have been mapped - these are probably of Recent age. In the north-central part of the area the remnants of a large volcanic cone with central crater have been mapped near Sesavu. These volcanics (the Sesavu Volcanics) consist of basalt, tuff and agglomerate. On the eastern edge of the area intermediate tuffs and agglomerate from the Waiowa volcano crop out.

Much of the eastern and western ends of the Musa Valley are covered by a Pleistocene-Recent piedmont deposit from the mountains to the south and east of the Valley.

ECONOMIC GEOLOGY

A number of hand-auger holes were sunk in soil cover overlying peridotite and dunite peridotite breccia to assess the percentage of nickel in the soil. Twenty-seven such holes were sunk in the Wowo Gap, Silinidi, Arikewo, and Jaruru Creek-Sivai Creek areas.

The maximum percentage obtained was 1.06 Ni. These results, together with the rather low ratio of ultrabasic to basic rock types and the lack of extensive areas of deep soil cover, give very little encouragement to the hope that the area is favourable for economic nickel prospects.

MISCELLANEOUS ACTIVITIES

D. O'Driscoll and B. P. Walpole attended the symposium on the Peaceful Uses of Atomic Energy held in Sydney in June, 1958. A paper on the Regional Distribution of Uranium Occurrences in the Northern Territory was prepared and read at the Symposium. Walpole also attended the meeting of A.N.Z.A.A.S. at Adelaide in August and read two papers in abstract.

W. C. White visited Honiara, Bellona Island, and various other islands of the Solomons group in April and May in the course of inaugurating the phosphate survey. In June he inspected the work of the regional party in the Musa River area, New Guinea.

In August he spent four weeks in the field supervising the work of parties at Tennant Creek, Trekelano, Cloncurry and Chillagoe.

A number of records and reports were edited in the Section.

About three to four months have been spent by the Canberra members of the Katherine-Darwin survey on compilation of parts of the Tectonic Map of Australia. In addition B. P. Walpole has been responsible for the overall draft compilation of this map. E. J. Malone spent the first half of the year preparing records, reports and maps dealing with field activities in New Guinea and the Northern Territory during 1957 and 1956. M. A. Randal joined the Constance Range party for the latter part of the field season.

B. P. Walpole spent two periods totalling about ten weeks on supervisory duties in the Northern Territory and assisted in the examination and report writing on an inspection of the Halls Creek Uranium Prospect.