COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1961/78

ATHERTON 4-MILE GEOLOGICAL SERIES SHEET E 55-5 EXPLANATORY NOTES

Compiled by

J.G.Best

ATHERTON 4-MILE GEOLOGICAL SERIES SHEET E 55-5

EXPLANATORY NOTES

Compiled by

J.G. Best.

RECORDS 1961/78

CONTENTS

TABLES, FIGURES AND PLATES

ATHERTON 4-MILE GEOLOGICAL SERIES SHEET E 55-5

EXPLANATORY NOTES

Compiled by

J. G. BEST.

Record No. 1961/78

INTRODUCTION.

The Atherton 4-mile Sheet is bounded by longitudes 144°E and 145°30'E, and latitudes 17°S and 18°S; it covers most of the Chillagoe Gold and Mineral Field and about half the Herberton Mineral Field.

The area is accessible from the port of Cairns by road and railway. There is a regular air service to Chillagoe, and there are airstrips suitable for light aircraft at Sunnymount and Mount Garnet, and for medium sized aircraft at Mareeba.

Figure I shows the Gold and Mineral Fields, railways, main streams and principal towns in the area covered by the Atherton 4-mile Sheet.

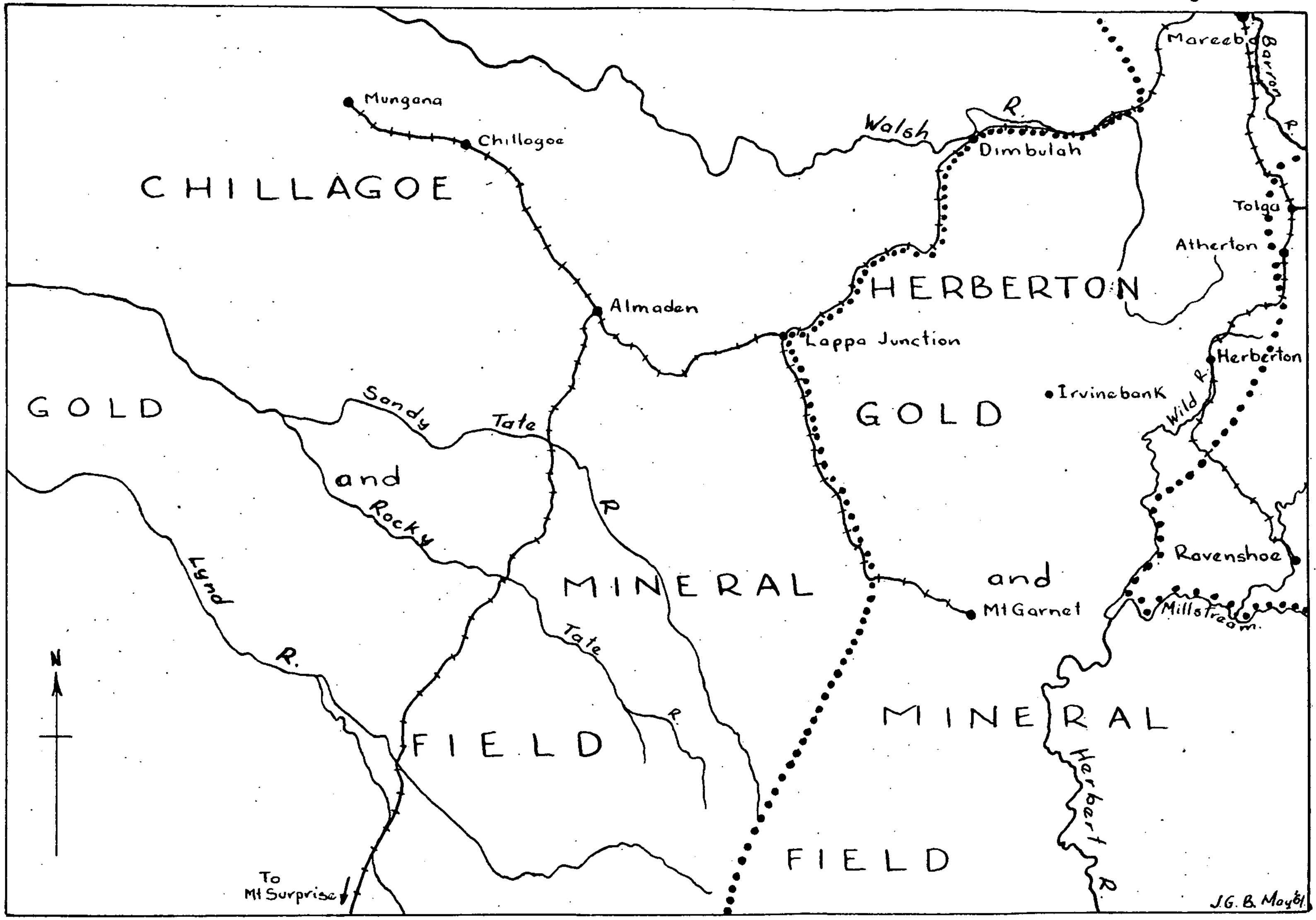
The map, which these notes accompany, was compiled from information gathered by combined parties of the Bureau of Mineral Resources and Geological Survey of Queensland which mapped this area in October, 1956, from May to October, 1958, and from May to October, 1959.

The maps and air-photographs covering this Sheet are listed in Tables I and II. (See page 2.)

Most of the Atherton Sheet is covered by mixed tropical woodland; along the eastern edge of the Sheet there are narrow belts of tropical rain forest and mixed coastal woodland; the distribution of vegetation closely follows that of the rainfall, which ranges from 30 inches per year in the west of the Sheet to over 60 inches per year along the eastern edge. Most of the precipitation falls during the period November to April; December, January and February are the wettest months with an average rainfall of over 5 inches per month.

The mean summer (December-January-February) temperature ranges from 80° to 85°F over the western half of the Sheet and 75° to 80°F over the eastern half. The normal mean winter (June-July-August) temperature ranges from 65° to 70°F.

Fig 1



ATHERTON 4-MILE SHEET

Scale 1inch to 10miles

Showing Gold and Mineral Fields, railways, main streams and principal towns.

Railway, Gold and Mineral Field boundary.

Fig. 2

E 55-5

ATHERTON 4-MILE SHEET

Showing component

ONE-MILE SHEETS

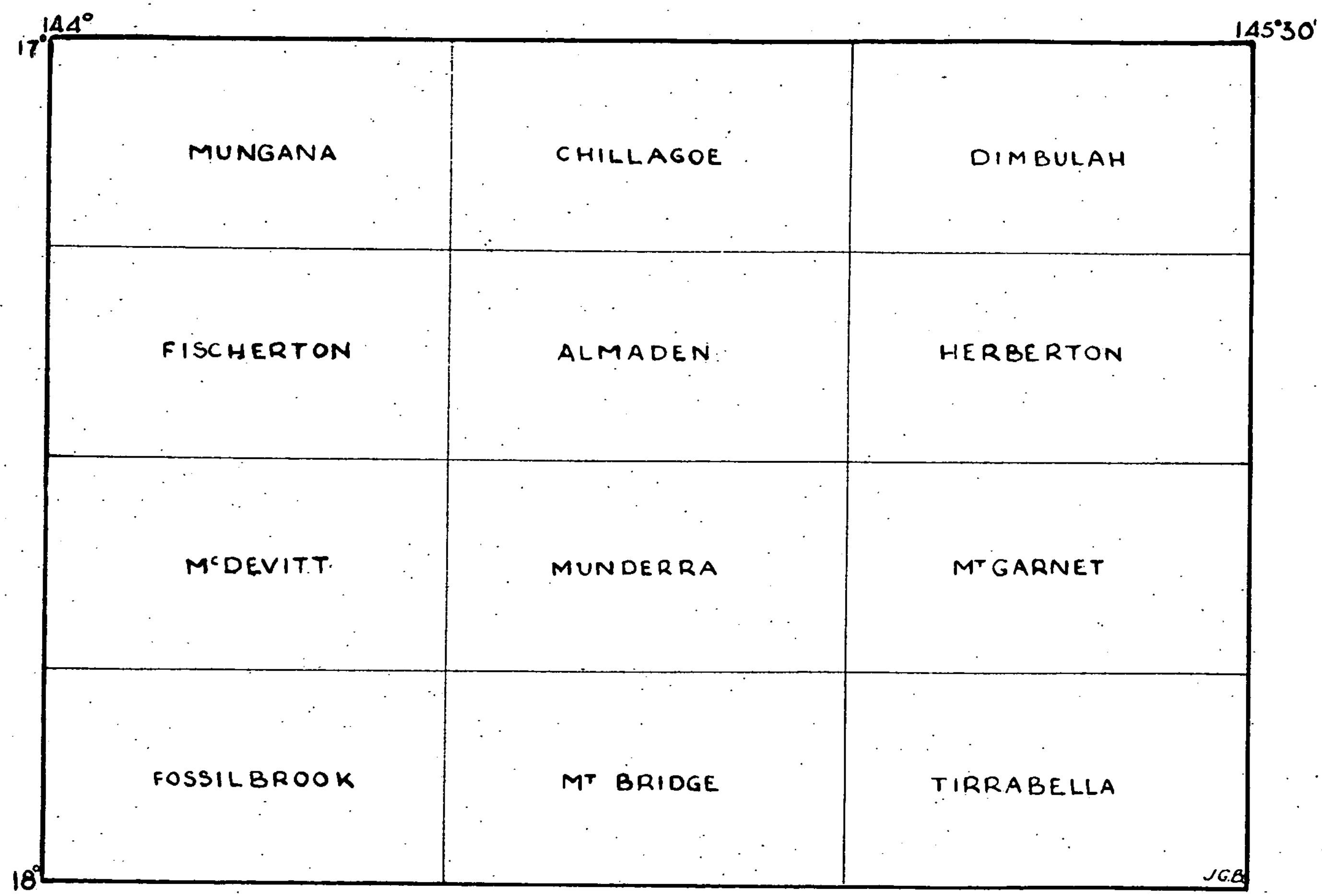


Table I - Maps covering the Atherton 4-mile Sheet.

Type	Scale	Name of Sheet & Number	Produced by	Date	Available from
Photo-map	1"to 4miles	Atherton E 55/5	Division of National Mapping		Division of National Mapping Canberra
Plani-metric	1" to 4miles	"	"	Jan. 1959	"
Military Sheet	"	"	Aust. Army Survey Corps	June 1944	Dept.National Dev-elopment.Melbourne
Military Sheet	"	Atherton Tablelands (special)	"	July 1944	"
Photo-map	1" to 1 mile	Half of Dimbulah	"	Published between 1/1/59 & 31/12/59	Queensland Lands Dept.
"	"	Mt. Garnet	"	Published between 1/1/59 &	"
"	"	Tirrabella	"	31/12/59	"

Table II - Air-photographs covering the Atherton 4-mile Sheet

Scale	Name	Flown by	For	Date	Available from
1: 50,000	Atherton	Royal Aust. Air Force	Dept. of National Development	1951	Secretary, Dept. of Air Canberra.
1: 24,000	Mungana	Adastra Airways Pty.Ltd.	Queensland Lands Dept.	12/8/49 3/9/49	Queensland Lands Dept.
"	Chillagoe	"	"	3/9/49	"
"	Mt.Garnet (eastern 1/3rd only)	"	"	June - December 1951	"
1: 28,000	Tirrabella	"	"	1956 and 1957	"

Fig.2. Illustrates the component One - mile Areas of the Atherton Four - Mile Sheet.

Previous Investigations.

J.V. Mulligan, in 1874, discovered alluvial cassiterite in a stream which he named the Wild River; but it was not until 1880 when payable tin was found in Prospector's Gully, a tributary of the Wild River, by Messrs. Jack, Newell, Brandon and Brown, that any interest was shown in the deposits. The 1880 discovery led to a spate of prospecting and mining which, over the succeeding twenty to thirty years, opened up numerous deposits of tin, wolfram, copper, silver/lead and gold. Mining was at its height in the late 19th and early 20th centnries; since then there has been a gradual decline in activity, arrested temporarily during periods of national emergency and economic depression.

The great number of lodes and prospects discovered on this Sheet/area have lead to numerous investigations and publications; in this summary it is proposed only to mention the more significant of them.

R.L. Jack examined the Wild River tin mines in 1880 and his report (1881) was the first geological report on any part of the Atherton Sheet/area; Jack described about ten lode tin mines and made brief mention of the alluvial workings. The first reference to red granite (Elizabeth Creek Granite of this survey) and coarse-grained granite intimately associated with the cassiterite lodes, is in Jack's report.

In 1883 Jack reported on the "Tin Mines of Herberton, Western and Thompson Creek Districts and the Silver Mines of the Dry River", in the report he described more than 120 mines and prospects: the number greatly exceeds those examined a few years earlier and illustrates the rapid expansion of the mining industry in the area at this time. Jack (1883) was of the opinion that the cassiterite had been introduced by basic dykes.

Jack (1884) first used the name "Hodgkinson" for the "slaty formation" which ranged "in fineness from shales to conglomerates", in his report on the Hodgkinson Goldfield; and in 1888 he stated that a thickness of 21,000 ft. had been calculated for the Hodgkinson Formation "although neither top nor bottom has been recognised".

In 1891, A.G. Maitland described the Coolgarra Tin Mines and surrounding district. Maitland subscribed to Jack's basic-dyke concept to explain the tin mineralisation and in support he drew attention to the many basic dykes around Coolgarra. Maitland recognised an unconformity between "acidic lavas and ashes" underlying "altered sedimentary rocks" about six miles south-west of Coolgarra. Maitland also described the thermal springs at Innot on Nettle Creek.

In 1892 Jack, in the Geology and Palaeontology of Queensland and New Guinea, summarized the knowledge of the geology of this area to that date.

In 1895, S.B.J. Skertchly examined the Herberton Deep (Tin) Lead and his report (1896) was the first to deal specifically with these deposits, which had been discovered in 1883.

In 1897 Skertchly published a lengthy report on the tin mines of Watsonville and surrounding district. This report contains plans and sections of many of the mines of this area and maps showing their location. Skertchly was of the opinion that "the primary source ....of the lodes is deep-seated" and that their emplacement was mainly controlled by dykes and faults.

R.C. Ringrose in 1895 published "Notes on the Conglomerate and Sandstone Series of the Wild River and the Headwaters of the Walsh River"; and in 1899 Skertchly considered the "Ringrose Conglomerate" to be part of the "Herberton Beds".

In 1898, Jack published a report on the Chillagoe mining district and the projected railway; he described many of the mines in the area and included a map which is of considerable assistance in appreciating the area as it was at that time.

In 1900, B. Dunstan found Halysites in a collection of corals he gathered from about three miles south-west of Mungana. This genus indicated a Silurian age for rocks which up to that time had been considered to be :-

(a) Permo-Carboniferous (Jack and Etheridge 1892).

(b) Carboniferous (Jack R.L. 1891).

(c) Carboniferous (Skertchly S.B.J. 1899).

W.E. Cameron in 1904 reported on wolfram and molybdenite mining in Queensland and included in this report is the first geological account of the mines around Wolfram Camp and Petford where wolfram, in payable quantities, had been found in 1894.

Cameron's 1904 paper on the Herberton Tin Field was a major contribution to the geology of the area; it presented many original observations on the distribution and origin of the lodes in the Herberton, Irvinebank, Coolgarra and Smith's Creek areas; and in addition to a map, it included statistics of production to 1904. Cameron (p.9) recorded that "the greater number of the more important lodes, are ....generally in the coarser greywackes and quartzites". Up to 1904, the consensus of opinion on the origin of the tin had been in favour of injection by basic dykes (Jack et al.), but Cameron (p.10) stated "Genetically there seems little doubt that the lodes owe their presence to the intrusion and solidification of the granite mass in and around which they occur". Of the lodes he recorded (p.9) "The lode material is only in exceptional cases separated by well-marked planes of division from the enclosing country. As a rule it merges into it with a gradational change from lode material to barren rock. The lode material is in almost all places evidentally a product of the alteration of the country rock by the action of mineralising agents, which changed its constitution by chemical action, and have at the same time deposited tin and other minerals within its interstices".

In 1904, R. Etheridge junior published a description of the Halysites from the Chillagoe area and proposed a specific name Halysites chillagoensis for the new species. Etheridge was in favour of a Silurian age for these fossils.

L.C. Ball in 1915 reported on the Wolfram, Molybdenite and Bismuth Mines of Bamford, and in 1918 on the Arbouin Copper Mines at Cardross in the Chillagoe Mineral Field. In his 1918 report, Ball recorded the discovery of Favosites sp., Heliolites sp., Cyathophyllum sp., Campophyllum sp., Halysites sp., Rhynchonella sp., Pentamerus sp., from the limestones south-west of Mungana.

H.I. Jensen (1923,p.5) drew attention to the "important lithological differences between the greywacke of the Herberton field and those of the Hodgkinson field". Jensen considered the Herberton series to be Ordovician. The map which accompanied the report shows the distribution of the Herberton Series.

In 1938 the Aerial, Geological and Geophysical Survey of Northern Australia mapped about one thousand square miles of the Herberton Mineral Field, and Jensen's report (1939) is the first account of systematic regional mapping in this area. The base-map (scale 2 inches to 1 mile) for this survey was prepared from air photographs flown by the Royal Australian Air Force.

A geophysical survey of the Herberton Deep Lead was carried out by the Aerial, Geological and Geophysical Survey of Northern Australia in 1938. The survey was initiated with the object of tracing the lead eastward from the extensively worked section between Nigger and Flaggy Creeks.

In 1942 the Queensland Mines Department unsuccessfully attempted to locate, by drilling, payable stanniferous deposits in the area indicated as favourable by the 1937 geophysical survey. Cribb (1946) reported these operations.

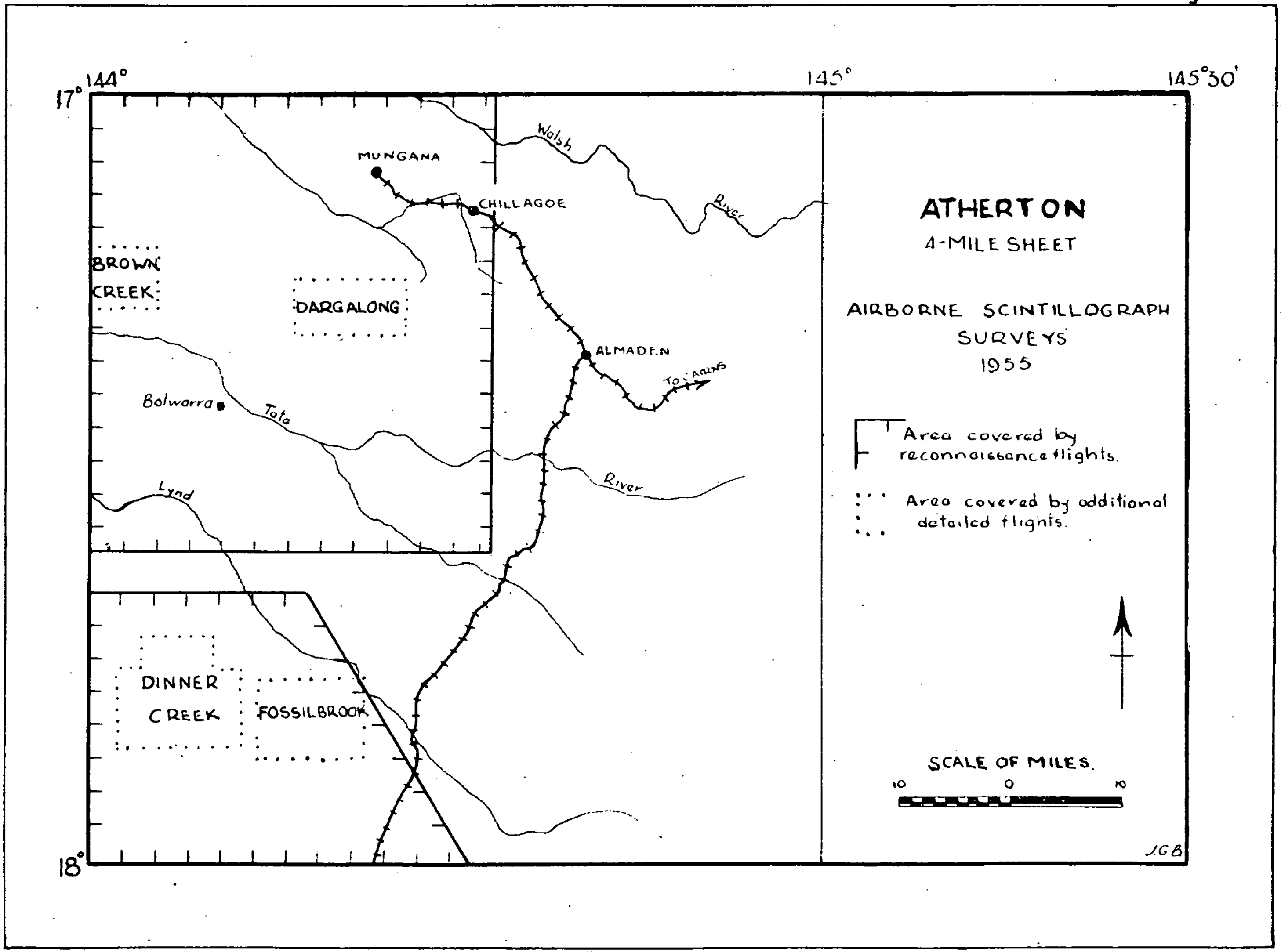
Between 1938 and 1956 many mines and prospects were investigated, most of these investigations were made by officers of the Queensland Geological Survey, the rest were by private companies.

In 1949, the Bureau of Mineral Resources geophysically prospected several mineralised areas around Chillagoe; the investigation was reported by Langron in 1957.

In 1955, the Bureau of Mineral Resources flew airborne scintillograph surveys over the western third of the Sheet area. This work was reported by Parkinson & Mulder (1956) (see Fig.3).

In 1956, a combined Bureau of Mineral Resources and Queensland Geological Survey party began geological mapping in North Queensland; this party spent about one month on an examination of the north-west corner of Atherton Sheet area. In 1958 this work was carried a stage further when the Chillagoe, Mungana and Almaden 1-mile areas were mapped, particular attention being paid to the mineralised Palaeozoic rocks. The remainder of the 4-mile Sheet area was completed, on a regional scale, by the party during the 1959 field season.

Fig 3.



144°
145°
145°30'
17°
18°
MUNGANA
CHILLAGOE
ALMADEN
Walsh
River
Tate
River
Lynd
Bolwarra
BROWN CREEK
DARGALONG
DINNER CREEK
FOSSILBROOK
ATHERTON
4-MILE SHEET
AIRBORNE SCINTILLOGRAPH SURVEYS 1955
Area covered by reconnaissance flights.
Area covered by additional detailed flights.
SCALE OF MILES.
10
0
10
J.G.B.

Physiography.

The Atherton 4-mile Sheet spans a climatic transition from Tropical Highlands on the east to Tropical Inland in the west. Summer rainfall prevails and ranges from about 30 inches per annum in the west to more than 60 inches along the eastern side of the Sheet.

Most of the land is pastoral, devoted chiefly to beef-cattle raising; in the centre and south-west of the Sheet /area the country is rugged, and waterless for most of the year, and is avoided by all but the miner and prospector. Formerly rain-forest covered a narrow belt along the eastern side of the sheet, but more than half of it has now been felled to provide land for agriculture and dairying.

With the exception of the eastern high-rainfall strip, most of the vegetation is open savannah woodland. 'Spear grass', Heteropogon contortus is ubiquitous throughout the low rainfall areas and its presence is a dominant factor in precluding sheep from the area.

'Heart Leaf Poison', Gastrolobium grandiflorum, is fatal to stock and commonly flourishes on laterite-capped areas; so far no satisfactory method of eradication has been devised and the infested areas are, at present, generally fenced out.

Further information on climate, vegetation and soils can be obtained from the Atlas of Australian Resources prepared by the Division of Regional Development, Department of National Development, Canberra.

The Great Dividing Range, commonly a barely perceptable reversal of slope, traverses the Sheet /area in a south-south-west direction from near the north-east corner of the Sheet /area. About three-quarters of the Sheet /area is drained by the Walsh, Tate and Lynd Rivers which trend north-west and empty ultimately into the Gulf of Carpentaria. The remainder of the Sheet /area is drained to the east into the Coral Sea.

Most of the streams which empty into the Gulf of Carpentaria occupy wide shallow valleys and there has been little down-cutting erosion except in the headwaters. A spectacular exception is the median section of the Walsh River, whose course through the rugged Featherbed Range is obviously controlled by the well developed joints in the Featherbed Volcanics.

That this river traverses this range rather than flows around it is strong evidence in favour of it being an antecedent stream.

The streams which drain to the Coral Sea are perennial and most of them are engaged in exhuming valleys partly filled with Tertiary Basalt; consequently their valleys range from youthful to mature.

The topography on this Sheet area ranges from level alluviated plains to rugged, deeply incised ranges. Over most of the western half of the Sheet area the country is gently undulating and the altitude ranges from 1100 ft., to 1500 ft. To the east the country rises irregularly and reaches its maximum altitude of about 4,300 ft. six miles west of Atherton. East of this point the country descends abruptly to the Atherton Tableland, whose altitude at Atherton township is about 2,500 ft. Fig. (4) illustrates, broadly, the geomorphological units on this Sheet.

The Newcastle Range has its maximum development to the south on the adjoining Georgetown and Einasleigh 4-mile Sheet areas; but its northern extremity is on the Atherton and westerly adjoining Red River 4-mile Sheet areas. The average altitude of about 2000 ft. is 300 to 400 ft. above the general surrounding level. On the Atherton Sheet, the Newcastle Range is essentially a ring-complex involving Upper Palaeozoic granites and volcanics, and capped with remnants of Cretaceous sediments.

Red Plateau. Twidale (1956) has outlined the Red Plateau on the adjoining Red River Sheet area. On the Atherton Sheet the eastern boundary of the plateau has been taken to coincide with the boundary of the Mesozoic sediments; it is commonly a scarp. The plateau forms a narrow belt along part of the western side of the Sheet area. It has an altitude of about 1000 ft., and slopes gently westwards on to the Red River Sheet.

The Tate-Lynd Upland occupies about 2000 square miles in the central region of the Sheet. The Upland has been formed from Precambrian granites and metamorphics, Palaeozoic granites, and Mesozoic sediments. It has a topography which ranges from level soil-covered plains to steeply undulating hills, the average altitude ranges from about 1100 ft. in the north to about 1600 ft. in the south, and the relief is about 100 to 200 ft. Outliers of Mesozoic sediments form mesas near the western side of the Upland. The Tate-Lynd Upland grades north-east into the Mungana-Chillagoe

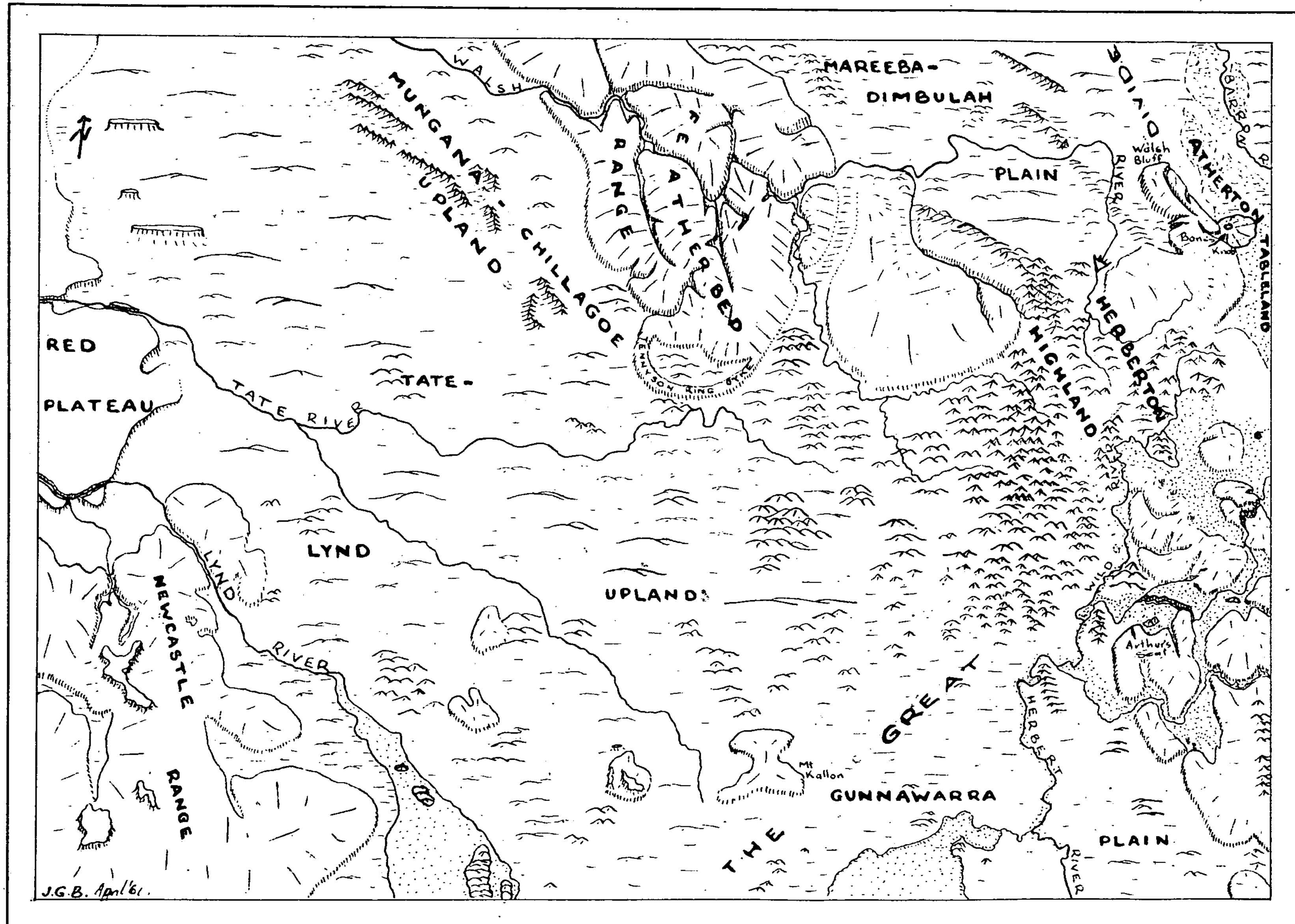


Fig. 4. Physiographic Units Atherton 4-mile Sheet Scale 1in : 12 miles.

Upland which, along its south-western side, consists of ridges of limestone, weathered into stark, fluted pinnacles and surrounded by soil-covered plains. The limestone ridges are flanked on the north-east by undulating hills eroded from Palaeozoic sediments and intrusive granite.

The Mungana-Chillagoe Upland is flanked on the east by the Featherbed Range and the change in topography is abrupt from gently undulating hills to a rugged rock-strewn deeply incised range. The Featherbed Range is composed of pink rhyolite flows overlain by grey ignimbrites and bounded by faults; it stands about 1000 ft. above the Mungana-Chillagoe Upland and occupies about 600 square miles on the Atherton Sheet area. To the south, it descends abruptly to the Tate-Lynd Upland and, to the east more gradually to the Mareeba-Dimbulah Plain.

The Mareeba-Dimbulah Plain occupies about 800 square miles in the north-west corner of the Sheet; it grades east into the Atherton Tableland and is bounded on the south by the Herberton Highland. The Walsh River drains from east to west across the plain and is flanked on both sides by extensive alluvial flats. Elsewhere the plain is gently to moderately undulating and is dominated by several north to north-west trending hills which range up to 2500 ft. above sea level and about 900 ft. above the alluvial flats.

The Atherton Tableland has its maximum extent on the easterly adjoining Innisfail 4-mile Sheet area; on the Atherton Sheet it covers about 100 square miles of the north-east corner of the Sheet area. The tableland ranges in altitude from 2500 ft. at Atherton to 1100 ft. at Mareeba; it is developed mainly over Cainozoic basalt flows and pyroclasts and ranges from flat to moderately undulating. The drainage in general is deeply incised and contrasts strongly with the Mareeba-Dimbulah Plain where the streams occupy wide shallow valeys partly filled with alluvium. Bones Knob, a prominent hill west of Tolga, is the remnant of a Tertiary volcano which produced most of the basalt in this segment of the Atherton Tableland.

The Herberton Highland occupies about 1700 square miles on the eastern side of the Sheet area; it is bounded roughly by a line from Atherton north-west to Walsh Bluff thence south-west to about Emuford, thence south-east to the south-east corner of the Sheet area. This is the most rugged part of the Sheet area; it is high and deeply dissected and reaches its maximum altitude at Wallum Trig. (4253 ft.) about 6 miles west of Atherton. In this area lithology has had a marked effect on topography; thus the valleys incised in Palaeozoic sediments are deep and narrow, and separated from one another by sharp interfluves; in the areas of acid extrusives, the valleys are deep and narrow but the interfluves are commonly broad and rock-strewn: generally, the topography over granite is more subdued, but there are places where it vies for roughness with the areas of sediments and acid extrusives. Along the eastern side of the Sheet area, Cainozoic basalt flows have partly filled some of the valleys and subdued the topography.

The Gunnawarra Plain occupies about 750 square miles in the south-east corner of the Sheet area. Most of it is a level to gently undulating plain covered with soil and alluvium, through which protrude isolated low hills of metamorphic and granitic rocks. The Herbert River drains from north to south across the centre of the plain. In Tertiary time, basalt flows from vents on the Atherton Tableland, coursed down this valley and junctioned (near Gunnawarra Homestead) with the distal portion of flows emitted from vents within the McBride Basalt Province (Einasleigh 4-mile Sheet). Most of the Atherton Basalt is now covered with alluvium, but inversion of topography has preserved the McBride Basalt as low, broad, boulder-strewn ridges flanked by Bell, Gunnawarra and Rudd Creeks.

STRATIGRAPHY AND PALAEONTOLOGY

General

Rocks ranging from Archaean to Cainozoic cropout in the Sheet area; generally, the Precambrian rocks occupy the area south of the north-west diagonal, the Palaeozoic rocks occupy the area north of this diagonal, and outliers of Cainozoic rocks are distributed along the eastern and southern sides of the Sheet area.

More than half the rocks which crop out on the Sheet area are igneous intrusives and extrusives, and the ages assigned to most of them are tentative. Some of the intrusive bodies have been sampled for radioactive age determination but none has been dated yet.

The stratigraphy and palaeontology of the Sheet area are summarized in Table III. The type localities for all the rock units lie within the boundaries of the Atherton and four adjoining 4-mile Sheet areas. The Geological History of the Sheet area is illustrated in Fig.5.

Precambrian

The Precambrian has been mapped on this Sheet area as three units :-

(a) Dargalong Metamorphics, named the Dargalong Beds by Skertchly (1899), have been tentatively assigned to the Archaean. The rocks are mica schist, gneiss, granulite, muscovite pegmatite, granitic rocks and quartzite and amphibolite; de Keyser, Bayley and Wolff (1959) suggest they belong to the albite-epidote amphibolite facies. They crop out extensively in the north-west corner of the Sheet area, and it is probable that most of the undifferentiated Precambrian in the south-west of the Sheet area are Dargalong Metamorphics.

Type localities for the Dargalong Metamorphics are the Cardross area (Ball, 1917a) five miles west-north-west of Mungana, and the Mt.Wandoo goldfield (Ball, 1918) eight and a half miles south-west of Mungana.

The Dargalong Metamorphics have a faulted boundary with Middle Palaeozoic sediments to the north-east; along the western side of the Sheet area they are unconformably overlain by Mesozoic sediments. Granites ranging in age from Precambrian to?Lower Mesozoic intrude the metamorphics.

(b) The McDevitt Metamorphics are named from Mount McDevitt longitude 144°17'E and latitude 17°34'S; they crop out over 300 square miles in an east-trending U-shaped area around Tate Township. The rocks are quartz-mica schist, andalusite schist, quartzite and garnet mica schist. The grade of metamorphism is not as high as in the Dargalong Metamorphics and on this basis they have been assigned to the Proterozoic.

The type area for the McDevitt Metamorphics is along the Tate River from Bolwarra Homestead to the Tate Township.

Granites ranging from Precambrian to ?Lower Mesozoic intrude the metamorphics and dolerite sills and dykes have been mapped about 4-8 miles south of Tate Township. Upper Palaeozoic -?Lower Mesozoic acid volcanics unconformably overlie the metamorphics along the southern boundary of the Sheet area; Mesozoic sediments overlie them unconformably along the western boundary of the Sheet area.

(c) Undifferentiated Precambrian has been mapped over most of the south-west quadrant of the Sheet area; time did not permit delineating the formations here, but there are rocks similar to the Dargalong Metamorphics, McDevitt Metamorphics and Forsayth Granite in the area.

Inliers of metamorphic rocks have been mapped well over on the eastern side of the Sheet area, they have been included in the undifferentiated Precambrian but most of them are gneissic and probably belong in the Archaean.

PALAEOZOIC

The Herberton Beds do not appear in the stratigraphic table, and because this unit has long occupied a place in Queensland stratigraphy, the reasons for its omission are enumerated below.

Skertchly (1899) defined the Herberton Beds as "the enormous series of slate, shales, conglomerates, grits, sandstones, and greywackes, which constitute the mass of the country between Herberton and Arbouine" (west of Mungana). Skertchly ascribed a Devonian age to these sediments and stated that in general they were "more arenaceous towards the east" and "more argillaceous westward". From Skertchly's description there is little doubt that his "Herberton Beds" included practically all the Palaeozoic sediments in the Atherton 4-mile Sheet area.

Jensen (1923) drew attention to "important lithological differences between the greywackes of the Herberton field and those of the Hodgkinson field"(p.5). He (p.6) ascribed an Ordivician age to the Herberton Beds and a Silurian age to the sediments cropping out south-south-east of Petford towards Mount Garnet. In his formal description of the "Herberton Series" Jensen (p.8) included "coarse greywackes, arkoses and quartzites interbedded with chlorite schists typically developed in the Herberton, Irvinebank, Koorboorah, and Emuford districts". The recent mapping, up to 1960, has shown that in the area delineated by Jensen, the greywackes belong either to the Mount Garnet or Hodgkinson Formations, the arkose is part of the Montalbion Sandstone (?Carboniferous), and the quartzite is part of the Ringrose Formation (?Carboniferous).

Fig. 5.

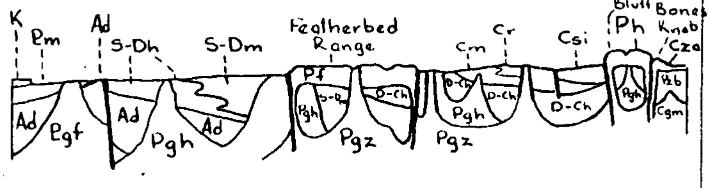
GEOLOGICAL HISTORY ATHERTON 4-MILE SHEET

LEGEND

Cza Atherton Basalt	Cn Nonyeta Volcanics	S-Dm Mt Garnet Formation
K Cretaceous sediments	Cm Montalbion Sandstone	Ꝑss Sandalwood Serpentinite
Pf Featherbed Volcanics	Cr Ringrose Formation	Ꝑm McDevitt Metamorphics
Ph Walsh Bluff Volcanics	Csi Silver Valley Conglomerate	Ꝑdc Cobbold Dolerite
Pgz Elizabeth Creek Granite	D-Ch Hodgkinson Formation	Ꝑgf Forsayth Granite
Pgh Herbert River Granite	Cgm Mareeba Granite	Ad Dargalong Metamorphics
Pny Nychum Volcanics	S-Dh Chillage Formation	

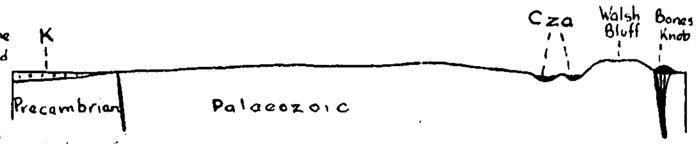
10 LATE TERTIARY to RECENT

Mainly a period of erosion. On the eastern side of the Sheet area strong vertical faulting caused beheading of west-flowing streams, and their diversion and capture, mostly, by east-flowing streams.



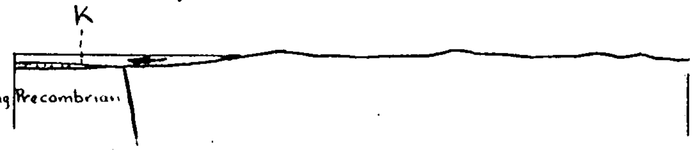
9 CAINOZOIC

Epeirogenic uplift caused withdrawal of the sea, exposure of Cretaceous sediments, increased erosion, and ultimately inversion of topography over most of the area covered by acid volcanic rocks. About Middle Tertiary time basalt volcanoes erupted and olivine basalt flows coursed down valleys along the eastern and southern sides of the Sheet area, and in places buried stanniferous gravels. Late-stage explosive activity covered some of the flows with basalt pyroclasts.



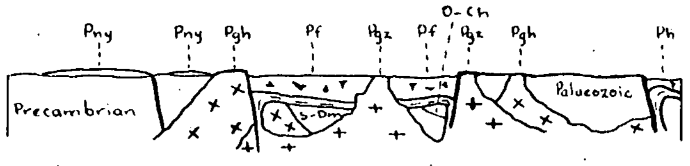
8 CRETACEOUS

The area had low relief; marine transgression from the west led to deposition of conglomerate, sandstone and siltstone (K) along western side of the Sheet area.



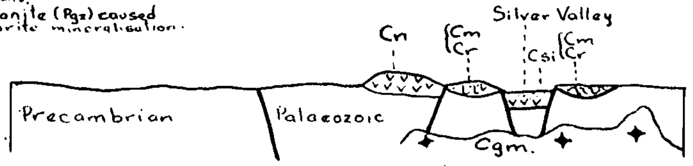
7 ?PERMIAN - TRIASSIC

Extrusion of basic, intermediate and acid volcanics over Glossopteris-bearing sediments. Younger acid volcanics (Pny) lapped onto Atherton Sheet area. Then followed extensive faulting, grabens formed, rhyolite erupted along fissures; later activity violently explosive and ignimbrites poured into the grabens. Intrusion of grey granite (Pgh) and later pink granite (Pgz) caused tin, copper, silver-lead, wolfram, molybdenum and fluorite mineralisation.



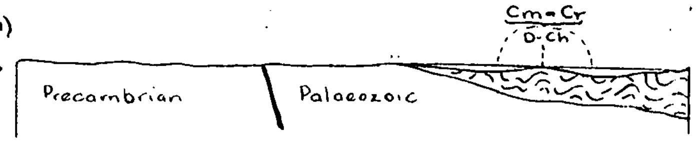
6 CARBONIFEROUS (b).

Mild orogeny, Carboniferous sediments folded; block faulting followed, and sediments and acid volcanics were deposited in the resulting grabens. Grey granite intruded in east of Sheet area



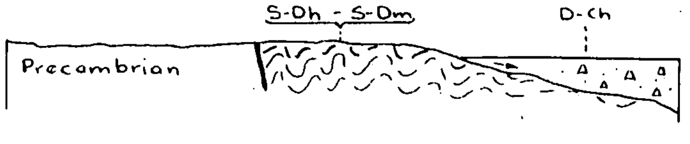
CARBONIFEROUS (a)

Major orogeny. Hodgkinson sediments folded and uplifted. Conglomerate sandstone and siltstone deposited in a basin or basins on the eastern half of the sheet area.



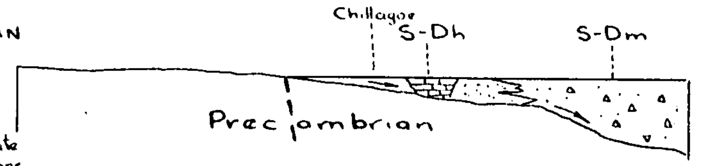
5. DEVONIAN

Major orogeny - Siluro-Devonian sediments folded and uplifted in most of the area but marine conditions prevailed in the north; deposition of greywackes, siltstone, chert and rare limestone began about Middle Devonian.



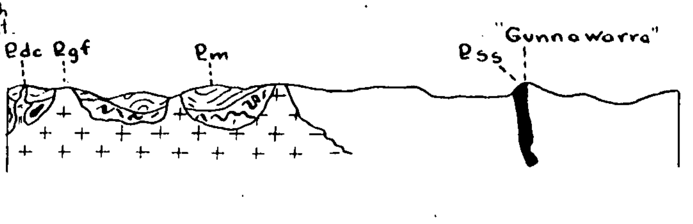
4 UPPER SILURIAN - LOWER DEVONIAN

Eastern part of area submerged, strand line trended SE from about Mungana to near 'Glen Gordon' and from there trended SSW. Limestone, sandstone, siltstone and chert (S-Dh) deposited on shelf in N.W. of area. Conglomerate massive greywacke, chert and rare limestone deposited east of S-Dh in North: In the South of the sheet, S-Dm flanks pЄ. S-Dh is absent.



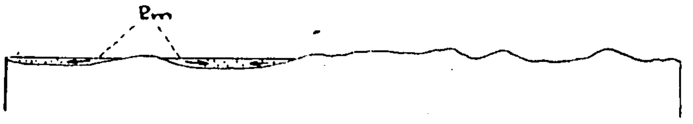
3. Late PRECAMBRIAN

Major orogeny - Proterozoic sediments folded, area uplifted and strongly faulted along the eastern side; serpentenite, dolerite and granite intruded.



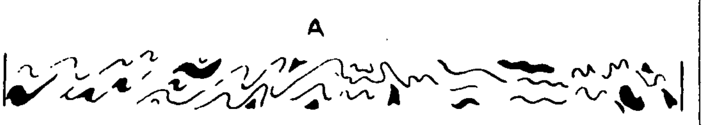
2. PROTEROZOIC

Basement uplifted above sea level on eastern side, and quartz sand and silt deposited in shallow basins on the west.



1 ARCHAEAN

Basement (A) formed from metamorphosed sediments and igneous rocks



To have persisted in using the name "Herberton", it would have been necessary to use it either as a formation name or a group name. Its use as a formation name would have necessitated restricting Skertchly's distribution and lithology; and, in addition, would have conflicted with Jensen's interpretation, because his description specifically rejected the only formation to which it could have been applied, namely the Mount Garnet Formation. Its use as a group name was precluded because of the intervening unconformities.

In order to preserve Herberton as a geological name, and to indicate its position in the stratigraphy, the units it embraces have been bracketed and labelled "Herberton Beds" on the map which these notes accompany.

Upper Silurian - Lower Devonian.

The Chillagoe Formation is the oldest Palaeozoic unit on the ~~Sheet~~ area; it was named by Jack and Etheridge in 1892. Many fossils, particularly corals, have been collected from it; the a ssemblage has Upper Silurian affinities, but may range into the Devonian (de Keyser et al. 1959). The rocks of this formation are limestone, chert, quartz greywacke, shaley siltstone, sandstone, conglomerate and rare basalt flows (de Keyser et al. 1959); with the exception of the limestone they crop out poorly.

Mount Garnet Formation has been proposed for the belt of sediments which lie to the east of the Chillagoe Formation and trend south-east to Mt. Garnet and beyond to the south-east corner of the ~~Sheet~~ area. The formation consists of greywacke, radiolarian jasper, greywacke conglomerate, limestone lenses, limestone conglomerate and fine dark grey quartz sandstone. These rocks are considered to be off-shore equivalents of the Chillagoe Formation. In the Chillagoe area both formations are present, but farther south the Chillagoe Formation is missing and this has been interpreted as indicating a change in the depositional environment - in the Chillagoe area, in Upper Silurian time, there is a wide shallow shelf and a deeper area of deposition offshore; in the Mt. Garnet area the wide shelf was missing, probably due to a steep coast line.

The fossils from the small limestone lenses in the Mount Garnet Formation are few and poorly preserved but are probably contemporaneous with the Chillagoe fauna.

Devonian - ? Carboniferous

The Hodgkinson Formation, named the Hodgkinson Beds by Jack in 1884, crops out over about one quarter of the north-east quadrant of the Sheet. The lithology is more uniform than in the older Silurian formations and consists of rhythmic, thin, well-bedded siltstones to medium arenites, showing abundant turbidity current structures, and rare thick greywacke beds and minor limestone lenses, limestone conglomerate and jasper horizons.

The relationship between the Hodgkinson Formation and the Mount Garnet Formation is not precisely known, but palaeontological evidence suggests that they are unconformable: the Mount Garnet Formation is Upper Silurian - ? Lower Devonian and the Hodgkinson Formation is Middle Devonian - ? Lower Carboniferous. About six miles north-west of Emuford the contact between the two formations is faulted, and elsewhere the contact is obscured.

The type area for the Hodgkinson Formation is in the Hodgkinson Goldfield on the Mossman 4-mile Sheet area.

Carboniferous

The Ringrose Formation was first described by R.C. Ringrose in 1895 and named the Ringrose Conglomerate by S.J.B. Skertchly in 1899. The rocks are dark grey quartz siltstone, silty mudstone, dark to pale grey fine sandstone, pale grey coarse sandstone, dark grey quartz conglomerate with clay galls. The beds are fairly tightly folded, but they are lithologically dissimilar to the underlying Hodgkinson Formation and have a much smaller distribution than it; for these reasons they are considered to overlie unconformably ~~overlie~~ the Hodgkinson Formation. So far they have proved to be unfossiliferous but they are overlain by Middle Carboniferous Silver Valley Conglomerate, and have been intruded and mineralised by Permian and Upper Permian - ? Triassic granites. On this evidence they have been assigned to the Carboniferous. The type areas are near Empress Trig. west of Herberton, and between Irvinebank and Coolgara.

The Montalbion Sandstone was named by S.B.J. Skertchly in 1899 and consists of white to pale grey sandstone with a ? basal pebble and cobble conglomerate. The beds are only moderately folded and generally have shallow dips; they overlie the underlying rocks with a marked unconformity. The outcrops are almost invariably restricted to the crests of hills and ridges and are commonly bounded by faults. This unit is considered to be a near-shore equivalent of the Ringrose Formation. The type area is around the former Mantalbion silver/lead mines.

Silver Valley Conglomerate crops out in a 6 square mile fault - bounded block about 8 miles south-west of Herberton. This unit is a thin sequence of sediments chiefly conglomerate, sandstone and shale with interbedded rhyolite. The fine-grained sediments near the top of the sequence contain Rhacopteris inequilatera (? Middle Carboniferous). The sediments unconformably overlie the Hodgkinson Formation and Ringrose Formation and are faulted against them.

Igneous Rocks.

The history of igneous activity of this area ranges from Upper Precambrian to Cainozoic and shows a marked periodicity; the magma injected into and through the crust has alternated between basic and acid (the volume of intermediate igneous rocks is insignificant), and the total volume of acid magma injected greatly exceeds the volume of basic magma.

Precambrian

Ultrabasic and basic. Swarms of dolerite and amphibolite dykes crop out within the Precambrian rocks on the western side of the Sheet. They have been intruded by Palaeozoic granites and are considered to be equivalents of the Cobbold Dolerite (White, 1959) on the Einasleigh 4-mile Sheet area.

A lenticular body of serpentinite was mapped near Gunnawarra Homestead; it crops out along the faulted eastern edge of the Precambrian basement and is similar to the bodies of "Sandalwood Serpentinite" mapped on the Einasleigh Sheet area.

Granite. Five bodies of Forsayth Granite, a grey, coarse-grained massive to porphyritic biotite granite, have been mapped on the western half of the Sheet area. The Forsayth Granite intrudes Precambrian metamorphics and is unconformably overlain by Upper Palaeozoic - ? Lower Mesozoic volcanics, and Mesozoic sediments. It is probable there are other masses of Forsayth Granite in the area shown as undifferentiated Precambrian.

PALAEOZOIC

Ultrabasic and Basic Rocks

A few small bodies of ultrabasic and basic rocks, predominantly dolerite, crop out through the eastern half of the sheet; they are commonly located along strong faults, but no evidence of their age was detected. They are possibly equivalent to the Devonian basic intrusions on the Einasleigh Sheet.

Chromite boulders and talc crop out on the surface of a probable fault-scarp about 10 miles south of Mareeba on the Atherton road which suggest the presence of basic and ultrabasic rocks; however, Tertiary basalt obscures the older rocks in this area.

CARBONIFEROUS.

Acid Volcanics.

Acid volcanic rocks are intercalated with sediments bearing Carboniferous plant remains (Rhacopteris sp.) in the Silver Valley area.

Nanyeta Volcanics

North-west of Mount Garnet a belt of acid volcanic rocks unconformably overlie the Mount Garnet Formation, and are conformably overlain by a few feet of light grey and green siltstones; these volcanics have been tentatively assigned to the Carboniferous.

Sunday Creek Volcanics

In the south-east corner of the Sheet, acid volcanic rocks with a considerable range of lithologies are unconformably overlain by younger, more homogeneous acid volcanics and are intruded by Herbert River Granite. These rocks are considered to be equivalents of the Nanyeta Volcanics.

PERMIAN

Volcanics.

Nychum Volcanics

The Nychum Volcanics have their maximum development on the Mossman 4-mile Sheet area. At the type locality, near Jug waterhole, the lithologies range from dominant acid lavas and tuffs to subordinate intermediate and basic lava flows. On the Atherton Sheet, this unit crops out in five small areas north of Mungana and the rocks are dominantly acid lavas.

Granites

The Herbert River Granite crops out over about 800 square miles on the Atherton Sheet area. The granite is grey, medium-grained and commonly contains pink feldspar phenocrysts, but there are variants and it is probable that the batholith contains a range of types which may differ slightly in age. The Herbert River Granite intrudes ? Carboniferous sediments and is intruded by Upper Permian - ? Triassic Elizabeth Creek Granite; it has been tentatively placed in the Permian and probably belongs in the Lower Permian.

The Almaden Granite is a quartz-poor variant of the Herbert River Granite; it intrudes Permian - Triassic volcanics near Chillagoe.

PERMIAN - ? TRIASSIC

Acid Volcanics

Pink rhyolite flows and grey ignimbrites crop out extensively over the Atherton Sheet; the largest continuous outcrop forms the Featherbed Range. On the Atherton Sheet no definite evidence of their age has been found; but on the adjacent northerly Mossman Sheet area there is evidence for a possible Lower Mesozoic age. At Jug waterhole, about 50 miles north-north-west of Mungana, sediments containing fossil plants are overlain by the Nychum volcanics (Morgan, 1961). Elsewhere the Nychum Volcanics are intruded by the Almaden Granite, and the Almaden Granite is overlain by the Featherbed Volcanics. The plant fossils are uppermost Permian, possibly Lower Triassic (White, Mary E., 1961a).

Granite

Pink even-grained granite, the Elizabeth Creek Granite crops out over 1300 square miles on the Atherton 4-mile Sheet; it intrudes the Featherbed Volcanics and its age is probably Upper Permian - Triassic.

Cainozoic

Small local deposits of unconsolidated to partly lithified flat-lying argillaceous and arenaceous sediments are exposed in valleys on the eastern side of the Sheet area. Most, if not all, of these sediments have been deposited in lakes formed by Tertiary basalt flows. On the Atherton Sheet area they have so far proved unfossiliferous, but similar deposits on the Einasleigh Sheet area are associated with diatomite deposits (White and Crespin, 1959).

Basic Volcanics

Atherton Basalt

There are two Tertiary volcanoes in the Atherton Sheet area. Bones Knob, an old shield volcano, about 3 miles west of Tolga, extruded most of the basalt in the north-east corner of the Sheet; late-stage explosive activity has reamed out the crater and built a pyroclastic dome overlapping the crater on the southern side. Hypipamee crater about 10 miles south of Atherton is a diatreme, which has been reamed through massive Elizabeth Creek Granite by violently explosive activity; basalt lapilli and fragmented granite are scattered for hundreds of yards around this vent.

Along the eastern and southern sides of the Sheet area are several valleys partly filled with the distal portions of basalt flows extruded from vents on the Innisfail and Einasleigh Sheet areas.

STRUCTURE

FOLDS

Precambrian

The folding in the Precambrian is tight and probably isoclinal; near the boundary with the Palaeozoic sediments the fold axes in the Dargalong Metamorphics appear to parallel the boundary, but farther west they trend south-west. The foliation is commonly steep to vertical.

Palaeozoic

The early and middle Palaeozoic sediments are tightly folded and their axes, generally, follow the trend of the edge of the Precambrian basement; thus in the Mt. Garnet area it is about north, and near Chillagoe, north-west.

The Montalbion Sandstone is moderately folded, and the Silver Valley beds, away from their faulted margin, are flat-lying.

Faults

Strong, vertical faulting is a major feature of the tectonic history in the Sheet area :

(a) a major linear fault-zone has defined the eastern edge of the Precambrian basement.

(b) strong linear and arcuate faults have delineated cauldronsubsidence areas, located volcanic focii, and aided the emplacement of plutonic rocks in the Precambrian and Palaeozoic.

The faults trend in all directions but the preferred azimuths are north, east, north-west, and north-east.

In most places it is not possible to date the faults precisely, but it is certain that some of them have been active for a long time.

There has been strong faulting during the Tertiary. In the headwater valleys of the Herbert River, west and south-west of Ravenshoe, outliers of basalt were mapped on the flanks of valleys 200 to 300 feet above flows of basalt in the floor of the valley. These valleys have been eroded along fault lines and movement of these faults during Tertiary time has elevated portions of the early basalt flows.

The most recent fault mapped in the Sheet area is in the north-east corner of the Sheet. The fault trends north-west and crosses the Atherton-Mareeba road about 10 miles south of Mareeba. The fault has displaced a Tertiary basalt flow about 100 feet (vertically); the western side has been upthrust. Chromite float and talc is exposed on the fault-scarp and its presence suggests that this fault-line is old and has, in the past, been the site of basic and ultrabasic intrusions.

Joints

The most strongly jointed rocks are the Upper Palaeozoic - Lower Mesozoic acid volcanics, and the Elizabeth Creek Granite. The joints are mainly vertical and trend in all azimuths, but the north-west, north-east, north and east directions are preferred.

ECONOMIC GEOLOGY

The Atherton 4-mile Sheet area covers part of the :-

Chillagoe Gold and Mineral Field and

Herberton " " " "

Mining began in this area about 1870, reached a peak in the late 19th and early 20th centuries and has declined irregularly to a low ebb at the present day. During this period twelve main minerals have been mined from about one thousand different localities within the Sheet area.

It is beyond the scope of these notes to treat each deposit individually, and, accordingly, the production, distribution, and type of deposit of the minerals will be treated generally.

COAL

Coal has been reported from north of Koorboora; it is interbedded with the Featherbed Volcanics and is probably equivalent to the Mount Mulligan Coal Measures on the Mossman Sheet area. The deposit is not economic.

COBALT

Cobalt has been reported from the Cambourne lode about 5 miles north-east of Mungana. It is not an economic deposit.

COPPER

The copper deposits around Chillagoe and Mungana were first prospected in 1888, but it was not until 1901 when the Chillagoe smelters opened that these deposits were seriously exploited.

Although most of the principal copper mines were in the Chillagoe-Mungana area, copper has been produced from many parts of the Atherton Sheet area. Most of the mines produced only a few tons of copper, but the Mount Garnet copper mine yielded about 4,500 tons.

The recorded production of copper from the Chillagoe and Herberton Mineral Fields is 45,308 tons, but included in this figure is the production from the O.K. and Mount Molloy mines on the Mossmah Sheet area; so it is probable that the production from the Atherton Sheet area aggregates somewhere between 35,000 and 40,000 tons.

At first glance the recorded figures of production give an erroneous impression of the relative importance of Chillagoe and Herberton Districts as copper provinces, but this impression is corrected when it is realized that up to 1908 the Chillagoe production was included in the Herberton returns.

The copper ores from the Chillagoe - Mungana area were commonly associated with silver and lead, and, from the Herberton area, with tin.

Most of the deposits in the Chillagoe - Mungana area were located on the contact of limestone and granodiorite. One marked exception was the Ruddygore which was a disseminated deposit in granodiorite.

Throughout the Sheet area most of the copper ore bodies are fairly closely associated with the Herbert River Granite, or its equivalent the Almaden Granite, and it is considered that this granite was responsible for the copper mineralisation. Likewise the Elizabeth Creek Granite has been the tin mineraliser, and it is significant that in the Herberton area, in the Copper Firing Line, where the lodes contain both tin and copper, both Herbert River Granite and Elizabeth Creek Granite crop out in close proximity.

FLUORSPAR

Most of the fluorspar has been won from the western side of the Sheet area, principally from fissure lodes in the Precambrian metamorphics. Production began in 1916 and up to 1960 31,728 tons had been mined.

The lode-containing fissures are strong and commonly can be traced for several miles, but the fluorspar is sporadically distributed along the fissure as discrete bodies. The gangue is commonly white quartz. The fluorspar is crystalline and massive, commonly clear, glassy and white, but may be coloured brown, purple or green.

GOLD

Gold was won from a number of localities, principally on the western side of the Sheet area, towards the end of the last century and early in the present century. The economic depression of the 1930's revived the gold mining industry and resulted in new finds in the Mt. Wandoo and Fluorspar areas.

Most of the gold has been won from the Chillagoe Gold and Mineral Field and recorded production for this field for the years 1909 to 1955 is 56,218 fine ozs.

IRON

Almost all of the iron ore mined in the Atherton Sheet area has been used as flux at the Chillagoe and Mt. Molloy copper smelters; commonly the ironstone was cupriferous. Most of the ironstone bodies are replacement lodes in limestone and they commonly grade into garnet rock. The largest deposit is Mt. Lucy, about 3 miles west of Almaden on the Chillagoe road, and estimated by Dunstan (1905) to contain about 350,000 tons of ore. About 45,000 tons of ore has been mined from this deposit.

SILVER, LEAD AND ZINC

Towards the end of the nineteenth centnry rich deposits of silver/lead ores were found in the area west and south of Herberton. Towns and smelters sprang up on the sites of richer deposits, flourished for a few years, then waned and were finally deserted. The main centres of the early silver/lead mining era were Muldiva, Dargalong, Montalbion, Orient Camp and Silver Valley. Subsequently the Lady Jane and Girofla mines near Mungana became the main producers.

Total recorded production for the Herberton and Chillagoe mineral fields is 8,150,798 ozs. of silver most of which was produced from the Chillagoe area. With the exception of Dargalong, where the mineralisation was in Precambrian metamorphics, most of the silver-lead ore bodies were replacement lodes in sediments, primarily limestones and sandstones. Commonly these lodes contained other minerals in addition to silver and lead; the most abundant was copper, and zinc was subordinate. The production figures for zinc on the Atherton Sheet area are incomplete; but for the years 1924-1926 the Chillagoe District produced 200 tons.

LIMESTONE

Initially limestone was mined to provide flux for the smelters and quarries were established near Chillagoe and Calcifer. To the end of 1912 about 120,000 tons of limestone had been quarried.

Subsequently deposits of "earthy lime" 5 miles north-west of Mungana were worked for agricultural purposes.

Currently all of the limestone exported from the area is being mined and processed at Ootann, 8 miles south-south-west of Almaden. Massive limestone is burnt for lime and crystalline calcite is crushed for agricultural purposes. Production in mid-1958 was 30 tons per day of crushed calcite and 30 tons per week of burnt lime.

MOLYBDENUM

Most of the molybdenum produced from the Atherton Sheet area has come from Wolfram Camp and Bamford Hill, where it is associated with wolfram and bismuth in quartz-filled vughs in granite. Production for the Chillagoe/Herberton District from 1900 to 1958 amounts to 2,930 tons of molybdenite concentrates.

SILICA

Fine-grained sugary quartzite was mined about half a mile east of Chillagoe and used as a flux at the Chillagoe smelters.

Twenty-four pounds of piezo-electric quartz were culled from several tons of crystalline quartz obtained from dumps at the Enterprise Mine, Wolfram Camp.

Large quartz crystals are known from an area 8 miles north of Petford but they are too cloudy and opaque for commercial use.

TIN

Tin has been the most abundant mineral on the Atherton Sheet area: it was the mineral which first focussed the attention of the prospector and miner on the area, and it has been mined continuously ever since.

Most of the tin has been won from the eastern half of the Sheet area, but some tin was mined from the south-west corner around Fulford Creek.

So far 103,973 tons of cassiterite have been produced from the Sheet area, a little over half of which has come from lode deposits.

In the Atherton Sheet area there is a close association in the distribution of tin, both lode and alluvial, and the distribution of the Elizabeth Creek Granite, and it is considered that this granite was the tin mineralizer in this area. The lodes are commonly confined to competent rocks which range from Middle Palaeozoic sediments (Mt. Garnet Formation) to Lower Mesozoic ignimbrites (Featherbed Volcanics).

Currently most of the tin being won from the area is recovered by two dredges working near Mt. Garnet; together they produce between 1000 and 1500 tons per year of cassiterite. A number of small lode-mines are working in the Ord - Irvinebank - Herberton - Bamford areas, and there are batteries at Brownville, Emuford, Sunnymount, Irvinebank and Herberton which crush the ore on a custom basis. The battery at Irvinebank is operated by the Queensland Government; the rest are privately owned and operated.

TUNGSTEN

Most of the tungsten produced from the Atherton Sheet area has come from Bamford Hill and Wolfram Camp, but there have been small deposits worked in many other parts of the Sheet area.

Wolfram was first mined at Bamford Hill in 1893 and the Wolfram Camp deposits were discovered the following year.

Total production of wolfram concentrates from the Sheet area is 11,806 tons of which Wolfram Camp has produced almost half.

The wolfram is almost invariably associated with quartz, but the host has ranged from vughs in granite to fractures in sediments.

WATER

High rainfall ensures that a narrow strip down the eastern side of the Sheet area is adequately supplied with water throughout the year. The Herbert River drains south from this high-rainfall area and waters what would otherwise be a somewhat arid area. The larger north-west trending streams contain large permanent waterholes and there are some springs, but over most of the Sheet area there is commonly a shortage of water during the greater part of the year.

In the mining areas around Stannary Hills, Herberton, Irvinebank, and Mt. Garnet many streams have been dammed, a number of dams still stand but many have been destroyed by floods and bushfires.

There are a few wind-operated pumps drawing on sub-artesian water, mainly along the southern half of the Sheet area. Apart from those there is no exploitation of underground water.

BIBLIOGRAPHY

A.G.G.S.N.A., 1935 Report for period ended 30th June, 1935. Aer. Sur. N. Aust.

" 1937 Report for period ended 31st December, 1937. Ibid.

" 1938 Report for period ended 30th June, 1938. Ibid.

ATHERTON, E.A., 1929 Progress at Chillagoe. Qld Govt Min. J., 30, (Dec.), 520.

BAKER, G., and EDWARDS, A.B., 1956 - Cassiterite concentrate from Tableland Tin Dredging N.L., southern Queensland. Sci. ind. Res. Org., Melb., mineragr. Invest. Rep. 649.

BALL, L.C., 1909a The King of the Ranges Tin Mine, Watsonville, North Queensland. Qld Govt Min. J., (May), 228.

" 1909b Irvinebank Company's treatment works. Ibid., 10 (July), 329.

" 1910 Certain Mines and Mineral Fields in North Queensland. Qld geol. Surv. Publ., 222.

" 1911 Wolfram and Molybdenite in Queensland. Qld Govt Min. J., 12, 504, 564.

" 1913a Rare Metal Mining in Queensland, Ibid., 114, 4-7.

" 1913b Mining map of the environs of Wolfram. Ibid., (Oct.), 526.

" 1914a The Muldiva mines. Ibid., 15, (Mar.), 129.

" 1914b Rare molybdenum minerals at Bamford. Ibid., (July), 389.

" 1914c The wolfram, molybdenite and bismuth mines of Bamford, North Queensland. Ibid., (Nov.), 568-575 and (Dec.), 617-623. Repeated in Qld geol. Surv. Publ., 248.

" 1917a The Arbouin copper mines at Cardross. Qld Govt Min. J., 18, (Oct.), 492-502 and (Nov.), 546-555. Repeated in Qld geol. Surv. Publ., 261.

" 1917b Tommy Burns tin mine. Qld Govt Min. J. 18 (Dec.), 601.

BALL, L.C., 1917c - Dargalong silver-lead occurrences. Ibid.,19, (Jan.), 8-9.

" 1918 - Old gold workings at Mount Wandoo goldfield, Chillagoe gold and mineral field. Ibid.,19, (Jan.) 8-9.

" 1919a - The geology of Wolfram, North Queensland, Ibid., 20, (Dec.), 509-511 and 21 (Jan.), 6-11 and 50-56.

" 1919b - Re Prince Alfred mine near Sunnymount. Unpublished memo to Undersecretary of Mines Queensland.

" 1923a - Ore provinces in Queensland. Proc.Pan-Pacific Sci.Cong., 1, 790-793.

" 1923b - Black King Tin Mines, Herberton Mineral Field. Qld Govt Min.J., 24, 371-4.

" 1923c - Scorpen's tin mine. Herberton, Ibid., 432.

" 1923d - Report on the St.Patrick Tin Mine, Herberton, Ibid., 24, 451-6.

" 1923e - Report on the Good Friday tin mine, Herberton Mineral Field. Ibid.,24,456-7.

" 1931 - Ann.Rep., Dep.Min.Qld for 1930, 137-138.

" 1933 - Forward to report by REID, J.H., "Herberton Productive tin area. Qld Govt Min.J., 24, 64-65.

BEST, J.G., 1959 - A natural pozzolan deposit near Tully Falls, North Queensland. Bur.Min.Resour. Aust. Rec. 1959/116.

" 1959 - Cainozoic basalts on the Einasleigh 4-mile Sheet, North Queensland. Ibid., 1959/117.

" 1960 - Some Cainozoic basaltic volcanoes in North Queensland. Ibid., 1960/78.

BLANCHARD, R., 1947 - Some pipe deposits of Eastern Australia. Econ.Geol., 42, 265-304.

BRANCH, C.D., 1959 - Progress report on Upper Palaeozoic intrusions controlled by ring fractures, near Kidston, North Queensland. Bur. Min. Resour. Aust. Rec. 1959/104.

" 1960 - Geology of the Ruddygore and Zillmanton copper mine areas, near Chillagoe, North Queensland. Ibid., 1960/51.

" 1960 - Summary report of Croydon Sub-Party. Ibid., 1960/135.

" 1961 - A new intrusion mechanism for some high-level granites, and the relationship with ignimbrites in North Queensland. (Abstract) read at A.N.Z.A.A.S. 1961.

BRANCH, C.D., WHITE, D.A., and WYATT, D.H., 1960. - Terrestrial volcanics and related porphyries and granites of North Queensland. IN GEOLOGY OF QUEENSLAND, J.Geol.Soc.Aus., 7, 237-243.

BROADHURST, E., 1942 - Herberton and Watsonville Tinfield. Chem.Eng.Min.Rev., (Feb.) 143-7.

" 1949 - Geology of the Ruddygore copper mine, Chillagoe. Proc.Aust.Inst.Min.Metall., No. 154-155, 105-122.

" 1951 - The Structural geology of the Herberton Tin Field. Proc.Aust.Dept.Min.Met. 160-161.

" 1952 - The geology of the Mungana-Redcap area, Chillagoe district. Ibid., No.164-165, 5-30.

" 1953a - The Herberton Tinfield in GEOLOGY OF AUSTRALIAN ORE DEPOSITS. 5th Emp.Min. metall. Cong. 1, 703-717.

" 1953b - Chillagoe copper-lead field. Ibid., 768-782.

BROADHURST, E., and EDWARDS, A.B., 1953 - Supergene ore at the Girofla Mine, Mungana. Proc.Aust.Inst. Min.Metall., No.170, 5-17.

BRYAN, W.H., 1925 - Earth movements in Queensland. Proc. Roy. Soc.Qld, 37, 1-82.

BRYAN, W.H, and WHITEHOUSE, F.W., 1929 - A record of Devonian Rhyolites in Queensland. Ibid., 41, (9).

BRYAN, W.H., and JONES, O.A., 1944 - A revised glossary of Queensland stratigraphy. Univ.Qld Dep. Geol.Pap., 2(11).

" " 1946 - The geological history of Queensland. A stratigraphical outline. Ibid., 2, (12)

CAMERON, W.E., 1900 - The Stannary Hills tin deposits. Qld Govt Min.J., 1, 190-1.

" 1901a - Thompson's Creek Tin, Herberton. Ibid., (Aug.,), 364.

" 1901b - On the CARDIGAN QUEENSLAND, tin syndicate properties, THOMPSON'S CREEK and the COOLGARRA Federal Tin Corporation, Limited, Leases, Herberton Mineral District. Qld geol.Surv.Publ., 165.

" 1903 - Wolfram, Molybdenite and bismuth mining at Wolfram Camp, Hodgkinson goldfield. Qld Govt Min.J., 4 (July), 350-352.

CAMERON, W.E., 1904a - Wolfram and molybdenite mining in Queensland. Qld geol.Surv.Publ., 188. Repeated in Qld Govt Min.J., 5 (Feb.) 62-65.

" 1904b - The Herberton tin field. Qld geol.Surv. Publ., 192, 8-12.

CLARK, A.B., 1958 - Preliminary report on the Authority to Prospect No.107M, North Queensland, and explanatory notes on the Authority to Prospect No.112M, Burdekin area, North Queensland. New Consolidated Gold Fields (A'sia) Pty. Ltd., unpublished report.

CLARKE, A.W., 1887 - Mineralogy. Ann.Rep.Dept Mines., Queensland, 118.

CONNAH, F.E., 1908 - Chillagoe garnet rocks. Proc.Roy.Soc. Qld, 22, 31-34.

CONNAH, T.H., 1952 - Tetina wolfram mine, Tolga. Qld Govt Min.J., 53 (Oct.)

" 1953 - Chromite discovery near Mareeba Ibid., 54, (Jan.)

" 1954 - Wolfram Camp Field - review of mining operations, 1945-1952. Ibid.,55,(628) 127-132.

CRIBB, H.G.S., 1946 - Boring on the Herberton Deep Lead, near Tepon. Ibid., 47.(July).

CROLL, I.C.H., 1949 - Supplies of fluorspar for Australian industry. Bur.Min.Resour.Aust., (Min. Econ.Sect.) Rec.No.1949/15.

CRESPIN, Irene, 1959 - Radiolaria in the Lower Cretaceous rocks of Australia. Ibid., 1959/110.

C.S.I.R.O., 1940 - Molybdenite from Wolfram Camp. Sci.ind. Res.Org.,Melb.Mineragr.Invest. Rep.190.

" 1941 - Test flotation concentrate, Brass Bottle tin ore,Irvinebank, Queensland. Ibid., 314.

" 1947 - Igneous rocks from the Ruddygore mine Chillagoe, Queensland. Ibid., P.373.

" 1948 - Lead-zinc ore from the Isabella mine, Herberton, Queensland. Ibid., 378.

" 1950b - Bore cores from Mount Redcap, near Chillagoe, Queensland. Ibid., Rep.468.

" 1950c - Specimens from No.2 borehole, Mount Redcap, Queensland. Ibid., Rep.474.

" 1950d - Further specimens from No.2 borehole, Mount Redcap, Queensland. Ibid.,Rep. 475.

C.S.I.R.O. 1952 - Ore specimens from the Girofla and Lady Jane mines, Chillagoe, Queensland. Ibid., Rep.510.

" 1955 - Weathered specimens from Mungana, Queensland, Ibid.,Rep.620.

" 1955b - Weathered rocks from Mungana,Queensland. Ibid., Rep.623.

" 1956 - Drill core specimens from Mungana, Queensland. Ibid., Rep. 669.

" 1957a - Drill core from Mungana, Queensland. Ibid., Rep.693.

" 1957b - Further drill core samples from Mungana Queensland. Ibid., Rep.723.

" 1960 - Drill core specimens from the GILMORE TIN MINE, North Queensland. Ibid., Rep. 813.

DALY, J., 1959 - Radiometric investigation at Wolfram Camp, Queensland. Bur.Min.Resour.Aust., Rec. 1959/135.

DAINTREE, R., 1872 - Notes on the geology of the Colony of Queensland. Quart.Jour.Geol.Soc., 28. 278-317.

DANES, J.V., 1910 - Physiography of some limestone areas in Queensland. Proc.Roy.Soc.Qld 23,75-83.

DAVID, T.W.E., 1932 - Explanatory notes to accompany a new geological map of the Commonwealth of Australia. Couns.sci.ind.Res.Aust.

" 1950 - The Geology of the Commonwealth of Australia. Edward Arnold & Co. London.

de KEYSER, F., BAYLY, M.B., and WOLFF, K., 1959 - The geology and mineral deposits of the Mungana, Chillagoe and Almaden 1-mile Sheets. Bur.Min.Resour.Aust.,Rec. 1959/108.

DENMEAD, A.K., 1933a - Stannum Mine, Herberton. Qld Govt Min.J., (Dec.) 387.

" 1933b - Happy Jack tin mine, Herberton. Ibid., (Dec.) 387.

" 1933c - Elanor tin mines, Silver Valley. Ibid., (Dec.) 389.

" 1934a - Consolation Mine, Watsonville. Ibid., 35,11.

" 1934b --Great Northern tin mine Herberton. Ibid., 73.

" 1934c - New Zealand Flag Mine, Almaden. Ibid., 35, (Mar.) 75.

"

DENMEAD, A.K., 1934d - Golden King claim, Almaden. Ibid., 35, (Mar.) 75.

" 1934e - McMillan's lode, Zillmanton. Ibid., (May), 156.

" 1935 - Dover Castle mine, Bamford. Unpublished memo to Chief Government Geologist of Queensland.

DIMMICK, T.D., and CORDWELL, K., 1959 - The Greater Herberton Mineral Field. New Consolidated Gold Fields (Asia) Pty Ltd. Unpublished report.

DUNSTAN, B., 1899 - Annual progress report of the Geological Survey for the years 1896 to 1898. Qld geol. Surv. Publ., No. 143

" 1900 - Some Queensland Mineral Springs. Qld Govt Min., J., 1,2.

" 1901 - Some Chillagoe geological notes. Ann. Prog. Rep. Qld geol. Surv. for 1900. Qld geol. Surv. Publ. No. 159

" 1905a - Torpy's silver mine, Crooked Creek, Almaden. Qld Govt Min. J., (July), 346. Repeated in Ann. Rep. Dep. Min. Qld for 1904, 149-150.

" 1905b - Wolfram in Queensland. Qld Govt Min. J., 6(July), 333-334. Repeated in Ann. Rep. Dep. Min. Qld for 1904, 150-152.

" 1905c - Ironstone at Mount Lucy, Chillagoe district. Qld Govt Min. J., 7, (Mar.) 137-138.

" 1913 - Queensland Mineral Index. Qld geol. Surv. Publ., No. 241.

EDWARDS, A.B., 1951 - Some occurrences of stannite in Australia. Proc. Aust. Inst. Min. and Metall., 160-161.

ETHERIDGE, R., Jr., 1904 - On the occurrence of the genus Halysites in the Palaeozoic rocks of Queensland, and its geological significance. Qld geol. Surv. Publ., No. 190, 30.

" 1911 - The Lower Palaeozoic corals of Chillagoe and Clermont, Part 1. Ibid., No. 231.

GAIR, V.C., 1947 - Government's aim for revival of mining in the Chillagoe district. Qld Govt Min. J., 48, (546), 115.

GREENFIELD, W., 1909 - Sketch map of the Herberton and Chillagoe gold and mineral fields. Qld geol. Surv. Publ., 220.

HADLEY, C. and TAYLOR, T.G., 1907 - Coral reefs of the Great Barrier Queensland: a study of their structure, life, distribution and relation to Mainland physiography. Aust. Assoc. Adv. Sci., 11, 397-413.

HILL, DOROTHY, 1943 - A re-interpretation of the Australian Palaeozoic record, based on a study of the rugose corals. Proc. Roy. Soc. Qld, 54, 53.

" 1943 - Geology of Queensland. Rep.Aust.Ass. Adv.Sci., Brisbane. 13-24.

HORVATH, J. 1959 - Preliminary report on geophysical survey at Ruddygore copper deposit, Chillagoe North Queensland. Bur.Min.Resour.Aust. Rec. 1959/124.

JACK, R.L., 1881a - On explorations in Cape York Peninsula, 1879-80. Qld geol.Surv.Publ., 8.

" 1881b - Further reports on the progress of the gold prospecting expedition in Cape York Peninsula, and report on the Wild River tin mines. Ibid., 9.

" 1883a - On the tin mines of Herberton, Western and Thompson's Creek districts, and the silver mines of the Dry River. Ibid., 13.

" 1883b - First sketch of a geological map of the Hodgkinson Goldfield. Ibid., 14.

" 1884 - On the Hodgkinson Goldfield. Ibid.,16.

" 1887a - Geological observations in the north of Queensland, 1886-7. Ibid., 35.

" 1887b - On Mineral Lease, 276, Watsonville. Ibid., 48.

" 1891 - On the Chillagoe and Koorboora mining districts. Ibid., 69.

" 1892 - Geological Map of Queensland, on a scale of 16 miles to an inch. Ibid.,90.

" 1893 - On the Russel River goldfield. Ibid., 89.

" 1898 - Chillagoe mining district and the projected railway. Ibid., 134, Bull., 9.

JACK, R.L. and ETHERIDGE, R., Jr., 1892 - The geology and palaeontology of Queensland and New Guinea. Ibid., 92.

JACKSON, C.F.V., 1906 - On the Chillagoe district. Qld Govt Min.J., 7, (Nov.) 583-588.

JENSEN, H.I., 1919 - Scattered geological observations, Koorboora Bamford and Petford areas. Unpublished report to Chief Government Geologist of Queensland.

" 1920a - Report on Robson's Tinaroo mine and adjacent alluvial freehold. Qld Govt Min.J., 21,(Jan.), 11-12.

" 1920b - Geological observations and notes on the mines in the Chillagoe district. Ibid., 21 (Mar), 97-101.

" 1920c - Observations at Mungana. Ibid.,(April), 97-101.

" 1920d - Observations at Lady Jane, Girofla, Dorothy, Griffiths and Red Cap Leases, Mungana. Ibid.,21, 150-153.

" 1920e - The geology and mineral prospects and future of North Queensland. Qld geogr.J. 35, 23-36.

" 1923 - Geology of the Cairns Hinterland and other parts of North Queensland. Qld geol.Surv.Publ., 274.

" 1939 - The Herberton district. Aer.Surv.N.Aust., unpublished report No.Q.40.

" 1941 - The Chillagoe district. Ibid., No.Q.53.

JONES, O.A., 1943 - The tin, tungsten and molybdenum deposits of Australia. Pap.Univ.Qld Dep. Geol., 2(9).

" 1947 - Presidential address: Ore genesis of Queensland. Proc.Roy.Soc.Qld, 59 (1), 1-91.

" 1953 - The structural geology of the Precambrian in Queensland in relation to mineralisation; in GEOLOGY OF AUSTRALIAN ORE DEPOSITS. 5th.Emp.Min. and Metall.Congr., 1, 344 - 351.

KNIGHT, C.L., 1937 - Minerals identified during 1936. Qld Govt Min.J., 38 (April), 125.

LAING, A.C.M., and POWER, P.E., 1959 - New names in Queensland Stratigraphy. Aust.Oil and Gas., 5(8), 27-36.

LANDER, C.T., 1935 - Impressions of Chillagoe and its smelters. Qld Govt Min.J.,36 (Jan).4-5.

LANGRON, W., 1950 - Plan of Shannon - Zillmanton area, showing the geology, geophysical layout and electromagnetic indications. Bur.Min. Resour.Aust.,Rec., Map No.G 84S.

LANGRON, W., 1957 - Geophysical survey of the Chillagoe-Mungana District, Queensland 1949. Ibid., 1957/99.

LAUDER, J.M., 1932 - Chillagoe State Smelters. Qld Govt Min.J. 36, (May). 4-5.

LEES, W.M., 1907 - The upper mines and Mineral Fields of Queensland. Qld Country Life.

LEVINGSTON, K.R., 1955 - Wolfram-molybdenite-bismuth workings, Bamford Hill, Petford. Qld Govt Min.J., 56.

" 1958a - Sunday tin prospect, Koorboora. Unpublished report to Chief Government Geologist of Queensland.

" 1958b - Christmas Gift tin mine, Sunnymount. Qld Govt Min.J., (Dec).

" 1960 - "Dover Castle" and Midas" tin mines, Petford. Ibid., (Sept.) 459-461.

LEICHHARDT, L., 1847 - The overland expedition from Moreton Bay to Port Essington. T. and W.Boone., London.

LINDON, E.B., 1887 - Catalogue of Queensland minerals. Proc.Roy.Soc.Qld., 4, 32.

MACLAREN, J.M., 1900 - On Stannary Hills tin mines, Eureka Creek, Watsonville District, North Queensland. Qld geol. Surv.Publ., 146.

MAITLAND, A.G., 1891 - The geology of the Coolgarra tin mines and surrounding districts. Qld geol. Surv.Publ., 72.

MARKS, E.O., 1911 - Herberton Deep Lead. Qld Govt Min.J., (May) 212-214.

MASON, A.A.C., 1953 - Vulcan tin mine in GEOLOGY OF AUSTRALIAN ORE DEPOSITS. 5th Emp.Min.Metall.Cong., 718.

McBRIDE, P.A. et al., 1940- Report for period ending 31 Dec., 1940. Aer.Surv.N.Aust. half yearly reports, unpublished. 29-41.

MORGAN, W.R., 1961 - The Carboniferous and Permo-Triassic igneous rocks of the Mossman 4-mile Sheet Area, North Queensland. Bur.Min.Resour. Aust., Rec., (in press).

MORTON, C.C., 1926a - Fluorspar in the Mungana district. Qld Govt Min.J., 27 (June). 202.

MORTON, C.C., 1926b - The Redcap leases, Mungana district. Ibid., (Dec.), 426-430.

" 1927 - Tennyson mine, Koorboora. Unpublished report to Chief Government Geologist of Queensland.

MORTON, C.C. 1930a - Economic Geology in HANDBOOK FOR QUEENSLAND.. Aust.Ass.Adv.Sci., 41.

" 1930b - Gold resources of Queensland. 25th.Int.Geol.Congress.

" 1931a - Proposed prospecting at Great Northern Mine, Herberton. Qld Govt Min.J.,(Oct.) 404.

" 1931b - Stella Mine Herberton. Ibid.,(Nov.)439.

" 1935a - Mount Wandoo workings, Mungana district. Ibid.

" 1935b - Lucky Tree mine, Chillagoe. Ibid., 36, (Sept.) 306-307.

" 1940 - Bamford wolfram-molybdenite-bismuth mines. Ibid., 41 (Feb.), 40-42.

" 1943 - Molybdenite at Wolfram Camp. Ibid.,44, (503).,32-33.

" 1944a - Great Northern Tin. ~~Qld.~~ Ibid, (Jan). 7.

" 1944b - Excellent tin mine, Brownville. Ibid., 513, 178.

" 1944c - Iceland spar, Mungana. Ibid., 45,(516) 269.

" 1944d - Mavis Bruce mine, Koorboora. Ibid.,45, (517) 298-299.

" 1944e - Wolfram Camp rare metal field, North Queensland. Ibid., 45, 117-131.

" 1945 - Wolfram Camp rare metal field, North Queensland. Ibid., 45 (523), 138-140.

MORTON, C.C., and RIDGWAY, J.E., 1944a- Mount Kitchin mica deposits. Ibid., 45, (508), 36-39;

" " 1944b- Wolfram Camp rare metal field, North Queensland. Ibid.,(511), 117.

NAPIER-BELL, S.,1909 - Notes on the mineral resources of Northern Queensland. Chem.Eng Min.Rev., 1, (11), 351-355.

OWEN, H.B., 1942 - Notes on mica occurrences at Mount Kitchin Chillagoe district, North Queensland. Unpublished report to the Mica Commission.

PARKINSON, W.D., and MULDER, J.M., 1956 - Preliminary report of airborne scintillograph surveys at Chillagoe, Einasleigh and Gilberton. Bur.Min.Resour.Aust.,Rec.,1956/63.

POOLE, W., 1909 - Notes on the physiography of North Queensland. Rep.Aust.Ass.Adv.Sci., 12, 316-317.

" 1922 - Mungana mines, Qld Govt Min.J., 23, (July), 260-261.

POLAK, E.J., and MANN, P.E., 1959a - Geophysical survey at the Barron Falls Hydro-electric Scheme, Kuranda, near Cairns Queensland. Bur.Min.Resour.Aust., Rec. 1959/93.

" " 1959b - Geophysical survey at the Koombooloomba dam site near Ravenshoe, Queensland. Ibid., 1959/126.

QUEENSLAND DEPARTMENT MINES, 1953 - Geological Map of Queensland.

" " 1953 - Wolfram Camp Queensland. 5th.Emp.Min.Metall.Cong. Aust.N.Z., 1. 328-835.

QUEENSLAND GOVERNMENT MINING JOURNAL, - 1914 - Wienerts group of mines at Orient Camp, Qld Govt Min.J.(June),288-289.

" " 1923 - State mining activities at Chillagoe. Ibid.,24 (Apr.), 129-131.

" " 1933 - Oaky Creek Mines, N.L., Mount Garnet, Ibid., (Feb.), 32.

RANDS, W.H., 1894 - On the Towall. and Mareeba Goldfields. Qld geol.Surv.,Publ., 97.

" 1896 - Deep (Tin) Lead, Herberton. Ibid., 115.

REID, J.H., 1930 - The Queensland Upper Palaeozoic Succession. Ibid.,278, 25-26.

" 1932a- The Four J's, Lucky Tree and Stevens' claims, Chillagoe. Qld Govt Min.J., 33. (May), 135-136.

" 1932b- Mount Wandoo gold mine, Mungana district. Ibid., (June), 164-167.

" 1932c- The Beaverbrook and United Empire, Chillagoe. Ibid., 167-168.

" 1932d- Great Northern freehold tin mine, Herberton. Ibid.,(July), 192-193.

" 1932e- Aurum gold lease, Mount Wandoo. Ibid., (July), 193.

" 1932f- The Great Southern, Irvinebank. Ibid., (July),194.

" 1932g- Progress notes on Mount Wandoo goldfield, Ibid., 194.

" 1932h- Great Northern Freehold Mine, Herberton. Ibid., (Aug.),224-225.

" 1932i- Streak Workings, Wyatt's Lease, Irvinebank. Ibid., (Aug.),224.

" 1932j- Silver Valley Mines. Ibid., (Oct.), 288-290.

REID, J.H., 1932k - Alluvial tin at Herberton. Ibid., (Oct.), 291-292.

" 1932l - Three-in-One, Irvinebank. Ibid., (Oct.) 292.

" 1932m - Herberton lode tin mines. Ibid., (Oct.), 292-293.

" 1932n - The Atlanta, Stannary Hills. Ibid., (Oct.), 294.

" 1932o - North Star prospecting claim, Herberton, Ibid., (Nov.), 329.

" 1932p - Great Northern tin mine, Herberton. Ibid., (Nov.), 330.

" 1932q - Prospecting at Herberton, Qld Govt Min.J., (Nov.), 332.

" 1932r - Wild Irishman Mine, Herberton. Ibid., (Nov.), 333-334.

" 1932s - Cornishman Mine, Herberton. Ibid., (Dec.), 385.

" 1933a - Consolation Mine, Watsonville. Ibid., (Jan.), 3.

" 1933b - The Prospector Claim, Ord, Mt.Garnet Line. Ibid., (Jan.), 4.

" 1933c - Great Northern Mine, Herberton. Ibid., (Jan.), 4.

" 1933d - Caledonia, Watsonville. Ibid., (Jan.), 5.

" 1933e - Mount Cardwell Mine and district, North Queensland. Ibid., (Jan.), 5.

" 1933f - Gold Find at Convex Creek, Almaden. Ibid., (Jan.), 6.

" 1933g - Oaky Creek Mines, N.L.Mount Garnet. Ibid., (Feb.), 32.

" 1933h - Federal Flag Mine, Almaden. Ibid., (Feb.), 33.

" 1933i - Herberton productive tin area. Ibid., (Mar.), 64-65.

" 1933j - Great Northern tin mine, Herberton. Ibid., (July), 191-193.

" 1933k - A summary of the copper resources of Queensland. Int.geol.Congr., Washington, 751-757.

RICHARDS, H.C., and HEDLEY, F.L.S., 1923 - A geological reconnaissance in Northern Queensland. Trans. Roy. geogr. Soc.Aust., Qld, 1, N.S.

RIDGWAY, J.E., 1945 - Fluorspar deposits, Emuford, Almaden, Qld Govt Min.J., 46 (529), 326-333

" 1946a - Wolfram Camp rare metal field, North Queensland. Ibid., 47, (532), 43-44.

" 1946b - "Elaine Mary" tin mine Watsonville-Morris Bros. Ibid., 542, 374.

RINGROSE, R.C., 1897 - Notes on the conglomerate and sandstone series of the Wild River Valley, and of the headwaters of the Walsh River. Proc.Roy.Soc.Qld, 12, 54-58.

RUTLEDGE, C.G., 1931 - Chillagoe State Smelters. Qld Govt Min.J. (Nov.), 436.

RUTLEDGE, C.G. and MORTON, C.G., 1933 - Mount Wandoo gold mine. Unpublished memo to Undersecretary for Mines.

SAINT-SMITH, E.C., 1916a - Malvern tin mine, Gurrumbah, North Queensland. Qld Govt Min.J. (Aug.), 367.

" 1916b - Boulder West mine, Gurrumbah. Ibid., 17, 55-57.

" 1916c - Robsons lodes of wolfram, tin etc., Tinaroo North Queensland. Ibid., 17, 368-370.

" 1917a - The Kitchener molybdenite mine, Khartoum. Ibid., 18, (May), 226-229.

" 1917b - Ohlsen's molybdenite claim, Lappa, North Queensland. Ibid.,18, 272-273.

" 1920 - Green and Marvells tin claim, Emuford. Ibid., (Oct.), 413.

" 1921 - The Mistake wolfram and fluorspar lode, Emuford. Ibid., 22 (Jan.), 14-15.

" 1923 - Fluorspar lode near Almaden Chillagoe district. Ibid., 24, (Nov.), 418-419.

" 1925a - Notes on some tin lodes in the Gurrumbah/Emuford district. Qld Govt Min.J., 26, 146-147.

" 1925b - Great Northern Freehold Tin Mine, Herberton. Ibid., (Nov.), 427.

" 1925c - Queensland alluvial tin deposits. Ibid., 26, 428-429.

SHEPHERD, R.L., 1913 - Report on the Klondyke, Gold Link, Spaniard, Leed and Sister Maid Lease and the Valley claim. In PROSPECTUS OF THE KLONDYKE COPPER MINES, N.L.

SKERTCHLY, S.B.J., 1896 - On the deep (tin) lead, Herberton. Qld geol.Surv.Publ., 115.

" 1897 - Report on the tin mines of Watsonville and on various tin, silver, gold and copper mines at Herberton, Mount Albion, Irvinebank, Muldiva, Calcifer, Chillagoe, California Creek, and Tate River etc. Ibid., 119.

" 1899 - The geology and mineral deposits of the country around Herberton, Watsonville and Chillagoe, North Queensland. Proc.Roy.Soc.Qld, 14, 9 27.

SMITH, E.M., 1958 - Queensland Lexique Stratigraphique Internationale, 6, (5a).

STILLWELL, F.L., 1940 - Molybdenite from Wolfram Camp. Sci.ind.Res.Org., Melb.Mineragr. Invest. Rep.190.

STIRLING, J., 1904 - Monograph on the geology and mining features of Silver Valley, Herberton, North Queensland, Australia. J.C. Konig and Ebhardt, Hanover.

TAYLOR, T.G., 1911 - Physiography of Eastern Australia. Comm.Bur Met.Melbourne., Bull. 8.

WHITEHOUSE, F.W., 1930 - The Geology of Queensland in HANDBOOK FOR QUEENSLAND. Aust.Ass.Adv.Sci., Brisbane.

" 1955 - The Geology of the Queensland portion of the Great Artesian Basin. Appendix G. in ARTESIAN WATER SUPPLIES IN QUEENSLAND. Dep.Co-ord.Gen.Publ.Works. Parl.Pap.A, 56, 1955.

WHITE, D.A., and HUGHES, K.K., 1957 - Progress report on regional geological mapping, North Queensland, 1956. Bur.Min.Resour.Aust.,Rec.1957/38.

WHITE, D.A., BEST, J.G., and BRANCH, C.D., 1959 - Progress report on regional geological mapping, Northern Queensland. 1958. Ibid., 1959/115.

WHITE, D.A., and CRESPIN, IRENE, 1959 - Some Diatomite Deposits, North Queensland. Bur.Min.Resour. Aust.,Rec. 1959/12 (unpub.) Qld Govt Min.J., 50/689, 191-193.

WHITE, D.A., 1959 - Explanatory notes to the Einasleigh 4-mile Sheet. Bur.Min.Resour.Aust.Rec. 1959/129.

" 1960a- Explanatory notes to the Clarke River 4-mile Sheet. Ibid., 1960/82.

" 1960b- Explanatory Notes to the Gilberton 4-mile Sheet. Ibid., 1960/83.

TWIDALE, C.R., 1956 - Chronology of denudation in north-west Queensland. Bull. geol. Soc. Amer., 67, 867-882.

WHITE, D.A., 1960c - Explanatory Notes to the Georgetown 4-mile Sheet. Ibid., 1960/84.

WHITE, D.A., and WYATT, D.H., 1960 - GEOLOGY OF QUEENSLAND. J.Geol.Soc.Aust., 7, pp.62-74, 123-8. 149-54, 177-80, 237-43.

WHITE, MARY E., 1959 - Report on further collections of plant fossils from the Einasleigh region, Northeastern Queensland. Bur.Min.Resour.Aust., Rec.1959/75.

" 1960 - Plant fossils from Stannary Hills district, North Queensland. Ibid., 1960/19.

" 1961a- Plant fossils from Mitchell River and Mount Mulligan, North Queensland. Ibid., 1961/16.

" 1961b- Plant fossils from the Hodgkinson formation North Queensland. Ibid., 1961/17.

WILLIAMS, O.M., 1923 - Rare metal mining. Qld Govt Min.J., 24, (Nov.), 378-385.

" 1935 - Draining Herberton Deep Lead. Ibid., (May), 172-174.

TABLE III STRATIGRAPHY OF ATHERTON 4-MILE SHEET

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age	Stratigraphical Relationship	Economic Geology	Principal References
	QUATERNARY	Alluvium (Qa)	0-100 ft. in the Mt. Garnet area	Silt, sand and gravel.	Flanks of streams and on flood plains; partly filling old valleys in the Mt.Garnet area.	Level to slightly undulating plains.		Much of this material probably ranges back into the Tertiary		Mainly alluvial tin, some alluvial gold on west of Sheet rea. Good water at shallow depth near major streams	
		Residual Soils (Qs)		Grey, brown and red soils range in texture from silt to sand.	Extensive deposits over Precambrian rocks, Herbert River Granite, and most of the Atherton Basalt.	Mainly level to gently undulating plains; deeply dissected and steeply undulating over Atherton Basalt.			Derived mainly from underlying rocks, some resorted alluvium.		
	TERTIARY	Laterite (Czl)	20-30 ft.	Mottled ferruginous horizon which grades down into an indefinite pallid zone	Mainly in south-east corner of Sheet, some outliers in centre of Sheet.	Level to undulating plains, commonly bounded by cliffs 15 - 20 ft. high. Some mesas in centre of Sheet.	Hard, red ferruginous cap overlying mottled red and white clay, and sand horizons.		Mainly overlies Herbert River Granite and Precambrian rocks.	Fair grazing land but commonly infested with "Heart Leaf Poison".	Whitehouse 1940. Simonett 1957.
CAINOZOIC		Atherton Basalt (Cza)	Unknown, flows probably about 500 ft., pyroclasts about 100 ft.	Grey fine-grained olivine basalt, mantled with pyroclastic basalt mainly tuff.	Partly filling valleys along the eastern side of the Sheet. Some flows have coursed about 40 miles from their vents. The pyroclasts are more restricted, they were mainly subaerially deposited; there are some lahar deposits along the SW fringe of the province.	Level to steeply undulating over basaltic tuffs. Commonly level, with deeply incised twin lateral and / or median streams over basalt flows.	Partly filled the valleys of the ancestral Mitchell and Johnston Rivers Overtopped low divides on the western side of the valleys and coursed down the headwaters of the Herbert R. Late-stage explosive activity mantled all but the distal flows with up to 100 ft. of basalt pyroclasts. Bones Knob and Hypipamee crater are the only volcanoes on the Sheet area.	McBride, Undara, and probably Kinrara Basalts on the Einasleigh Sheet.	Overlies stanniferous gravels in the Wild River. Unconformably overlies Walsh Bluff and Glen Gordon Volcanics Elizabeth Creek and Herbert R. Granites and Mt. Garnet Formation.	Deep leads (stanniferous) in the Herberton / Wondecla area. Forest products, agricultural and dairying on the basalt tuff.	Best, 1959 ____, 1960
		Culgar Basalt (Czg)		Grey fine-grained olivine basalt	Small outliers along Oakey Ck. valley, SE of "Springmount". Mainly flows, some bombs, no obvious vents.	Very small hillside outcrops in headwaters; floors wide valley below headwaters.	Vents and inclined flows in headwaters, more continuous flow in wide [illegible] below headwaters.	[illegible] Undara Basalt?	Unconformably overlies Hodgkinson Formation.		

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age.	Stratigraphical Relationship	Economic Geology	Principal References
CAINOZOIC	TERTIARY	Basalt undifferentiated (Czb)		Grey fine-grained olivine basalt	Small outlier NW of Walsh Bluff.	Gently undulating with sporadic basalt boulders at the surface.		Atherton Basalt.			
CAINOZOIC	TERTIARY	McBride Basalt (Czm)	Unknown, probably 50-100 ft.	Grey fine-grained olivine basalt; the olivine is commonly iddingstised	Partly fills ancestral stream channels along the southern side of the Sheet area.	Level surface covered with basalt boulders and flanked by twin lateral streams.	Distal portions of flows from vents in the McBride Basalt Province on the Einasleigh 4-mile Sheet.	Chudleigh Basalt and Nulla Basalt on the Clarke River Sheet. ? Pliocene - ? Pleistocene.	Unconformably overlies Precambrian metamorphics and Upper Palaeozoic granites.	Commonly flanked by perennial streams.	Twidale 1956 White and Hughes, 1957 Best, 1959
MESOZOIC	CRETACEOUS	Cretaceous undifferentiated (K)	Unknown, probably about 200 ft.	Almost continuous outcrop along the western edge of the Sheet area and outliers up to 50 miles east of the western edge of the Sheet.	Mainly sandstone with underlying conglomerate; size of constituents and proportion of cgt to s'stone increases to the east.	Plateaux, commonly bounded by cliffs along the eastern side. Outliers generally as mesas.	Low regional dip to the west.	Unconformably overlies Precambrian metamorphics and Upper Palaeozoic-Lower Mesozoic igneous rocks. Overlain by ? Tertiary sand.	Gilbert River Formation and the Wrotham Park Sandstone.	Intake beds for the Carpentaria Basin.	Laing and Power, 1959 [illegible], 1960
PALAEOZOIC	PERMIAN (— TRIASSIC ?)	Igneous Rocks undifferentiated. (Pzu)		(1) Dolerite, (2) diorite, (3) rhyolite.	(1) Dyke-swarms in western third of Sheet area. (2) Scattered outcrops range up to 10 square miles in area. (3) Dyke-swarms of most of the Sheet area.	Long narrow depressions. Commonly areas of low relief. Long narrow ridges.	Vertical dykes commonly trend ESE to SE. Vertical dykes commonly trend E to SE.	Intrude Precambrian metamorphics and Upper Proterozoic granite. Intrudes all rocks up to Lower Mesozoic.			
PALAEOZOIC	PERMIAN (— TRIASSIC ?)	Elizabeth Creek Granite (Pgz)		Pink granite, consists mainly of salmon pink orthoclase and colourless transparent quartz; near the margins of the pluton there are variants which range from aplitic to porphyritic. The porphyritic types commonly contain biotite.	Discontinuous outcrops aggregate about 1300 square miles on the Atherton Sheet.	Steep rough hills, which in the more arid areas are bare of soil and devoid of timber.	Outcrops range from ring dykes with an area of 5 sq. miles to batholiths of 500 sq. miles. There is no evidence of thermal metamorphism around contact area.	Probably co-magmatic with the Upper Palaeozoic - Lower Mesozoic volcanics (Featherbed, Glen Gordon, Walsh Bluff, etc.)	Intrudes Precambrian metamorphics Middle and Upper Palaeozoic granite, and Upper Palaeozoic-Lower Mesozoic volcanics.	Tin, tungsten (wolfram) fluorite, bismuth, molybdenum.	White, Best et al (1959) Branch, White & Wyatt. (1960)
PALAEOZOIC	PERMIAN (— TRIASSIC ?)	Gilmore Volcanics (Pi)		Pink rhyolite and grey ignimbrite.	Crops out over about 30 sq. miles west of Ord Railway Stn.	Steep rough hills.	Ring fractures bound blocks of sedimentary, volcanic and plutonic rocks. Trachyte dykes [illegible] the ring fractures.	Equivalents of Featherbed and Glen Gordon Volcanics. Upper Palaeozoic-Lower Mesozoic.	Intrudes Mt. Garnet Fm.		

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age	Stratigraphical Relationship	Economic Geology	Principal References.
PALAEOZOIC	(—— TRIASSIC?)	Boxwood Volcanics (Po)		Pink rhyolite and grey ignimbrite.	Crops out over 15 sq. miles in the headwaters of Oakey Ck., near "Boxwood" Homestead.	Steep, rough hills.	Ring fractures bound blocks of sedimentary, volcanic and plutonic rocks.	Equivalent to Featherbed, and Glen Gordon Volcanics. Upper Palaeozoic-Lower Mesozoic.	Is intruded by Elizabeth Creek Granite.		
		Warby Volcanics (Pw)		Pink rhyolite and grey ignimbrite.	Crops out over about 60 sq. miles in the SW corner of the Sheet area.	Steep, rough hills.	Segments of pink rhyolite and grey ignimbrite bounded by ring fractures and intruded by pink granite and quartz trachyte.	Equivalent to Featherbed, and Glen Gordon Volcanics. Upper Palaeozoic-Lower Mesozoic	Intrudes Forsayth Granite, intruded by Elizabeth Ck. Granite, and unconformably overlain by Cretaceous sandstone.	Lode tin	
		Featherbed Volcanics (Pf)	About 4000 ft.	Pink rhyolites and grey ignimbrite.	About 500 sq. miles in a block about [illegible]0 miles long 10-15 miles wide NW from Stannary Hills.	Rough, deeply incised plateau; stream pattern rigidly controlled by jointing.	Pink flow-banded rhyolite overlain by massive grey ignimbrite. Beds dip inward away from the faulted margin. These rocks were probably deposited in a graben by a predominantly explosive volcanic action.	Equivalent to Glen Gordon Volcanics. Upper Palaeozoic-Lower Mesozoic.	Unconformably overlies Almaden Granite, intruded by Elizabeth Ck. Granite.	Lode tin	Jensen, (1920) Branch, White & Wyatt (19[illegible]0).
		Walsh Bluff Volcanics (Ph)	About 1500 ft.	Pink rhyolite and grey ignimbrite.	About 50 sq. miles in a rectangular block trending NW from Atherton	Rough, deeply dissected plateau.	Bounded by faults, beds have a shallow dip south and inwards from the margin.	Featherbed Volcanics, Atherton Sheet. Newcastle Range Volcanics on the Georgetown Sheet. Upper Palaeozoic-Lower Mesozoic.	Unconformably overlies Hodgkinson Formation, intruded by rhyolite porphyry dykes.		
		Kallon Volcanics (Pk)	About 2000-3000 ft.	Pink rhyolite and grey ignimbrite.	Crops out in four areas along the south side of the Sheet area. aggregates about 70 sq. miles.	Steep, rough hills.	Bounded by arcuate faults, dip shallow, inward away from the margin.	Equivalent to the Featherbed and Glen Gordon Volcanics. Upper Palaeozoic-Lower Mesozoic.	Unconformably overlies Precambrian Metamorphics. Intruded by Elizabeth Ck. Granite.		
		Glen Gordon Volcanics (Pl)	About 1500-2000 ft.	Pink rhyolite and grey ignimbrite.	About 300 sq. miles in a NNW trending belt 8-10 miles wide from the SE corner of the Sheet to about 16 miles NW of Ravenshoe.	Steep, rough hills.	Dips range up to vertical, Strike generally NW. Outcrops bounded by faults.	Featherbed Volcanics on the Atherton Sheet; Newcastle Range Volcanics on the Georgetown Sheet.	Unconformably overlie Sunday Ck. Volcanics, unconformably overlain by Atherton Basalt.		
	PERMIAN	Scardons Volcanics (Ps)	From 2000-4000 ft.	Pink rhyolite and grey ignimbrite.	About 200 sq. miles between Lynd River and "Fulleringer" Homestead.	Steep, rough hills.	Ring fractures bound the blocks of volcanics which are exposed over a stratigraphic range of levels. Dips generally shallow, and inwards from faulted margins.	Featherbed Volcanics. Upper Palaeozoic-Lower Mesozoic.	Unconformably overlies McDevitt Metamorphics, intruded by Elizabeth Creek Granite, unconformably overlain by Cretaceous sandstone.		

TABLE III

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age	Stratigraphical Relationship	Economic Geology	Principal References.
PALAEOZOIC.	PERMIAN — (TRIASSIC?)	Herbert River Granite (Pgh)		Massive, medium-grained grey biotite granite commonly with pink feldspar phenocrysts.	Crops out over about 800 sq.miles, trends roughly NW across the middle of the Sheet area	Commonly level to gently undulating plains covered with sandy soil.	Irregular shaped outcrops, thermal metamorphic effects common around the margin.	Herbert River Granite, Einasleigh Sheet. Permian	Intrudes Montalbion Sandstone (Carboniferous) and is intruded by Elizabeth Ck. Granite.	Copper, silver, lead, gold.	White, Best, et al., (1959) Jour.Geol. Soc.Aust., 7, (1960)
		Almaden Granite (Pga)		Grey, medium-grained porphyritic granodiorite	About 50 sq.miles between Almaden and the Walsh River.	Level to gently undulating plains covered with sandy soil.	Quartz-poor variant of the Herbert River Granite.	Herbert River Granite Permian.	Intrudes Chillagoe Formation & Nychum Volcanics unconformably overlain by Featherbed Volcanics.	Copper, silver, lead, gold.	Jour.Geol. Soc.Aust., 7, (1960) DeKeyser, Bayley and Wolff, (1959)
		Ixe Monzonite (Pmi)		Porphyritic micro-monzonite	About 20 sq.miles in two outcrops west of Bullock Ck. railway siding.	Steep, rough hills.		Probably related to the Herbert River Granite.	Intrudes Forsayth Granite; intruded by Elizabeth Ck. Granite.		
		Gingerella Trachyte (Ptg)		Trachyte and dolerite; in places flow-banded.	About 5 sq. miles around Gingerella Cutstation.	Gently undulating soil covered plain.	Discordant intrusion.	Probably genetically related to the Herbert River Granite.	Intrudes Forsayth Granite; unconformably overlain by Kallon Volcanics		
		Nychun Volcanics (Pny)		Dominant acid lavas & tuffs, subordinate intermediate & basic lavas, rare sediments, some with coal.	Five outcrops north of Mungana aggregate area about 20 sq.miles	Rough Hills.	Gently folded volcanics.	Upper Permian.	Intruded by Almaden Granite overlain by Cretaceous sandstone.		Morgan, 1961.

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age	Stratigraphical Relationship	Economic Geology	Principal References
PALAEOZOIC	? CARBONIFEROUS	Nanyeta Creek Volcanics (Cn)		Porphyritic rhyolite flows and pyroclasts, basal beds contain greywacke xenoliths; upper beds are thin-bedded fine grained pale grey and cream sediments.	About 35 sq. miles in a belt trending NW from Mt. Garnet.	Steep, rough hills.	Dips generally shallow and inward from the fault-bounded margin.	Sunday Creek Volcanics. ? Carboniferous	Unconformably overlies Mt. Garnet Formation, unconformably overlain by Glen Gordon Volcanics.		
		Sunday Creek Volcanics (Cn)		Rhyolite and andesite, the lithologies are much more diverse than in the over-lying Glen Gordon Volcanics.	About 8 sq. miles in the SE corner of the sheet.	Steep rough hills over the rhyolite, more subdued over the andesites.	Fault-bounded and tilted blocks, dips range up to 45 degrees.	Nanyeta Volcanics. ?Carboniferous	Unconformably overlain by Glen Gordon Volcanics, intruded by Herbert River Granite.		White, (1959).
		M[illegible] Granite (Cgm).		Grey porphyritic biotite granite with rare horn-blende and some tourmaline-rich variants.	About 80 sq. miles in the NE corner of the Sheet.	Commonly level plains to gently un-dulating hills covered with sandy soil.	Predominantly concordant intrusion; faulted contact along the western side of the pluton.	Probably genetically related to Herbert River Granite ?Carboniferous.	Intrudes Barron River Metamorphics and Hodgkinson Fm. unconformably overlain by Atherton Basalt.	Tin and gold.	Jensen, (1923).
		Silver Valley Conglomerate (Csi)	About 300 ft.	Shale, sandstone, pebble and cobble conglomerate, grey volcanics (rhyolite)	About four sq. miles, 8 miles south-west of Herberton.	Depression with incised dendritic drainage, surrounded by high rough hills.	Fault-bounded block preserved by down-faulting. Beds are [illegible] and traversed by numerous vertical faults.	Plant fossils, Rhacopteris inequilatera. ? Middle Carboniferous	Unconformably overlies Hodgkinson Formation and Ringrose Formation, and is faulted against them.	Silver, lead, copper.	Stirling, (1904). Reid, (1930).
		Montalbion Sandstone (Cm)	Commonly 100 ft., may range up to 1000 ft.	White to pale grey sandstone, basal pebble and cobble conglomerate.	Crops out over eastern third of Sheet, aggregates 10-15 sq.miles.	Commonly caps steep rough hills and ridges.	Dips commonly N to NE. Outcrops gen-erally bounded by faults, where dips steep.	Ringrose Formation. Carboniferous.	Unconformably overlies Hodg-kinson Formation, unconformably underlies Silver Valley Conglomerate, interfingers with the Ringrose Formation and is intruded by Elizabeth Creek Granite.	Tin, silver, lead, copper.	Skertchly, (1899)
	CARBONIFEROUS	Ringrose Formation (Cr)	Unknown probably 1000+ ft.	Dark grey quartz siltstone, silty mudstone, dark to pale grey fine sandstone, pale grey coarse sand-stone, dark grey quartz conglomerate with clay galls.	Crops out over eastern third of Sheet; aggregates about 50 sq. miles, most of it around Irvinebank.	Steep, rugged hills.	Moderate to steep dips, same beds overturned, outcrop commonly bounded by faults.	Montalbion Sandstone. Carboniferous.	Unconformably over-lies Hodgkinson Formation, uncon-formably underlies Silver Valley Conglomerate. Interfingers with Montalbion Sandstone and is intruded by Herbert River Granite and Elizabeth Creek Granite.	Tin, silver, lead.	Ringrose, ([illegible]) Skertchly ([illegible])

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age	Stratigraphical Relationship	Economic Geology	Principal References.
PALAEOZOIC	? MIDDLE DEVONIAN LOWER CARBONIFEROUS	Hodgkinson Formation D-Ch	Unknown probably not more than 20,000 ft. on Atherton Sheet area, but greater further north.	Silty mudstone & slate, Greywacke, chert sandstone, siltstone conglomerate and limestone lenses.	300-400 sq. miles in the NE quadrant of the Sheet.	Gentle to moderately undulating.	Tightly folded commonly overfolded, trends mainly NW to N. Southern end of the Hodgkinson Basin	Star Group <u>Pachypora</u> sp., <u>Cyathophyllum</u> sp., <u>Lepidodendron australe</u> <u>Ratzia</u> sp., <u>Psilophytalen</u> sp., ?Middle Devonian - Lower Carboniferous.	Unconformably overlain by Mingrose Fm., Montalbion Sandstone Silver Valley Conglomerate. Faulted against Mt. Garnet Fm.. Intruded by Herbert River Granite and Elizabeth Creek Granite.	Tin, silver, lead, copper, gold.	Jack, (1884), (1889), (1892). Dunstan, (1913) Ball, (1917). Jensen, (1943)
	UPPER SILURIAN - LOWER DEVONIAN.	Chillagoe Formation S - Dh		Limestone, chert, sandstone, siltstone greywacke conglomerate and rare acid and basic volcanic rocks.	A NW trending belt about 30 miles long and 6 miles wide in the NW quadrant of the sheet.	Prominent ridges (100-150 ft.high) of cavernous karren-eroded limestone surrounded by soil covered plains.	Tightly folded beds strike about NW and dips range up to vertical.	<u>Favosites</u> sp., <u>Heliolites</u> sp., <u>Halysites</u> sp., <u>Cladopora</u> sp., <u>Propora</u> sp., <u>Tryplasma</u> sp., <u>Kyphophyllum</u> sp., <u>Cyathophyllum</u> sp., <u>Spongophullum</u> sp., <u>Cystiphyllum</u> sp., <u>Xystriphyllum</u> sp., <u>Pseudamplexis</u> sp., <u>Grypophyllum</u> sp., ?<u>Stringocephalus</u> sp., Silurian to possibly Lower Devonian.	Faulted boundary with Dargalong Metamorphics. Interfingers with Mt. Garnet Fm., and intruded by Almaden Granite ? Lower Mesozoic rhyolite porphyry dykes.	Copper, silver, lead, limestone.	Jack & Etheridge, (1892). Jack, (1891), (1898). Skertchly, (1897) Jensen, (1923) (1941). White and Hughes, (1957). DeKeyser, Bayley and Wolff, (1958).
		Mt. Garnet Formation S - Dm	Unknown possibly 15,000 ft.	Massive greywacke, siltstone, sandstone, thin bedded radiolarian jasper; lenses of limestone, limestone conglomerate and greywacke conglomerate. ? Intrusive dolerite.	Numerous inliers in a belt trending NW across the sheet from the SE corner of the sheet.	Commonly subdued plains to gently undulating hills; prominent hills where strengthened by faulting and quartz veining.	Tightly folded, strike commonly NW, but ranges around to NE. Dips range up to vertical.	<u>Entelophyllum</u> sp., <u>Syringolites</u> sp., <u>Thamnopora</u> sp., <u>Favosites</u> sp., ?Silurian, possibly Devonian.	Interfingers with and grades into Chillagoe Fm. Intruded by Herbert River and Elizabeth Creek Granites. Unconformably overlain by ?Carboniferous and ? Lower Mesozoic acid volcanics.	Copper, silver lead, tin, iron, fluorite, wolfram.	Whitehouse, (1930). **Wbite**, Best et al (1959).
	UNDIFFERENTIATED.	Barron River Metamorphics Pzb		Phyllite, Schist, quartzite, thin-bedded metamorphosed greywacke and siltstone, rare marble lenses.	Crops out over 25 - 30 sq. miles in the NE corner of the sheet.	Gently to steeply undulating hills.	Tightly folded, strike ranges from NW to NE, dips range up to vertical, commonly moderate to SW. Intimately intruded by the Mareeba Granite.	≡ Hodgkinson Formation at least in part, possibly inter-fingering. ? Middle Devonian-Lower Carboniferous or greater.	Intruded by Mareeba Granite, unconformably overlain by Atherton Basalt. Sharp metamorphic discordance with Hodgkinson Fm..	Gold and tin.	Whitehouse, (1930). Qld. Geol. Map. (1953).

TABLE III

Era	Period	Rock Unit	Thickness	Lithology	Distribution	Topography	Structure	Correlation Palaeontology and Age.	Stratigraphical Relationship	Economic Geology	Principal References
PRECAMBRIAN	UNDIFFERENTIATED	Precambrian undifferentiated		Schist, gneiss, granite, quartzite, and amphibolite	Crops out over about 250 sq. miles in the SW quadrant of the Sheet and as isolated inliers aggregating about 10 sq. miles on the eastern half of the Sheet.	Gently to steeply undulating hills.	Tightly folded commonly strongly sheared and foliated.	Probably includes Dargalong and McDevitt Metamorphics and Forsayth Granite.	Intruded by Herbert River Granite and Elizabeth Creek Granite. Unconformably overlain by Palaeozoic acid volcanics, Cretaceous sediments, and Tertiary basalt.	Copper, gold.	
	PROTEROZOIC	Forsayth Granite Pgf		Grey, coarse-grained massive to porphyritic biotite granite. Platy flow on margins.	Crops out over about 100 sq. miles in five outcrops on the western half of the Sheet.	Gently undulating hills and level plains covered with soil.		Robin Hood Granite & Dumbano Granite. Late Precambrian	Intrudes Dargalong & McDevitt Metamorphics. Unconformably overlain by Palaeozoic acid volcanics and Cretaceous sandstone.	?Copper	White & Hughes, (1957) White, Best et al. (1959)
		Cobbold Dolerite Pdc		Dolerite, gabbro, and amphibolite	Linear belts in the western half of the sheet.	Strike ridges, hills and low rises.	Steeply dipping dykes, and sills.	Cobbold Dolerite on Georgetown & Einasleigh 4-mile Sheet areas. Precambrian	Intruded by Forsayth Granite (Einasleigh Sheet) Intrudes Proterozoic sediments.		White, Best et al. (1959)
		Sandalwood Serpentenite. Pss		Serpentenite, gabbro. Crops out commonly as brown silica boxworks.	Small lens forms a prominent hill west of "Gunnawarra" homestead.	Prominent hill.	Steeply dipping lenticular dyke.	Sandalwood Serpentenite on Einasleigh and Clarke River 4-mile Sheets. Precambrian	Intruded by McKinnons Creek Granite (Einasleigh 4-mile Sheet)	?nickel, gold.	Green (1958) White et al 1958.
		McDevitt Metamorphics Pm		Quartz-muscovite garnet-cordierite-schist, quartz-muscovite schist and quartzite.	About 300 sq. miles in the NW quadrant of the sheet.	Gently undulating hills interspersed with plains.	Tightly folded. Metamorphism is low-grade regional.	Robertson River Metamorphics on the Georgetown 4-mile Sheet. Proterozoic.	Intruded by Forsayth Granite, Herbert River Granite, Elizabeth Creek Granite; and unconformably overlain by Cretaceous sediments	Gold and tin	White (1960)
	ARCHAEAN	Dargalong Metamorphics Ad		Mica schist, gneiss, granulite, pegmatite, granite, quartzite and amphibolite.	500-600 sq. miles in the NW quadrant of the Sheet.	Gently undulating hills, interspersed with plains.	Tightly folded, foliated and lineated. High grade regional metamorphics.	Einasleigh Metamorphics on the Georgetown and Einasleigh 4-mile Sheets. ? Archaean	Metamorphic unconformity with the McDevitt Metamorphics. Unconformably overlain by Chillagoe Fm., Intruded by Forsayth Granite, Herbert River Granite and Elizabeth Creek Granite.	Copper, gold, Ilmenite.	Skertchly (1899) Whitehouse (1930) de Keyser, [illegible] Lucas and Wolff (1950)

AUSTRALIA 1:253 440

ATHERTON

QUEENSLAND

4 MILE GEOLOGICAL SERIES SHEET E 55-5