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PROGRESS REPORT ON REGIONAL GEOLOGICAL MAPPING,

NORTHERN QUEENSLAND, 1957.

GRAY CREEK, BROKEN RIVER AND CLARKE RIVER AREAS.

by

D.A. White, J.R. Stewart, C.D. Branch,
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SUMMARY

A joint regional geological survey carried out by the Bureau of Mineral Resources and the Queensland Geological Survey has been in progress for the past two years in Northern Queensland.

Detailed mapping in 1957 of the boundary between the Precambrian and Palaeozoic successions in the Hall's Reward Mine and Gray Creek areas has shown that some of the 1956 conclusions (White and Hughes, 1957) need revision. It now appears probable that the deposition of quartz sandstone and siltstone of the Paddys Creek Formation on the shelf zone of the "Georgetown Massif" (Hill, 1951) was continuous in time with the deposition of siltstone and shale of the Perry Creek Formation of Siluro-Devonian age.

Basement rocks to the Palaeozoic succession are exposed in the Hall's Reward Mine area. They are amphibolite, mica schist, quartzite and migmatite. These metamorphics are considered to be Precambrian in age and outcrop 15 miles to the south where similar metamorphics with granite and serpentine are exposed in the Bauhinia Creek area. In late Ordovician or early Silurian time this basement was uplifted to form a tectonic land mass in the Bauhinia Creek area.

The uplift was followed by a period of eugeosynclinal sedimentation in late Ordovician times with greywacke deposition and basic vulcanism along the eastern margin of the land mass accompanied by either a resorting of portion of the Paddys Creek Formation or else a cessation of sedimentation on its western boundary.

Farther south, in the Broken River area, away from the land mass, the greywacke succession grades into a very thick sequence of siltstone and sandstone with thick lenses of coral limestone. Here conditions were more stable and marine sedimentation continued from the Upper Silurian to the Middle Devonian, when freshwater sediments were conformably deposited on the marine sequence to the west of the Pandanus Creek/Broken River area. This freshwater sedimentation continued throughout the Upper Devonian and probably lower Carboniferous. Detailed study of the coral faunas from the Siluro-Devonian sequence has been commenced by Dr. D. Hill, University of Queensland, who has discovered several new genera and many new species from the Broken River area.

East of the tectonic land mass fine clastics, with some greywacke and conglomerate, and limestone lenses were deposited deposited in Upper Silurian and Lower Devonian time.

Between Gray Creek and the Clarke River Carboniferous freshwater sediments with some thin basal marine intercalations, unconformably overlie the Siluro-Devonian sequence.

The main orogeny in the area took place early in the Carboniferous, when serpentinite and other ultrabasic and basic rocks were emplaced in the Gray Creek and Hall's Reward Mine area. During this orogeny granitic rocks intruded the Siluro-Devonian sequence in the Clarke River area.

Two other orogenies are recognized, the one at the end of the Precambrian and another in post-Middle Carboniferous time. During these orogenies major north-north-east trending faults were formed along the western margin of the Siluro-Devonian succession.

Detailed study of the serpentinite and basic rocks of the Gray Creek Complex has shown that it may have been emplaced as a feeder phase to the basalt of the Everetts Creek Volcanics extruded in Silurian time before the Lower Carboniferous orogeny.

Towards the end of the Palaeozoic large masses of rhyolite and porphyry were emplaced. The largest mass is exposed in the Newcastle Range, where emplacement was probably by couldron subsidence accompanied by ring dykes.

Geochemical testing for copper and nickel was carried out in the Hall's Reward Mine area. Copper values ranging from 20 to 50 p.p.m. were detected in the soils south of the Hall's Reward Copper Mine. Nickel values up to 0.5% were found in serpentinite and overlying laterite. Testing to deeper levels in the lateritic profile is recommended.

About 6,000 tons per vertical foot of chromite with an average grade of 33% Cr_2O_3 is exposed in serpentinite along the south-eastern margin of the Gray Creek Complex. This deposit is recommended for geophysical testing by gravity and magnetometer methods.

Regional geological mapping will be continued in 1958 to complete the Georgetown, Einasleigh, Gilberton and Clarke River Four-mile Sheets.

I N T R O D U C T I O N

This report deals with the regional mapping carried out in 1957 by a combined party of the Bureau of Mineral Resources and the Geological Survey of Queensland in the Gray Creek, Broken River and Clarke River areas of Northern Queensland (Plate 1). The survey was a continuation of a programme of regional geological mapping commenced in Northern Queensland in 1956 and part of the programme under by the Bureau of Mineral Resources and the Geological Survey of Queensland in the search for radioactive and metalliferous deposits.

The geologists who took part in the survey were D.A. White (leader), J.R. Stewart, C.D. Branch, D.H. Green, and D. H. Wyatt (Geological Survey of Queensland). Geochemists S. Baker (for a period of two months) and J. R. Beevers (for two and half months) also worked with the party. During the survey Dr. D. Hill, University of Queensland, spent a week with the party collecting corals from the Broken River area.

An area of about 3,500 square miles was mapped at a scale of 1 inch to 1 mile. The area covered the Dido One Mile Area of the Einasleigh Four-mile Sheet (Plate 2), the Phantom Creek (Plate 2), Montgomery Range (Plate 3), Yering (Plate 4), Castle Hill (Plate 5), Porphyry (Plate 6), and Niall One-mile areas of the Clarke River Four-mile Sheet (Plate 1). The Hall's Reward Mine area in the south-eastern part of the Dido One-mile area was mapped at a scale of approximately 1 inch : 1200 feet (Plate 7). This work, together with the underground mapping of the mine, has been dealt with elsewhere (White, Branch and Green, 1958).

In conjunction with the geological mapping programme, chemical testing of soils for copper and nickel was carried out in the Hall's Reward Copper Mine area and

for copper, lead and zinc on part of the Stockyard Creek Siltstone (White and Hughes, 1957) in the central part of the Georgetown Four Mile sheet.

Field sheets of the area were compiled from uncontrolled photomosaics for immediate distribution to interested companies. Data from the field sheets and aerial photographs will be replotted on controlled planimetric base maps for final compilation.

Photomosaics and planimetric base maps covering the area mapped were compiled by the National Mapping Division, Department of National Development, from photographs taken by the Royal Australian Air Force.

PREVIOUS INVESTIGATIONS

The area is situated near the boundary of the Etheridge and Kangaroo Hills Mineral Fields at the contact between the Precambrian(?) metamorphics of the "Etheridge Complex" (Geological Map of Queensland, 1953) and the western part of the Palaeozoic Tasman Geosyncline. The first important contribution to the understanding of this part of the field was made by Maitland (1891), who described an older series of metamorphics of probably Precambrian age and sediments of the "Burdekin System" of Middle Devonian age. Maitland showed the boundary between these two rock units to coincide with the Burdekin River and this boundary does not differ greatly from that shown on the Geological Map of Queensland (1953).

Later Jack and Etheridge (1892) described the sediments in the Broken River area and correlated the "Broken River Series" with the "Burdekin Beds" of Middle Devonian age. Later geologists, including Cameron (1900), Marks (1911), Ball (1915) and Jensen (1920 and 1923), were mainly concerned with the central portion of the Etheridge Goldfield rather than with its boundary with the Kangaroo Hills Mineral Field. Since then geological mapping in the area has been confined to the Hall's Reward Mine (Ninety Mile), which has been described by Morton (1941 and 1943), Denmead (1947), and other geologists of the Geological Survey of Queensland.

A reconnaissance survey by the Geological Survey of Queensland and the Bureau of Mineral Resources was carried out in 1956 in Gray Creek (White and Hughes, 1957).

STRATIGRAPHY

Previous knowledge of the stratigraphy of the area is based mainly on the 1956 regional geological mapping programme (White and Hughes, 1957). As a result of this mapping geosynclinal deposits of trough and slope (Etheridge Formation), and shelf (Einasleigh Metamorphics, Mt. Moran, Lucky Creek and Paddys Creek Formations) environments of probably Precambrian age were recognized. The sediments were folded, metamorphosed and intruded by the Forsayth Granite. Also it was recognized that, along their south-eastern margin in the Gray Creek area, the Precambrian deposits were separated from a Palaeozoic succession by a thrust zone along which serpentinite and basic rocks were intruded. The Palaeozoic succession was considered to overlie the Forsayth Batholith unconformably in the Gregory Springs and Blackbraes areas.

TABLE I.

TENTATIVE STRATIGRAPHY OF GEORGETOWN, EINASLEIGH, GILBERTON, CLARKE RIVER AND ATHERTON 4-MILE SHEETS, NORTHERN QUEENSLAND

AGE	ROCK UNIT	LITHOLOGY	STRUCTURE	THICKNESS	RELATIONSHIPS AND REMARKS
Cainozoic	Unnamed	Basalt	Flat lying, mesa cappings and old river valley fillings.	10'-75'	Crops out in four main areas. L. Atherton Tablelands. 2. Mt. Surprise (includes "McBride Province", Twidale, 1956). 3. Nulla Nulla ("Nulla Province", Twidale, 1956). 4. Chudleigh ("Chudleigh Province", Twidale, 1956).
		Laterite	Mesa cappings	10'-20'	
Cretaceous	Blythesdale Group	Conglomerate, sandstone, arkose, claystone, and siltstone.	Flat lying. Mesa cappings	50'-150'	Plant fossils collected from base of succession near Forest Home Station suggest a Lower Jurassic-Cretaceous age.
	Croydon "Felsite"	Rhyolite, quartz, porphyry, felsite and some granite porphyry. Generally graphite bearing.	Basin structure with dips up to 45° towards centre.	1,000'+	Rhyolite and quartz porphyry occur as a hood to the granite porphyry on eastern side of Gregory Range.
Upper Palaeozoic (Undifferentiated)	Newcastle Range Volcanics	Rhyolite, agglomerate with lenses of limestone, arkose and conglomerate at base	Basin structure with dips up to 40°. Dykes.	3,000'	Basal sediments unconformably overlie Forsayth Batholith in east, overlain by seven thick, undifferentiated porphyritic rhyolite flows associated with tuffs and volcanic breccia. Mass let down along ring fractures (caldron subsidence) and intruded by granite.
	Bagstowe Ring Dyke Complex	Quartz-feldspar porphyry, granite porphyry & some rhyolite.	Probably basin	?	Intrudes the Forsayth Batholith.
Permo-Carboniferous	Agate Creek Volcanics	Rhyolite, agglomerate, tuff, amygdaloidal basalt with some shale and quartz greywacke.	Dips up to 30°.	4,000' max.	Sediments at top and base of volcanics contain Permo-Carboniferous plants.
	Cumberland Range Volcanics	Rhyolite, agglomerate, quartz porphyry with thin basal shale.	Basin structure with dips up to 30°.	500' to 1000'	Intrudes the Forsayth Batholith near its intrusive contact with the Etheridge Formation. Basal shale contains Permo-Carboniferous plants.
	Feather Bed Range "Porphyries"	Quartz porphyry, rhyolite and granite porphyry.	Not known	-	Overlain by Permo-Carboniferous coal measures of Mt. Mulligan. Probably similar in age to Agate Creek Volcanics.
	Oweenee Granite	Coarse grained pink granite, generally pegmatitic with some fine grained porphyritic types at higher levels.	Strongly jointed.	Crops out over about 35 sq. m. eastern edge of Clarke River sheet.	Intrudes Perry Creek Formation and associated porphyritic phase intruded Clarke River Formation and Emu Creek Diorite.
	Emu Creek Diorite	Coarse grained diorite.	Occupies core of small fold in Clarke River Fm.	Crops out over about 4 sq. m.	Intrudes Clarke River Formation. Intruded by porphyry of Oweenee Granite.
Lower Carboniferous	Clarke River Formation	Quartz-jasper conglomerate, quartz greywacke, siltstone, greywacke conglomerate with lenses of limestone, calcareous siltstone and sandstone, and some tuff and rhyolite.	Elongate basins trending N-S or N.E.-S.W. Moderately folded with strong faulting. Dips average 40°.	5,000 to 7,500'?	Unconformably overlies Siluro-Devonian succession. Western and Northern boundaries are faulted. Marine beds crop out near base of freshwater beds containing Lepidodendron and Rhacopteris plants. Upper limit of sedimentation is probably Middle Carboniferous.
	Gowrie Conglomerate	Pebble to boulder greywacke conglomerate.	Massive, little or no bedding. Typical "Valley fill" deposit.	50' max.	Irregularly distributed over land surface at Perry Creek Formation and Tribute Hills Formation (Siluro-Devonian).

AGE	ROCK UNIT	LITHOLOGY	STRUCTURE	THICKNESS	RELATIONSHIPS AND REMARKS
	Gilberton Formation	Arkose, conglomerate ferruginous shale.	Gently folded. Dips up to 30°.	200' to 500'	Unconformably overlies Bernecker Creek Formation. Beds contain Leptophloeum plants and antiarchan fish remains.
Orogeny	Gray Creek Complex. Boiler Gully Complex.	Serpentine, dunite, pyroxenite, gabbro, diorite and amphibolite xenoliths.	Elongate mass about 15 miles long and 4 miles wide (max.).	-	Intrudes Siluro-Devonian succession. Differentiation of base magma at shallow depth and intrusion of differentiates due to compression in the Upper Devonian orogeny.
	Dumbano Granite	Coarse porphyritic types predominate. Numerous pegmatites and quartz veins.		Crops out over 600 sq. m. on S. part of Clarke River.	Intrudes the Bundock Creek Formation (Upper Devonian).
	Craigie Granodiorite	Medium grained hornblende granodiorite.		Elongate mass about 1 sq. m. in area.	Intrudes the Broken River Formation (Siluro-Devonian) in Broken River. It may be a contaminated portion of the Gregory River Granite.
	Dido Granodiorite	Massive to porphyritic, coarse grained hornblende granodiorite with some muscovite phase.		Crops out over an area of about 800 sq. m.	Intrudes the Lucky Creek Mt. Moran Formations. Probably a part of the Forsayth Batholith. Faulted against the Bundock Formation (Upper Devonian) to the south.
Upper Devonian	Bundock Creek Formation	Quartz greywacke quartz siltstone shale with lenses of pebble conglomerate and limestone.	Board fills with some basin structures. Dips up to 60°, generally 45°.	20,000'+ ?	Mainly freshwater sediment conformably overlying (with some interfingering) the Broken River Formation. Contains thin marine intercalations at base. Intruded by quartz porphyry masses. Appears to extend into Lower Carboniferous.
	Broken River Formation	Limestone, quartz greywacke, siltstone, shale, lenses of pebble conglomerate calcareous siltstone.	Board to tight folds with dips generally 60-70° with some overturned beds. Trend N.N.E.	30,000'+ ?	Limestone beds range in age from Upper Silurian to Middle Devonian, containing abundant coral fauna with some brachiopods. The limestone beds range in thickness from 6" to about 3,500' and are generally well bedded with little to no jointing and silicification. Conformably overlies and grades into the Graveyard Creek Formation.
	A - J Limestone Lenses	Massive to bedded coralline limestones.	Broad to tight folds with dips up to 90°.	Variable	Age from Upper Silurian to Middle Devonian.
	Graveyard Creek Formation	Greywacke, greywacke conglomerate, greywacke siltstone with some quartz greywacke and lenses of limestone.	Tight anticlines and synclines. Dips up to 85° and overturned in some structures.	8,000' to 12,000'	Dominantly a greywacke facies deposited in a trough immediately east of the Bauhinia Creek landmass. Conformably overlies and in part interfingers with the Perry Creek Formation and Paddys Creek Formation, and conformably underlies and grades into the Broken River Formation. Coral bearing limestone near base of succession suggests sedimentation commenced in Upper Ordovician or Lower Silurian times.
	Crooked Creek Conglomerate Member	Cobble to boulder greywacke conglomerate containing pebbles of gabbro, amphibolite, porphyry, schist and serpentine.	As for Graveyard Creek Formation. Exposed in a tight syncline between Gray Creek Complex and Bauhinia Creek Metamorphics.	Extremely variable. 500'-3,000'	Provenance is Bauhinia Creek Metamorphics with associated gabbro, amphibolite, serpentine and granite. Pebbles vary from boulder to pebble size away from provenance.
	Everetts Creek Volcanics	Basalt, agglomerate, porphyry with some greywacke.	Syncline immediately east of Gray Creek Complex. Dips steep Sill, dyke and flows. Graded bedding in greywacke.	Up to 3,000'	Conformably overlies and in part interfingers with the Carriers Well Limestone (Silurian) and the Perry Creek Formation. Conformably underlies and in part equivalent to the Graveyard Creek Formation.

AGE	ROCK UNIT	LITHOLOGY	STRUCTURE	THICKNESS	RELATIONSHIPS AND REMARKS
Siluro-Devonian	Perry Creek Formation	Quartz sandstone, siltstone, shale with some quartz greywacke, calcareous siltstone, jasper, conglomerate, sedimentary breccia and limestone, and rare rhyolite & porphyry.	Tight folds with steep to vertical dips, with intense shearing. Trend arcuate from NE-SW to N-S. Sandstone and siltstone frequently crossbedded.	Unknown. Probably 10,000'+	Conformably below and in part interfingers with Crooked Creek Conglomerate, Carriers Well Limestone, Everetts Creek Volcanics and Broken River Formation. Conformably with phyllite of Paddys Creek Formation.
	Four Mile Creek Formation	Quartz greywacke, greywacke conglomerate, some greywacke, limestone conglomerate and limestone. Rare red quartz siltstone.	Tightly folded with steep dips. Trend arcuate from E-W to N-S.	Variable possibly 5,000' max.	Considered to be a facies varient of the Perry Creek Formation.
	Tribute Hills Formation	Quartz siltstone, quartz greywacke, quartz sandstone.	Tightly folded with dips between 60° and vertical Trend N.E.-S.W. Regional dip to N.W.	3,500' to 5,000'?	Conformable with and interfingers with the Perry Creek Formation. Probably equivalent to the beds in the Pelican Range area.
Silurian	Carriers Well Limestone	Quartz greywacke, siltstone, calcareous siltstone, calcareous sandstone, chert breccia, feldspathic sandstone and lenticular biohermal and oolitic limestones.	Western limb of syncline immediately east of Gray Creek Complex. Shearing common. Dips vertical.	2,000' (limestone lenses up to 1,000')	Conformably underlies the Everetts Creek Volcanics and conformably overlies, with some interfingering, the Perry Creek Formation. Crops out on eastern margin of the Gray Creek Complex.
	Differential uplift of Bauhinia Creek Metamorphics and associated granite and Sandalwood Serpentine. Intrusion and extrusion of basalts along the line of the Gray Creek Complex causing deposition of the Everetts Creek Volcanics.				
Lower Palaeozoic ? (Pre-Silurian)	Paddys Creek Formation	Quartz siltstone, quartz sandstone with some quartzite and phyllite.	Broad folds with shallow pitch. Dips from 20-60°. Trend N.N.E.	1,000' to 3,000'	Conformably overlies and interfingers with the Lucky Creek Formation. Overlaps Halls Reward and Stenhouse Creek Metamorphics (Precambrian?) and possibly interfingers with Perry Creek Formation (Siluro-Devonian).
	Lucky Creek Formation	Calcareous greywacke, limestone, calcareous siltstone, calcarenite with locally metamorphosed calcilicate hornfels & marble.	Tight to broad folds with shallow pitch. Trend N.N.E.	101000'+	Conformably underlies and interfingers with the Paddys Creek Formation. Conformably with and grades to the west into the Bernecker Creek Formation. Intruded by granite.
	Bernecker Formation	Calcareous sandstone, calcareous siltstone with lenses of impure limestone locally metamorphosed to hornblende-epidote plagioclase gneiss and marble.	Broad folds. Regional trend is arcuate from N.E. to E-W. Calcareous sandstone generally crossbedded.	10,000' to 16,000'	Grades into the Lucky Creek Formation. Considered to be a more arenaceous facies of the Lucky Creek Formation. Intruded by granite.
(?) Precambrian orogeny with regional metamorphism. In the Halls Reward and Bauhinia Creek areas this was followed by intrusion of the Sandalwood Serpentinite and then by emplacement of post-kinematic muscovite granite.					

AGE	ROCK UNIT	LITHOLOGY	STRUCTURE	THICKNESS	RELATIONSHIPS AND REMARKS
Precambrian or Lower Palaeozoic	Etheridge Formation	Quartz, siltstone, shale, fine grained quartz sandstone, carbonaceous siltstone and chert.	Broad to tight folds which pitch west and north-west, Dips 50-70°. Trend is arcuate from N-S to E.W.	15,000'	Interfingers with quartzite of Einasleigh Metamorphics along its eastern boundary. Relationship with Bernecker Creek Formation is unknown. Intruded by granite to form andalusite hornfels.
	Langdon River Member	Greywacke siltstone, shale with some quartz greywacke lenses.	Tight folds. Pitch about 30° to the north. Trend N-S to N.N.W.	5,000' to 10,000'	Conformably overlies and interfingers with the Stockyard Creek Siltstone Member and the Etheridge Formation.
	Stockyard Creek Siltstone Member	Carbonaceous siltstone, generally containing pyrite.	Dips up to 60°. Trends arcuate from N-S to E.W.	50' - 300'.	Crops out as lenses towards the top of the Etheridge Formation and below the Langdon River Member, and interfingers with chert of the Etheridge Formation.
	Einasleigh Metamorphics	Quartz-mica schist, quartzite, garnet schist, migmatite and amphibolite.	Moderate folds. Dips 50-70°. Trend arcuate E-W to N-S.	5,000' to 7,000'	Quartzite and quartz-mica schist beds interfinger with phyllite and black quartz siltstone of Etheridge Formation. Regionally metamorphosed and intruded by the Forsayth Batholith.
Precambrian	Dargalong Metamorphics	Mica-, andalusite-, garnet schists, with quartzite.	Moderate folds. Dips 50-70°. Trend E-W to N.E.	5,000'?	Exposed as roof pendants west of the Chillagoe Beds (Siluro-Devonian). Probably unconformably below the Chillagoe Beds.
	Hall's Reward Metamorphics	Quartz-mica schist, quartzite, mica schist garnet-mica schist with some migmatite.	Tightly folded and sheared. Steep dips up to 90°. Minor folds plunge very steeply.	Unknown 3,000'?	Probably conformably overlies the Stenhouse Creek Amphibolite. Intruded by serpentine, gabbro and granite. Unconformably underlie phyllite of the Paddys Creek and Perry Creek Formation.
	Stenhouse Creek Amphibolite	Impure banded amphibolite and granulite usually containing diopside, clinozoisite, epidote, plagioclase (saussuritized) and hornblende or actinolite, with lenses of impure marble.	Tightly folded. Steep dips up to 90°.	Unknown. 3,000?	Probably underlies and interfingers with Moores Creek Metamorphics. Metamorphics belong to the top of albite-epidote amphibolite facies. Intruded by gabbro and serpentinite of Sandalwood Serpentinite.
	Bauhinia Creek Metamorphics	Quartz mica schist, hornblende hornfels quartzite and phyllite.	Moderately folded with steep dips of 70-80°.	?	Unconformably below the Crooked Creek Conglomerate Member (Siluro-Devonian) and part of the provenance for the conglomerate. Intruded by granite, serpentinite and gabbro. Probably a part of the Halls Reward Metamorphics.

Detailed mapping in 1957 of the boundary between the Precambrian and Palaeozoic successions in the Hall's Reward Mine and Gray Creek areas has shown that some of the 1956 conclusions need revision. It now appears probably that part of the deposition of the Paddys Creek Formation (White and Hughes, 1957) on the shelf zone of the Georgetown Geosyncline was continuous in time with part of the sedimentation in the Palaeozoic Tasman Geosyncline. Also the granite in the Gregory Springs area was shown to intrude the Palaeozoic succession. This, therefore, is further evidence to suggest that some of the sedimentation in the Georgetown Geosyncline took place in Palaeozoic time.

The Precambrian(?) rocks in the area are now considered to be confined to a narrow belt which trends south-southwest from the Hall's Reward Mine area for about 20 miles to the Bauhinia Creek area. Here the Precambrian(?) metamorphics formed a provenance along their eastern margin for a thick pile of greywacke, the deposition of which commenced probably in Lower Silurian time. Contemporaneous with this greywacke sedimentation was a period of basic vulcanism, with intermittent coral reef formation. Farther south, in the Pandanus Creek and Broken River areas, the Silurian sequence is conformable with a thick marine sequence which ranges up to the Middle Devonian. Along its western margin the Siluro-Devonian sequence is conformably overlain by a freshwater sequence of Upper Devonian age.

In the eastern part of the area a sequence of mainly freshwater sediments of Carboniferous age unconformably overlies and is faulted against the Siluro-Devonian sediments.

Cainozoic basalt and laterite deposits unconformably overlie the Palaeozoic sediments in the central and southern parts of the area.

Ultrabasic and basic igneous rocks are intruded along the western margin of the Siluro-Devonian succession. Two ages of intrusion can be recognized. Granitic rocks intrude Precambrian and Palaeozoic successions. Other igneous rocks in the area include porphyry and rhyolite which were probably emplaced in Permo-Carboniferous time.

Table I shows the stratigraphical succession of rock types recognized in the area mapped together with their relationship with the units recognized in 1956.

PRECAMBRIAN

Previous geologists, including Jensen (1920), Bryan (1925) and Jones (1948) considered the rocks of the Etheridge Goldfield to be of Precambrian age. These conclusions were based mainly on grade of metamorphism compared with other known Precambrian and Palaeozoic sequences. The complete absence of fossils in the Etheridge Goldfield supports the view that the age for most of the strata is Precambrian.

White and Hughes (1957) correlated the metamorphics in the Hall's Reward Mine area with the schist, quartzite and calc-silicate metamorphics in the Paddys Creek and Lucky Creek areas and considered that they were of Precambrian age. However from the 1957 detailed mapping of this area (White, Branch and Green, 1958) it now appears probable that the

metamorphics of the Hall's Reward Mine area are the oldest rocks of the area and they they form a structural and metamorphic unit distinct from the metamorphics of the Paddys Creek and Lucky Creek areas. The metamorphics of the Hall's Reward Mine area are unconformably overlain along their southern margin by lower grade metamorphics, which are identical with the metamorphics of the Paddys Creek area and which appear to grade into sediments of Siluro-Devonian age. The metamorphics of the Hall's Reward Mine area are therefore regarded as probably Precambrian.

The Precambrian(?) metamorphics form a linear belt which crops out from about 4 miles north of the Hall's Reward Mine and extends south-south-west across the Burdekin River for about 25 miles to the Bauhinia Creek area, where they pass under Tertiary laterite and soil cover. The foliated granitic gneiss exposed about 8 miles south-east of Lyndhurst Station (White and Hughes, 1957) is probably the southernmost extension of the Precambrian rocks.

The Precambrian metamorphics are intruded by granite, serpentinite and gabbro.

The Precambrian consist of the following rock units:

Stenhouse Creek Amphibolite

The Stenhouse Creek Amphibolite consists of a banded amphibolite which contains hornblende and saussuritized plagioclase, with narrow bands and lenses of diopside, clinozoisite and epidote. The hornblende is orientated and generally alternates with layers of feldspar. In some places the amphibolite contains lenses of impure marble and other calc-silicate metamorphics.

The Stenhouse Creek Amphibolite is named from Stenhouse Creek, which joins the Burdekin River at longitude 145°28'E and latitude 18°57'S (Plate 2).

The thickness of the Stenhouse Creek formation is difficult to determine owing to the tight folding and shearing. It probably does not exceed 3,000'.

The Stenhouse Creek Amphibolite has been regionally metamorphosed to the top of the albite-epidote amphibolite metamorphic facies (Turner and Verhoogen, 1951).

Specimen No. 2113A, exposed in Stenhouse Creek, is typical of the Stenhouse Creek Amphibolite. This specimen is grey, fine grained, schistose and consists mainly of amphibole. The thin section shows that the rock is made up almost entirely of actinolite (65%) and saussuritized plagioclase (35%). Quartz is a rare accessory. The c-axes of most of the actinolite crystals show a marked parallelism, but have almost random directions within the plane of schistosity.

Specimens No. M1a and M1b, exposed on the footwall of the Hall's Reward Mine at the 150 feet level, are varieties of the Stenhouse Creek Amphibolite. Specimen M1a is a massive, fine-grained, dark green rock containing needles (0.55 mm.) of "actinolite" apparently in random orientation. Small patches or veinlets of quartz and veinlets of a dark mineral are present. In thin section the rock is granoblastic and consists of anhedral to subhedral epidote and blue-green

hornblende in about equal proportions, with accessory quartz, plagioclase, calcite, and chlorite. The hornblende averages about 0.1 mm. in length; the epidote is finer-grained, averaging about 0.05 mm. The hornblende and epidote each form between about 40% and 60% of the rock. Hornblende crystals show a poorly developed dimensional and crystallographic orientation. Quartz occurs as small interstitial grains, which are generally clear and devoid of strain features. Calcite is present as small veinlets and irregular patches. Plagioclase feldspar (andesine-labradorite, Ab_{50}) is rarely twinned and forms small clear grains. A very dark green chlorite occurs in small veinlets and irregular patches as a joint filling. Specimen M1b differs from M1a in that it contains albite (Ab_{92}) instead of andesine-labradorite (Ab_{50}).

The main area of outcrop of the Stenhouse Creek Amphibolite is in the Hall's Reward Mine area. Here it is exposed in a linear belt extending from Copper Creek to a point about 5 miles south of the mine. In this area it lenses out and interfingers with the schist and quartzite of the Hall's Reward Metamorphics. Some Stenhouse Creek Amphibolite possibly crops out farther south in the linear gabbro belt shown in Plate 2.

Hall's Reward Metamorphics

A sequence of mica schist, quartz-mica schist, garnet-mica schist, quartzite and migmatite crop out in the Hall's Reward area in a broad belt about 8 miles long and 3 miles wide. They extend for about 3 miles north of the Burdekin River and for about 5 miles south of the mine. The sequence is well exposed in Moores Creek (Plate 2). The metamorphics are intensely veined with quartz and pegmatite; they are generally ptygmatically folded where they occur in migmatite. Large area of migmatite, interbedded with schist, are exposed in the core of a major syncline in Moores Creek. All gradations between the two rock types can be recognized.

The metamorphics are named from the Hall's Reward Copper Mine, located at longitude 144°59'E and latitude 18°55'S, where they form the hanging wall of the copper lode. Here they are unconformably overlain by phyllite of the Paddys Creek Formation and the Perry Creek Formation of Palaeozoic age.

The Hall's Reward Metamorphics conformably overlie and interfinger with the Stenhouse Creek Amphibolite.

Bauhinia Creek Metamorphics

This unit consists of quartz-mica schist, with some quartzite, which crops out in Dinner Creek and for 3 miles to the south in the Bauhinia Creek area. The metamorphics are named from Bauhinia Creek, which flows into Crooked Creek at longitude 144°51'E, latitude 19°7'S.

The Bauhinia Creek Metamorphics generally have a well developed axial plane foliation with a north/south trend and a near vertical dip; in the contact aureole around small intrusive granite stocks, this foliation is very contorted and the metamorphics contain quartz pods.

A roof pendant of metamorphics, about one square mile in area, is exposed in granite in the Bauhinia Creek area. These metamorphics consist of hornblende-quartz and biotite-quartz hornfels, with some quartzite and a lens of silicified limestone, and probably are part of the Bauhinia Creek Metamorphics.

The Bauhinia Creek Metamorphics are intruded by a muscovite granite stock and associated apophyses of probable Precambrian age. In the northern part of its outcrop the metamorphics are intruded by gabbro and serpentine.

The relationship between the Bauhinia Creek Metamorphics and the Paddys Creek Formation along its western margin is not known. Paddys Creek Formation probably unconformably overlaps the metamorphics. Along their eastern margin the metamorphics are unconformably overlain by the Graveyard Creek Formation of Siluro-Devonian age. Boulders derived from the Bauhinia Creek Metamorphics are found in the Crooked Creek Conglomerate.

PALAEOZOIC

LOWER PALAEOZOIC(?)

A sequence of unfossiliferous sediments and metamorphics consisting mainly of impure calcareous lutite, arenite, calc-silicate hornfels and marble crop out in the western part of the area.

The age of this sequence is not precisely known but, as described elsewhere (White, Branch and Green, 1958), in the Hall's Reward Mine area its deposition is considered to have been possibly continuous with, and older than, the main Siluro-Devonian sedimentation. Hence a Lower Palaeozoic age is suggested for the succession, which includes the Lucky Creek, Paddys Creek and Bernecker Formations of White and Hughes (1957).

The western limit of the Lower Palaeozoic succession is not known. White and Hughes (1957) suggested a possible unconformity between the Mt. Moran Formation and the Einasleigh Metamorphics in the south-western part of the Georgetown Four Mile Sheet. If this is correct the Etheridge Group and Einasleigh Metamorphics (White and Hughes, 1957) could be Precambrian in age. However a reconnaissance survey carried out in 1957 between the Robertson and Gilbert Rivers suggests that the Etheridge Group is conformably underlain by impure calcareous beds which are probably continuous with the Bernecker Formation. If this is substantiated by the 1958 mapping it would suggest that the Etheridge Group and the Einasleigh Metamorphics are of Lower Palaeozoic age.

Paddys Creek Formation

This has been described by White and Hughes (1957) as the "Paddys Creek Metamorphics" from the Paddys Creek area, where quartz schist, phyllite, with some sandstone and siltstone, are exposed. However, White and Hughes (1957) included the schists and quartzite of the Hall's Reward area in the "Paddys Creek Metamorphics". These are now regarded as an older sequence of higher grade metamorphics and part of the Hall's Reward Metamorphics of Precambrian(?) age.

Along its western and southern margins the Paddys Creek Formation conformably overlies and interfingers with the Lucky Creek Formation. Along its eastern margin it is faulted against the Hall's Reward Metamorphics and gabbro of the Boiler Gully complex. The quartz phyllite exposed in a small basin about 5 miles south-south-west of the Hall's Reward Mine is considered to be part of the Paddys Creek Formation.

Here a structural and metamorphic unconformity is exposed between the phyllite of the Paddys Creek Formation and the metamorphics of the Stenhouse Creek Amphibolite and Moores Creek Metamorphics. Moreover this phyllite is conformable along its eastern margin with fossiliferous sediments of the Perry Creek Formation, of Siluro-Devonian age. For these reasons the Paddys Creek Formation is considered to be of Lower Palaeozoic age.

Lucky Creek Formation

This has been described by White and Hughes (1957). However in this Formation they included the amphibolite of the Hall's Reward Mine area, which is now considered to be an older sequence, the Stenhouse Creek Amphibolite (White, Branch, and Green, 1958). Nothing can be added to the previous knowledge of the Lucky Creek Formation as outlined by White and Hughes (1957).

The impure calcareous beds of the Lucky Creek Formation are locally contact metamorphosed along their western margin to calc-silicate hornfels. Still farther west, near the junction of the Hann Highway and the Ninety Mile track, these metamorphics interfinger with the calc silicate hornfels and marble of the Bernecker Formation (White and Hughes, 1957).

Bernecker Formation

Little mapping of this formation was carried out in 1957, except along its eastern margin where it is in contact with the Lucky Creek Formation. Here a 1,000 feet thick bed of marble was located in banded calc-silicate hornfels of the Bernecker Formation. The formation has been described as the Mt. Moran Formation by White and Hughes (1957).

Some regional mapping was carried out in the Ortona Copper Mine area, which White and Hughes (1957) described as the western edge of the Bernecker Formation. At Ortona crossbedded calcilutite is interbedded with shale and intruded by dolerite. Farther north the calcareous sediments are more impure and crop out as "tombstones", which resemble the outcrops of calcareous greywacke of the Lucky Creek Formation. In this area the impure calcareous sediments are interbedded with abundant shale. These sediments probably [illegible] north to the Robertson River, where they are less [illegible]s and probably conformably underlie the Etheridge [illegible]te and Hughes, 1957).

SILURO-DEVONIAN

Fossiliferous sediments of Siluro-Devonian age crop out east of the Precambrian(?) and Lower Palaeozoic metamorphics in the Gray Creek (Plate 2), Broken River (Plates 3, 4 and 5) and Perry Creek areas (Plate 6). Little mapping was carried out in these areas in 1956, but in the 1957 survey detailed mapping of the formations was commenced. The survey is grateful to Dr. D. Hill, University of Queensland, for her determinations of the coral faunas collected from the limestones throughout the sequence (Appendix 1).

The mapping to date has shown that in this area sedimentation was continuous from at least the Lower Silurian, and possible Upper Ordovician, to the Lower

Carboniferous (Tournaisian). Marine sedimentation continued until near the end of the Middle Devonian after which deposition was mainly in freshwater.

The Siluro-Devonian succession consists of eugeosynclinal trough deposits of greywacke and basic volcanics along its western margin in the Gray Creek area (Plate 2), which conformably underlie and grade into better sorted clastics and thick limestone reefs to the south in the Broken River area (Plates 3, 4 and 5) and grade into impure siltstone and sandstone, with some conglomerate and limestone to the east, in the Perry Creek and Blue Range areas (Plate 6).

To the east the Siluro-Devonian succession is partly faulted against, and partly unconformably overlain by, Carboniferous freshwater sediments. The succession has been intruded by basic and ultrabasic rocks of the Gray Creek Complex, the Boiler Gully Complex in the Gray Creek area (Green, 1958), and intruded by granitic rocks in the Gregory Springs and Clarke River areas to the south.

The following rock units have been recognized in the Siluro-Devonian succession in this area:

Carriers Well Formation

The Carriers Well Formation consists of red and green fine-grained chert breccia and conglomerate, calcareous, greywacke, calcareous siltstone and sandstone, with some quartz greywacke and quartz greywacke siltstone, and lenses of feldspathic sandstone. It also contains limestone lenses; some are biohermal and richly fossiliferous, but generally they consist of massive, rarely oolitic, and non fossiliferous limestone. Preliminary examination of the corals from localities G.C.D.1 and 2 (Plate 2 and Appendix 1) by Dr. D. Hill suggest a Lower Silurian or possibly Upper Ordovician age for the limestone. The formation ranges from about 1,000 feet to 2,000 feet thick.

It crops out in the neighbourhood of Gray Creek (Plate 2) and immediately east of the Grey Creek Complex. The sediments are well exposed in Spring Creek and to the south near Carriers Well, from which the Formation is named.

The Carriers Well Formation in part conformably overlies the Perry Creek Formation and underlies the Everetts Creek Volcanics. The Formation lenses out into the Perry Creek Formation and to the south probably interfingers with the Graveyard Creek Formation and the Everetts Creek Volcanics.

Along the contact with the Gray Creek Complex the ell Formation is metamorphosed to calcareous and biotite schists, which are generally veined with calcite. Shearing is common within the Formation and has produced mylonitic rocks in which lenses and fragments of more competent beds occur in a sheared matrix of quartz greywacke siltstone.

The Silurian fossiliferous limestone (G.C.D.2168, Plate 2) about 4 miles east of the Gray Creek Complex is possibly equivalent to the limestone of the Carriers Well Formation. The two localities are separated by the overlying Carboniferous Clarke River Formation. The interbedded quartz greywacke at this locality is possibly part of the Carriers Well Formation.

Everetts Creek Volcanics

Basic volcanics crop out along the eastern margin of the Gray Creek Complex. They are well exposed in Everetts Creek,

which joins Gray Creek about 15 miles south-south-west of the Hall's Reward Mine (Plate 2).

The Everetts Creek Volcanics consist mainly of albitized basalt (spilite) and basaltic agglomerate with some greywacke and tuff. The greywacke, which displays graded bedding, is restricted to the top of the sequence and probably indicates a transitional into the greywacke of the Graveyard Creek Formation. The thickness of the Everetts Creek Volcanics is difficult to estimate owing to folding and faulting, but it probably does not exceed 3,000 feet.

The Everetts Creek Volcanics conformably overlie the Carriers Well Formation. South of the Gray Creek Complex the volcanics conformably underlie and interfinger with the Graveyard Creek Formation. Near Spring Creek the volcanics are unconformably overlain by the Carboniferous Clarke River Formation. As the volcanics conformably overlie the limestone of Carriers Well Formation their age is probably Silurian.

The basalt flows contain some small basaltic dykes and sills. The flows show no pillow structure. In one exposure 100 yards north of the junction of Dinner Creek and Gray Creek there is a sharp, chilled, contact between two flows. The contact suggests rapid cooling, following sub-aerial extrusion.

Intermediate volcanics crop out below the Graveyard Creek Formation in a small area about 2 miles west of the Gray Creek Complex. These volcanics are separated by a shear zone from the Crooked Creek Conglomerate and a limestone of Lower Silurian of Upper Ordovician age (fossil locality G.C.D.3, Plate 2). The absence of volcanics between this area and the main outcrop of the Everetts Creek Volcanics suggest that it has a separate local source similar to the Everetts Creek Volcanics. This locality probably represents the western limit of the vulcanism of the Everetts Creek Volcanics.

Other isolated outcrops of basic volcanics are exposed along the southern margin of the Gray Creek Complex below the Crooked Creek Conglomerate and also 2 miles east of Gray Creek.

A number of specimens of the Everetts Creek Volcanics from near the junction of Gray Creek and Dinner Creek have been examined in thin section. Specimens No. 1688b and 1689 have a basaltic texture consisting of a matrix of albite laths with calcite, chlorite, epidote and possibly clinopyroxene. Flow developed around phenocrysts. Calcite-filled [illegible]e common. In 1688b there are patches of magnetite, [illegible]hlorite and a carbonate, which probably represent alteration products of pre-existing olivine phenocrysts. Some partly chloritized pigeonite phenocrysts are present. Interstitial iron ore granules increase markedly toward vesicle margins.

Specimen No. 1688a is from a fine-grained dyke including a basalt flow (1688b). This specimen contains euhedral albite laths with interstitial chlorite, epidote, quartz (?secondary), iron oxide grains and possibly some pyroxene. The rock is a fine grained, albitized quartz dolerite.

Specimen 1574c is a fragmentary rock with fragments of fine grained basalt or dolerite which contains feldspar phenocrysts. The fragments commonly have a fine grained rim,

probably of devitrified glass. The matrix consists of feldspar, calcite, iron oxide, chlorite and some quartz. The material is probably of explosive volcanic origin.

Graveyard Creek Formation

A greywacke sequence crops out in a linear belt between the Precambrian metamorphics and the Gray Creek Complex. (Plate 2). It consists of alternating 1" to 3" thick beds of greywacke, greywacke siltstone and greywacke conglomerate with graded bedding. The thickness ranges from about 5,000 feet along its eastern margin to 12,000 feet along its western margin.

North of Dinner Creek the Graveyard Creek Formation conformably overlies, with some interfingering, the Perry Creek Formation, and probably the Paddys Creek Formation. It conformably overlies and interfingers with the Everetts Creek Volcanics along its eastern margin. The Graveyard Creek Formation conformably underlies, and also grades into, the Broken River Formation in the neighbourhood of Pandanus Creek Station (Plate3).

The Formatio is named from Graveyard Creek which is a tributary of Gray Creek near the northern edge of Plate 3.

From fossil evidence (localities G.C.D.3; B.R.S.71, 72, 17 20; and 2104, Appendix I) it appears that the deposition of the Graveyard Creek Formation began in the Upper Ordovician or Lower Silurian, at about the same time as or closely following the extrusion of the Everetts Creek Volcanics, and continued farther south into Lower Devonian. The greywacke sedimentation was restricted to a narrow belt, the eastern margin of which did not extend much beyond Gray Creek. Here the greywacke sediments interfinger with cleaner clastics of the Perry Creek Formation of Upper Silurian or Lower Devonian age.

Crooked Creek Conglomerate Member

This is a greywacke conglomerate which crops out near the base of the Graveyard Creek Formation in Dinner, Crooked and Bauhinia Creek along its south-western margin (Plate 2). The thickness of the conglomerate ranges from about 500 feet to 3,000 feet.

The greywacke conglomerate ranges in grain size from boulder to pebble conglomerate. In Dinner Creek, Crooked Creek and Bauhinia Creek, and particularly along the margin of Ordovician Bauhinia Creek Metamorphics, the conglomerate contains boulders up to 4 feet in diameter. These boulders are granite, gabbro, amphibolite, serpentinite, gneiss, phyllite, quartzite and limestone (probably from the biohermal Lower Silurian or Ordovician limestone as at locality G.C.D.3 (Plate 2). The source of these boulders is the area of Bauhinia Creek Metamorphics and granite, serpentinite and gabbro intrusions exposed along the western margin of the conglomerate.

The Crooked Creek Conglomerate is a boulder conglomerate at its base and becomes progressively finer towards its top and farther away from the Precambrian basement. The conglomerate exposed along the western and southern margin of the GrayCreek Complex contains few basic boulders and is generally a cobble conglomerate containing micaceous quartzite, quartz-mica phyllite, quartz, and rare limestone boulders. The presence of large boulders of gabbro and amphibolite in a

south plunging anticline near Pandanus Creek Homestead suggests that the Precambrian provenance continued farther south-west to include the granitic gneiss and basic rocks about 6 miles south-south-east of Lyndhurst Homestead.

Basic and Ultrabasic Boulders in the Crooked Creek Conglomerate

The Crooked Creek Conglomerate, particularly in its coarser basal parts contains boulders of basic igneous and ultrabasic rocks. In the boulder conglomerate each outcrop shows a dominance of one particular rock type. This suggests erosion from a small adjacent source area.

A thin section examination has been made of a few of the boulders. Specimen 2161 was collected as a typical boulder of sheared gabbro, considered to have been derived from the sheared gabbro south of Dinner Creek. In thin section, it is an actinolite schist with elongate actinolite crystals which show excellent alignment and with interstitial areas of fine grained, indeterminate material (possibly prehnite?) secondary after feldspar. Commonly small veinlets of a coarse-fibre mineral (chalcedony or chrysotile?) occur marginally to the actinolite grains. These fibres are unstressed and are a late feature. Texturally the rock is identical to specimen C6b from the sheared gabbro south of Dinner Creek. There is a mineralogical difference in that 2161 does not contain albite and epidote, but only a very fine grained feldspar alteration product. Possibly 2161 is of a slightly lower metamorphic grade than C6b, but correlation between the two is justified.

Specimens 2149 and 2158 are boulders considered to be derived from serpentinite. The greater part of 2149 consists of fine-grained talc with rare cores of relict pyroxene, pseudomorphed by parallel laths of talc and magnetite dust with chlorite and rare tremolitic amphibole. Pale green, commonly euhedral garnet (granularite) is common. There are irregular patches containing a fine grained mineral with a low birefringence and low refractive index (1.54); these are probably areas of relict serpentine. Small colloform veinlets and irregular vugh like patches of chalcedonic and opaline silica are common and dolomite is present in some of the veinlets. Magnetite forms many irregular veinlets and patches, and brown chromite occurs in several anhedral, dendritic grains which have an identical form to the chromite occurring interstitially in the ultrabasic rocks. There is a poorly defined schistosity in hand specimen but this is not yet obvious in the thin section.

Section 2158 is very similar to 2149 but there has extensive addition of or replacement by (?)dolomite ated opaline silica. The silica fills irregular cracks. Relict pyroxene crystals are common and in some places are cut by irregular fracture, along which garnet crystals have grown.

From the thin section examination it is apparent that these rocks are thermally metamorphosed ultrabasics with later low temperature addition of dolomite and silica. The serpentine bodies south of Dinner Creek have been metamorphosed, with formations of antigorite, but no rocks containing garnet and talc have yet been observed. If, as seems probable, the granite post-dates the serpentinite bodies garnet-talc rocks could have been produced by contact metamorphism. There is little doubt that the altered ultrabasics present in the Crooked Creek Conglomerate were derived from the Sandalwood Serpentinite in the Bauhinia Creek area (Plate 2).

Perry Creek Formation

Sediments of the Perry Creek Formation occupy undulating to rugged country extending from Gray Creek east through Greenvale Station to Camel Creek and south to Gill Creek and Niall Station (Plates 2 & 6). The Formation consists essentially of quartz greywacke, siltstone, quartz sandstone and conglomerate, with minor small limestone lenses associated with limestone-chert conglomerate, and bedded jasper. Spheroidal rhyolite and quartz porphyry occur in the lower Camel Creek area interbedded with the sediments. The Perry Creek Formation generally gives rise to low topography and low relief in contrast with the rugged ranges formed by the Pelican Range Formation, the Four Mile Creek Formation and the Tribute Hills Formation. (See below).

The Formation is tentatively named Perry Creek, a tributary of the Burdekin River which it joins at Lat. 19°00'S, Long. 145°21'E. The formation is best exposed in Perry Creek. Jack (1887) mapped the sediments between Gray Creek and the Clarke River Telegraph Office as "Dotswood Beds" and similar sediments north of the Burdekin River were mapped by Maitland (1891) as "Burdekin Beds" of Middle Devonian age. Later the term "Kangaroo Hills Series" was applied to these sediments after Saint-Smith (1922) described similar rocks in the Kangaroo Hills district. On the Geological Map of Queensland (1953) the area is shown as part of the "Broken River Beds" of Siluro-Devonian age. It is likely that on further mapping in 1958 the Perry Creek Formation will be proved to be continuous with the "Kangaroo Hills Series", whereupon the name "Perry Creek Formation" will be redundant. For present purposes however it is considered advisable to consider the Perry Creek Formation as a separate unit.

The Perry Creek Formation is folded into a broad synclinorium which has a north-east axial trend; the axis passes through a point mid-way between Blue Range Station and Christmas Creek Outstation (Plate 6). Dips are steep to vertical and the bedding trend is arcuate from north/south to east-north-east/west-south-west.

Well bedded red jaspers are exposed at the main road crossing of Gray Creek; in Porphyry Creek, a mile upstream from its junction with McNeil's Creek; and also in New Chum Creek, 1¼ miles above its junction with Porphyry Creek. These beds average 2" to 3" in thickness. The origin of these jasper beds is not yet understood.

Westward from Charcoal Creek, a tributary of Christ- to Gray Creek, numerous ridges of quartz jasper op out. Many of these mark fault lines but others, which conform to the surrounding sediments, are less readily interpreted, in some places they are regarded as beds, in others as faults parallel to the bedding. These jaspers appear to be restricted to the western or lower portion of the Perry Creek Formation, where serpentinite intrudes the Formation. Some of the jaspers may be formed by the release of silica during serpentinization.

The siltstones and some of the finer sandstones of the Perry Creek Formation are grey-green, finely laminated, and current bedded. The greywacke is thin bedded and changes abruptly in grain size between silt and fine conglomerate. In the more siliceous portions bedding is conspicuous, with beds ranging from 2" - 4" up to 2' - 3' thick. Regular alternation from silts to quartz sandstones in narrow beds (average thickness 2") is common.

The exact age of the Perry Creek Formation is not known. Small isolated fossiliferous limestone lenses occurring along, or slightly above, the upper margin of the interbedded Four Mile Creek Formation and Tribute Hills Formation indicate an Upper Silurian or Lower Devonian age; the weight of evidence favours a Lower Devonian age. The Formation probably extends lower into the Silurian or possibly into the Ordovician in the Gray Creek area (Appendix 1).

Four fossiliferous beds have been recognized within the Perry Creek Formation. These limestones are conformably above the Tribute Hills and Four Mile Creek Formations.

(i) Small isolated limestone lenses interbedded with conglomerate and rare calcareous arenite crops out over a length of 1,500 feet and a width of 150 feet approximately 1 mile south of Tin Hut Yard, south of the Burdekin River, on Blue Range Station (Plate 6). The calcareous beds trend east-north-east and dip near vertical to the north-north-west. The limestone is poorly fossiliferous and is in places oolitic. The age suggested by the coral assemblage is Upper Silurian-Lower Devonian (Appendix 1).

(ii) Small lenses of limestone and interbedded greywacke conglomerate crop out discontinuously in Crooked Creek, over a length of 150 feet and a width of 30 to 60 feet, 1½ miles south-west of the Clarke River Telegraph Office. The limestone varies in colour and texture from a fine-grained, grey, bed to a coarse-grained, recrystallized, light-coloured, bed. The conglomerate is composed essentially of quartz, chert and limestone fragments in a quartz greywacke matrix and ranges in grain size from pebble to boulder conglomerate. The age, on coral evidence, is probably Upper Silurian-Lower Devonian (Appendix 1).

(iii) Massive, low-pinnacled, lenticular limestone is exposed 2½ miles south-west of the Clarke River Telegraph Office and 2 miles south-east of the junction of Maryvale Creek with the Clarke River. The limestone has an abundant coralline and stromatoporoid fauna suggesting a probable Upper Silurian-Lower Devonian age.

(iv) From 1¾ ti 2¼ miles south-south-west of Christmas Creek Outstation, on Blue Range Station, fine to medium-grained, grey, fossiliferous limestone outcrops discontinuously as low pinnacles. The limestone is poorly fossiliferous, but the fossil assemblage indicates a probable Upper Silurian-Lower
ge (Appendix 1).

Tribute Hills Formation

The sediments of the Tribute Hills Formation crop out as a north-east to south-west trending range of rugged hills in Tregaskis Parish, south of the Clarke River and the Burdekin River. The type section is in the headwaters of Crooked Creek which rises near Tribute Hills (Lat. 19°17'S, Long. 145°28'E) and flows north to the Clarke River. The Formation consists essentially of light brown to buff, impure (silty), quartz sandstone and quartz siltstone but grades into both orthoquartzite and quartz greywacke. The sediments are well bedded; beds range from one to two inches to several feet thick. Current bedding occurs in the upper beds of the Formation where regularly alternating current-bedded, impure, quartz arenite and grey, quartz greywacke siltstone occur as transition beds immediately below the Perry Creek Formation.

The formation is tightly folded; it has an east-north-east trend and a steep regional dip to the north-north-west. Jointing and fracturing are common.

Along its southern margin the Tribute Hills Formation is conformable with the Perry Creek Formation and along its northern boundary it is overlain by, and interfingers with, the Perry Creek Formation. To the west, near the junction of Gill Creek and the Clarke River, it is unconformably overlain by the Clarke River Formation of Carboniferous age. The thickness of the Tribute Hills Formation is also considerably less in this area than it is in the type section, possibly it thins out and/or interfingers with the Perry Creek Formation along strike to the south-west. Probably the Pelican Range Formation (see below) is the continuation of the Tribute Hills Formation to the north or, if the two formations are not contemporaneous and continuous under the Clarke River Formation they at least have the same superpositional relationship to adjoining units, and were deposited under similar conditions within a short period of each other.

Pelican Range Formation

The sediments of the Pelican Range Formation occupy the high country of the Pelican Range west of Greenvale Station, and extend south to the headwaters of Gill Creek where they are truncated by the down faulted Clarke River Formation of Carboniferous age. The type section is along the telegraph line from the headwaters of Scully's Creek, a tributary of Porphyry Creek, to Charcoal Creek, a tributary of Christmas Creek (i.e. from Lat. 19°3'45"S, Long. 145°8'24"E. to Lat. 19°5'26"S, Long. 145°11'30"E. approximately).

The lithology of the Pelican Range Formation is similar to that of the Tribute Hills Formation and the Pelican Range Formation is probably the northern extension of the Tribute Hills Formation. If this is the case then one of these two proposed names is redundant but for the moment it is preferred to retain the two until the relationship is definitely proved. When the Pelican Range Formation is traced farther to the north it may possibly prove to be part of the "Wairuna Beds" (Maitland, 1891).

The Formation is tightly folded with a probable major anticline in the Charcoal Creek area trending north-south. Trend of the Formation generally is north-south with steep dips ranging from 60° to 90°. Considerable faulting has also
n a north-south direction together with monoclinal
companied by faulting and shearing in east-north-east
the most important shear zone is between Christmas
Creek and the head of Scully's Creek.

Pelican Range Formation appears to be conformably underlain by the Perry Creek Formation although high angle oblique-slip faulting (Nevin, 1931) exists along both its upper and lower boundaries. The exact age of the Formation is unknown but it is younger than the Wallace's Well Formation (Silurian) and older than the limestone members lying above the Tribute Hills Formation and the Four Mile Creek Formation (Upper Silurian-Lower Devonian). The thickness is difficult to determine owing to the folding and lack of marker beds. The Formation probably has a minimum thickness of 3,000 feet and a maximum of at least 7,000 feet.

Four Mile Creek Formation

The sediments which form the narrow range of hills which trend south from the Burdekin River, near the junction of Perry Creek, to the headwaters of Four Mile Creek, thence south-east to the Clarke River are tentatively named the Four Mile Creek Formation. The type section is in the upper reaches of Four Mile Creek which joins the Clarke River about 5 miles west-south-west of the Clarke River Telegraph Office. Reference sections for the interbedded limestones are in Thatch Creek and Marble Creek.

The sediments of the Four Mile Creek Formation are coarse-grained compared with the normally fine-grained sediments of the Perry Creek Formation. The sediments consist of fine to coarse-grained, wellbedded, impure, quartz-conglomerate, quartz greywacke and limestone conglomerate, medium-grained quartz greywacke, and rare red quartz greywacke siltstone. The greywacke siltstone is more abundant north of Marble Creek than farther south. Limestone, interbedded with limestone conglomerate, occurs north of Thatch Creek, and also north of Marble Creek. The sediments appear to have been deposited in a shallow elongate basin; coarse sediments grade into finer grained sediments in the centre and along the northern and southern margins of the basin.

The formation is tightly folded, has an arctuate trend from north to north-west, and its strata dip from 60° to the east and north-east, to vertical.

The Four Mile Creek Formation is conformably underlain by the Perry Creek Formation but, to the south-east, interfingers with the Perry Creek Formation which itself interfingers with the Tribute Hills Formation some six miles farther to the south-east along the strike.

The thickness of the sediments is unknown but it probably reaches a maximum of 3,500 feet.

Massive limestone lenses with interbedded limestone-chert pebble conglomerate occur along the upper margin of the Four Mile Creek Formation. The larger lenses weather to typical pinnacle-shaped outcrops with extensive cave development. Fossil evidence, based mainly on the coral fauna (Appendix 1), suggests an Upper Silurian or Lower Devonian age. Two limestone beds have been recognized in the Four Mile Creek Formation. They are:

(i) Massive lenticular limestone, in which erosion has formed pinnacles and caves, is exposed north of Marble Creek, orth-west of Christmas Creek Outstation. The lens er a length of 1¼ miles and has a maximum width of

The limestone trends north and is interbedded with quartz siltstone and quartz greywacke; it dips steeply to the east. Its age ranges from Upper Silurian to Lower Devonian (Appendix 1).

(ii) Small limestone lenses and interbedded limestone-chert pebble conglomerate interbedded with impure quartz siltstone and sandstone crop out north of Thatch Creek, 2¼ miles west of Christmas Creek outstation. A smaller occurrence of these beds occurs ¾ mile further west. Trend of the sediment is north, with near-vertical dips. The limestone crops out discontinuously over a length of 1 mile, and has an average width of 50 feet.

Age ranges from Upper Silurian to Lower Devonian (Appendix 1).

Broken River Formation

(i) General. The Br ken River Formation consists of siltstone, sandstone and limestone, with minor amounts of conglomerate. These sediments crop out over about 150 sq. miles on the Clarke River 4-mile sheet and the Formation is named from the Broken River, a major tributary of the Clarke River.

(ii) Siltstones and Sandstones. The siltstones of the Broken River Formation are thin bedded quartz s.ltstones - no greywacke siltstones occur (c.f. Graveyard Creek Formation). They are micaceous in places, and are commonly interbedded with coarser sediments, which range in grainsize up to medium grained sandstone. The coarser beds are generally only a few inches thick. Excellent exposures of these sediments may be seen in the banks of the Broken River, west of the road crossing.

The siltstones are invariably dark grey when fresh; the slightly coarser beds are lighter in colour. Yellow and yellow-brown colours characterize weathered outcrops.

During orogenic deformation the siltstones were incompetant and were folded into numerous small, minor folds. Because of the generally poor siltstone outcrop, it is not possible to trace particular beds for any great distance. Numerous small faults also disrupt the sequence.

The siltstone sequence can thus be described as "crumpled" although this does not imply isoclinal folding.

Graded bedding is not found in the sediments of the Broken River Formation and current bedding is rare. In some areas (e.g. at Broken River road crossing) the siltstones are well cleaved; this gives rise to "pencils" of siltstone when they cut across the bedding at an acute angle.

Minor lenses of quartz pebble conglomerate occur in places but the most important conglomerate beds occur in the Broken River section.

(iii) Limestone. Limestone lenses constitute an important part of the Broken River Formation. They are generally thick and in most cases contain abundant, well-preserved, coral faunas. This enables the limestone lenses to be assigned definite ages, which range from Upper Silurian to Middle Devonian.

(iv) Type Section. At the beginning of the 1957 field season it was decided to try to measure a section through the Broken tion along the Broken River. It was thought that a uous, more complete, and less structurally disturbed ld be found here than in the Pandanus Creek area.

However, from later mapping it became obvious that the Pandanus Creek area section, despite its poorer outcrop and apparent complexity was, in fact, a more straight-forward one than that in the Broken River area.

Unfortunately there was not time to measure a second section in the Pandanus Creek area but approximate thicknesses have been estimated as a comparison with the Broken River section.

(a) Broken River Section

This section is complex. The core of the Bull Creek Anticline (Plate 3) is intruded by granodiorite and hence effects

the thickness measurements of sediments exposed in the anticline. Further the siltstones have been folded into such complex minor structures that their thickness cannot be accurately measured.

Stratigraphically higher up the section in the Broken River the structure is not clear and between the H Limestone Lens, near 6-mile Yard, and the base of the Bundock Creek Formation the siltstones have been folded into such complex minor structures that the major structure of the area cannot be worked out from them.

Unfortunately the limestone lenses do not crop out continuously, and hence the overall structure cannot be deduced from a study of these beds.

The only method available therefore for determining the sequence of the beds upsteam from the G Limestone Lens in the Broken River area is that of palaeontological dating, coupled with the obvious stratigraphic fact that the beds immediately adjoining the Bundock Creek Formation must be the youngest in the marine sequence of the Broken River Formation.

On palaeontological evidence the F, G, H and J Limestone Lenses and the various other limestone lenses that occur in the Broken River section between the top of Jack's Limestone Member and the base of the Bundock Creek Formation are all Middle Devonian.

Two alternative interpretations of the Devonian (as distinct from the Silurian) sequence in the Broken River section must be considered. Either an extremely thick, unrepeated Middle Devonian series of sediments is present or else the Middle Devonian sediments have been repeated several times by folding or faulting. The structural evidence suggests that the second interpretation is more likely to be correct.

The base of the Broken River Formation is not exposed in the Broken River area as the Formation has been faulted against the Clarke River Formation, of Carboniferous age, east of the Pandanus Creek-Wando Vale road crossing of the Broken River.

Considering all these factors the following section is regarded to be the most accurate assessment of the thickness of the Broken River Formation in the Broken River area:

Top — Passes conformably upwards into Bundock Creek Formation.

[illegible] of dark grey, fine-grained, thin bedded sandstone and siltstone, with some interbedded fine and medium-grained quartzite at the base.

5000(?) feet of thin-bedded, grey, siltstone and fine to medium-grained sandstone with prominent limestone lenses up to 1150 feet thick. The uppermost part of this unit consists of interbedded siltstone (with marine fossils) and quartzite (with plant fragments).

910 feet of thin bedded, poorly outcropping, grey siltstone.

910 feet of light grey, poorly-bedded limestone.

750 feet of thin-bedded, grey, siltstone and calcareous siltstone.

250 feet of light grey, poor-bedded limestone.

630 feet of grey siltstone

630 feet of interbedded quartz pebble conglomerate and thin-bedded, grey, siltstone. The conglomerate

also contains pebbles of quartzite and sandstone.

3500 feet of interbedded siltstone and fine to medium-grained sandstone, in places silicified to quartzite. Beds from several inches to several feet thick.

Lowest horizon exposed.

(b) Pandanus Creek Section

A type section for the Broken River Formation will be measured in the Pandanus Creek area during the 1958 field season.

Upper Silurian Limestone

Jack Limestone Member

This is named from Jack Hills after R. L. Jack, former Queensland Government Geologist, who in 1886 was the first to describe the Broken River limestones. Jack Limestone consists of three major lenses:

B Lens (Suj_B)*

This lens crops out near the headwaters of one of the major tributaries of Back Creek. Its outcrops delineate a synclinal and an anticlinal structure.

The limestone is grey and is up to about 960 feet thick. Fossils are not easily seen on the weathered surface but a collection of fossils of Upper Silurian age was obtained from a small gorge cut through the Member by the tributary of Back Creek.

The limestone cannot be traced continuously around the two structures mentioned but structure suggests that this Lens does, in fact, outline a syncline and an anticline.

The Fossil Collection from this Member is BRS26.

C Lens (Suj_C)

C Lens is the most persistent lens of the Jack Limestone Member. This lens crops out in a general north-easterly direction for a distance of 8 miles in the Broken River area. South of a point about 1 mile north of the Broken River the lens is divided into two parts by intercalated siltstones. The maximum thickness of the lens is 1910 feet.

The limestone is light grey, with poorly defined [illegible] dips steeply (almost vertically). It occurs on the north-western limb of a major anticlinal structure - the Bull Creek Anticline.

In the banks of the Broken River, immediately east of the western branch of C Lens, a remarkable occurrence of thin bedded, calcareous siltstone is exposed. The individual beds are 1-2" thick and almost every bed is tightly packed with fossil corals (Fossil Collections BRS8, BRS50).

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* The letter of each limestone lens is suffixed after the abbreviation of the formation: thus "Suj_B" refers to the B limestone lens of the Jack Limestone Member.

The Broken River cuts a small gorge through the western branch of Jack's Limestone Member.

Fossil Collections from C Lens are BRS7, BRS9 and BRS27.

D Lens (Suj_D)

The D Limestone Lens crops out over an area of 0.4 sq. miles and has a maximum thickness of at least 700 feet. It is a grey limestone, with poorly developed bedding. Fossils are present but not abundant.

The lens is folded into a small anticlinorium. It does not appear on structural evidence to occupy the same stratigraphic position as the C Limestone Lens although it lies on the south-eastern limb of the major anticlinal structure known as the Bull Creek Anticline. The outcrop of this Lens is limited along its eastern margin by overlying basalt.

At its norther extremity it is immediately underlain by fossiliferous, thin-bedded, calcareous siltstone similar to that occurring between the two branches of C Limestone Lens in the Broken River section.

Fossil Collections are BRS1, BRS2, BRS46 and BRS47.

Lower Devonian Limestone

A Lens ($D1b_A$)

This thick limestone lens occupies a lower stratigraphic position than the B Lens at Martin's Well, but fossils are not common in it and the material obtained is not sufficiently diagnostic to determine whether it should be assigned to the Lower Devonian or to the Upper Silurian.

The lens crops out near the headwaters of Magpie Creek as a prominent ridge of grey limestone, interbedded with some siltstone and sandstone; it is about 1,530 feet thick and 4 miles long.

The Fossil collection from A Lens is BRS20.

B Lens ($D1b_B$)

This limestone crops out as a persistent low ridge in the general area between Martin's Well and Lockup Well It outlines a large south-west plunging anticlinal synclinal nose to the west.

The greatest thickness of the B Limestone Lens is about 1010 feet and its total outcrop length is about 11½ miles. It is a grey limestone, with bedding planes obscure (perhaps largely because of the nature of the outcrop).

Abundant, well-preserved Lower Devonian corals are present in the lens and may be collected at Martin's Well, where coral colonies and individual corals have weathered out of the limestone and are scattered on the ground.

The trace of the lens in outcrop shows that the Magpie Creek Anticline has been modified by a synclinal buckel.

Fossil Collections are BRS37 and 10/5/5075 (1956).

Middle Devonian Limestone

A Lens (Dmb_A)

This major limestone lens crops out in Pandanus Creek, about $\frac{1}{4}$ mile west of Pandanus Creek Station. The road from Lyndhurst to Wando Vale traverses it for some $2\frac{1}{4}$ miles along strike.

The Lens does not consist entirely of limestone, but rather of predominant limestone interbedded with siltstone and sandstone. It crops out over a length of $6\frac{1}{4}$ miles and a width of up to $\frac{1}{2}$ mile. Some thickness (maximum) is 2,710 feet.

Fossil Collections are BRS35, BRS36, 1/5/5071 (1956), 5/4/5167 (1956) and 10/5/5073 (1956).

C Lens (Dmb_C)

The C limestone lens crops out over an area of nearly 8 square miles to the east of "Pandanus Creek" Homestead. It outlines the nose of a syncline and forms the nose of an anticlinal structure. It is thickest in the Martin's Well Syncline where it is about 1,690 feet thick. The thickness in the Magpie Creek Anticline cannot be determined.

The area of C limestone lens, as shown on Plate 3, includes numerous small discontinuous lenses of siltstone and fine-grained sandstone. Although the overall structure of the eastern part of the outcrop of this lens is anticlinal, in detail the structure is complex. Outcrops are not adequate to permit the mapping of the detailed structure, but some idea of its complexity can be gained from outcrops in the bed of a small creek north of the Pandanus Creek-Wando Vale road.

Owing to this complexity of structure most of the fossil collections from the lens cannot be placed in stratigraphic sequence but must be regarded as a composite collection. However Collection BRS38 is from the base of the lens and BRS39 is from the top.

Fossil Collections are BRS38, BRS24, 10/6/5117 (1956), 12/6/5117 (1956), 13/6/5117 (1956) and BRS39.

D Lens (Dmb_D)

This Lens crops out at Lockup Well (Plate 3) on the 'Pandanus Creek" Station to Basalt Well. The exposure ell is not very extensive but on palaeontological much larger belt of limestone farther west has been included in the unit.

The western belt has an outcrop length of 4 miles and a maximum thickness of 2,150 feet. Its eastern boundlary is partly obscured by overlying basalt (Plate 3).

The D Limestone Lens outlines part of a major syncline.

Fossil Collections are BRS21, BRS40, BRS22, BRS41 and BRS23.

E Lens (Dmb_E)

E Lens crops out over about 2½ square miles near Jessie Springs. The fairly large area of outcrop is due to complex folding. To the north the lens is masked by laterite. The shape of the outcrop suggests that it probably occurs in an area of pitch change with an anticline to the east.

E Limestone Lens consists almost entirely of light grey limestone with poorly developed bedding. It crops out in low relief country marked by thick scrub which in places is almost impenetrable.

Exact correlation with B Lens, near Lockup Well, cannot be established on structural grounds owing to laterite and basalt cover between the two lenses. However, on palaeontological grounds E Lens is correlated with B Lens and other associated small lenses.

Fossil Collections are BRS25 and BRS52.

F Lens (Dmb_F)

This limestone lens crops out over an area of 4¼ square miles near Dosey Creek, south of the Broken River. It outlines, in part, the major anticlinal structure named "Bull Creek Anticline", and is up to at least 1,150 feet thick.

As with most of the thick limestone units, this lens does not consist exclusively of limestone - beds of siltstone, sandstone, and quartz pebble conglomerate are interbedded with the limestone. A prominent conglomerate bed occurs near the south-western boundary of the outcrop.

Fossils were not collected from the lens itself but some very good collections were made in calcareous beds near the southern end of it.

G Lens (Dmb_G)

The G Lens crops out over a total length of almost 5 miles in the Broken River area. The maximum width of outcrop is 3,750 feet but the true thickness of the lens is not known because of structural complexity.

The lens can best be described as of interbedded limestone and siltstone, with limestone predominant. At the top and bottom of the lens the beds are only a few inches thick, but in the central portions limestone beds 5-10 ft. thick occur.

A small, tight syncline, plunging south at 80°, within the lens in the bed of the Broken River.

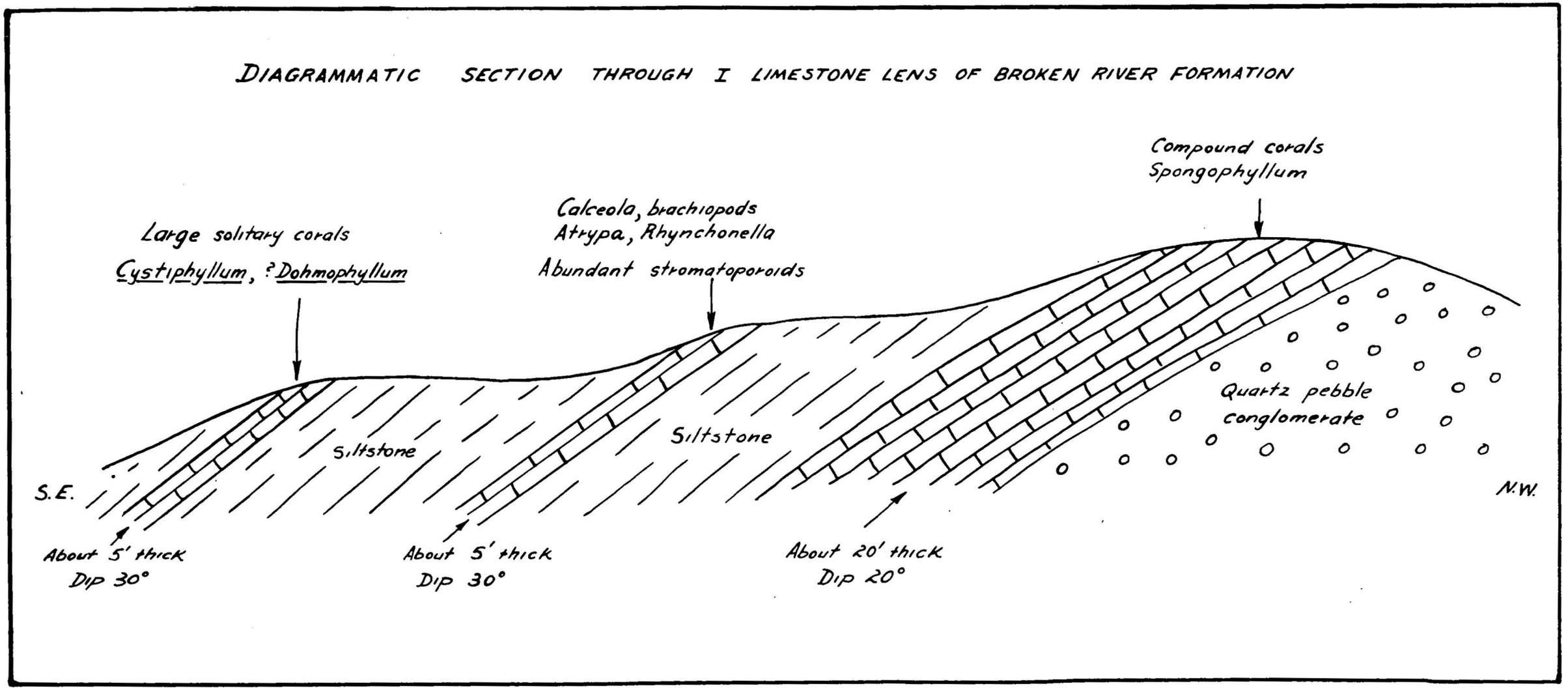
Fossil Collections are BRS10, BRS11, BRS48 and BRS61.

I Lens (Dmb_I)

This lens crops out just south of D Lens. It consists of several small lenses of limestone interbedded with siltstone and contains an extraordinarily abundant brachiopod and coral fauna. Its total outcrop length is 1¼ mile.

The accompanying diagram shows the type section. The Fossil Collections from I Lens is BRS59.

DIAGRAMMATIC SECTION THROUGH I LIMESTONE LENS OF BROKEN RIVER FORMATION



It is interesting to note the distinct faunal assemblages found associated with the various types of sediment. Although no detailed palaeoecological work could be carried out during the regional mapping programme in 1957 various distinct associations were recognized:

(a) Compound rugose corals and large stromatoporoids are commonly found in rather massive occurrences of grey limestone.

(b) Thin grey limestone lenses generally contain either large solitary corals (e.g. Cystiphyllum, Dohmophyllum, etc.) or Amphipora-Columnaria (Favistella) assemblages.

(c) Thin black limestone beds and lenses contain gastropods or brachiopods.

(d) Siltstones, typically with small pods and lenses of grey limestone, are characterised by Calceola-brachiopod faunas.

These remarks are intended to be taken as a rough guide only but there is no doubt that much very valuable palaeo-ecological information could be obtained by close study of the Pandanus Creek-Broken River area. The zone of change from clean grey limestone containing rugose corals to siltstone containing Calceola and brachiopods is particularly well exposed in the general area of Craigie Outstation.

H Lens (Dmb_H)

The H Limestone Lens crops out over a length of $2\frac{3}{4}$ miles in the Broken River area, near the 6-mile Yard of Wando Vale (Plate 3). It has a maximum thickness of about 900 feet. The limestone is generally massive and grey, and contains rugose corals but at its northern end it is black and has a brachiopod fauna.

Apparently the H Lens is yet another repetition of the Middle Devonian limestone horizon of the Middle Devonian limestone horizon and is equivalent to the F and G Lenses.

Fossil Collections BRS3, BRS5, BRS45.

J Lens (Dmb_J)

The J Lens crops out near Page Creek, a small tributary of the Broken River (Plate 4). It delineates an anticlinal nose and crops out over $2\frac{1}{2}$ miles. It is bounded to the south of overlying basalt.

It was thought that this limestone Lens would be [illegible] n the others in the Broken River area, as it occurs near the base of the Bundock Creek Formation. However, it too is Middle Devonian; the base of the Bundock Creek Formation must therefore be regarded as late Middle Devonian. This dating is supported by the Middle Devonian age of a limestone breccia bed which crops out immediately below the base of the Bundock Creek Formation near Pandanus Creek Homestead.

The J Lens is composed of a fairly massive, grey limestone and contains well preserved corals - fossil collection BRS57.

Other Occurrences of Limestone and Limestone Breccia

A prominent belt of limestone breccia crops out about 3 miles north-north-west of Pandanus Creek Homestead (Plates 2 & 3).

It has an outcrop length of 2¼ miles and a maximum thickness of about 3,000 feet.

The origin of this limestone breccia is not clear. It appears to be a reef breccia which has formed in situ, or almost in situ, but no reef has been found from which it could have been derived. Possibly, however, the parent reef may have been topographically above the breccia and has been eroded away.

The limestone breccia consists of angular fragments of limestone, commonly containing fossil corals, and set in a limestone matrix. Most of the angular fragments are several inches across; some are red, in contrast to the grey matrix of the rock.

On fossil evidence the age of the limestone breccia is Middle Devonian. (Fossil Collections BRS34, 4/4/5167).

Various other occurrences of limestone and limestone breccia are known within the Broken River Formation. Where these were encountered, fossils if present were collected and localities were recorded on the maps. They are too small to warrant separate description, particularly as they do not yeild any further information on the geological age of the Broken River Formation.

Palaeontology of the Siltstones

Both marine and plant fossils have been found in the siltstones of the Broken River Formation.

(a) Marine. Marine fossils occur in siltstones about ¼ mile west of the H Limestone Lens. They are mainly brachiopod, but solitary corals, trilobites and other forms also occur.

Very rich brachiopod fossil localities are found in the siltstones and mudstones in the general area of I Limestone Lens. Small gastropods, Calceola-type corals, and other forms are also found in abundance in the area.

(b) Non-Marine. At several localities in the bed of the Broken River, both east and west of the road crossing, abundant plant fossils have been found. They cannot be positively referred to any existing genera but appear to have affinities with Barinophyton and similar forms. They must represent a very early, primitive flora as they occur in beds of Upper Silurian age.

Fragments of unidentifiable plant stems have also .n the area south of I Limestone Lens and just below the Bundock Creek Formation in the Broken River section.

Summary and Relationships

The Broken River Formation is a marine sequence and ranges in age from Upper Silurian to Middle Devonian.

In the Broken River section transition beds occur at the top of the Broken River Formation. They are conformably overlain by the non-marine Bundock Creek Formation. The transition beds consist of alternating siltstone and subordinate limestone, with marine fossils, and quartzite, with plant fragments.

The fossil faunas of the Broken River Formation are exceptionally abundant and diverse and will be described in a detailed separate publication by Dr. D. Hill, of the University of Queensland.

Bundock Creek Formation

The Bundock Creek Formation crops out over a total area of about 400 square miles on the Clarke River 4-mile Sheet.

It is essentially a non-marine sandstone formation, containing plant fossils. Several minor fossiliferous limestone lenses occur but, on the whole, the Formation contains few fossils.

The clastic rocks of the Formation range in grainsize from siltstone to conglomerate but by far the greatest proportion have a grainsize within the arenite range.

A section was measured through the Bundock Creek Formation along the Broken River and its tributaries. Exposure of the softer beds is poor and it was considered that accurate section measurement was not warranted. The section was measured by careful plotting of detailed ground observations on the aerial photographs and is reproduced below:

Bottom

6500 feet of fine to medium grained, thin bedded, grey and yellow-brown (weathered), poorly outcropping, micaceous sandstone interbedded with light grey, medium grained, current bedded quartzite. Quartzite beds are, in general, 5-30 feet thick and do not constitute more than 10% of the section. Plant fossils occur in a 1 inch thick dark grey shale bed 4600 feet above the base of the 6500 feet unit.

6100 feet of fine to medium grained, thin bedded, grey, yellow-brown (weathered) and some purple-maroon, poorly-outcropping, micaceous sandstone interbedded with light grey, medium to coarse grained, current bedded quartzite and sandstone, in places conglomeratic. Beds in general are 5-30 feet thick.

3600 feet of light grey, medium to coarse-grained, current-bedded, sandstone interbedded with quartzite, commonly conglomeratic and soft, weathered, yellow-brown sandstone which crops out very poorly.

600 feet of light grey, medium grained, current-bedded, quartzite interbedded with purple-maroon, fine grained, micaceous sandstone or subgreywacke. Beds in general are 10-30 feet thick.

1700 feet of light grey, and purplish, current-bedded, medium to coarse-grained, conglomeratic, sandstone.

f interbedded purple, current-bedded, conglomerate with sub-angular to sub-rounded pebbles of red jasper, quartz, and rare white vein quartz, set in a purple sandstone matrix and purplish conglomeratic sandstone and dark red, fine-grained sandstone and micaceous siltstone.

(Red Range)

900 feet of light grey (in places light purple), medium-grained current-bedded sandstone with numerous conglomeratic layers that contain subrounded pebbles of quartzite, vein quartz, and a few schistose rock types.

3000 feet of light grey, medium-grained, current-bedded, quartzite with subordinate fine grained quartzite, and one 5 ft. bed of conglomerate with sub-rounded pebbles and cobbles of quartzite and vein quartz at the base. Passes conformably downwards (with interlayering) into the marine Broken River Formation.

23,000 feet Total thickness of Bundock Creek Formation.

Near the junction of the Gregory and Clarke Rivers the medium to coarse-grained, strongly current bedded, sandstones contain an appreciable percentage of pink orthoclase crystals and some are almost arkose. Associated with the feldspatchic sandstones are conglomerate beds, with pebbles and cobbles of red granite, quartzite, mica schist and vein quartz, set in a feldspathic sandstone matrix.

The source for the arkosic sandstones must have been at no great distance since the crystals or orthoclase are well preserved. The fact that the sandstones of the Bundock Creek Formation generally contain an appreciable percentage of mica also suggests that theprovenance of the Formation must have contained metamorphics and granites.

Although not everywhere present, beds of purple and maroon sediments characterize the Bundock Creek Formation - these colours are not found in sediments of the Broken River Formation.

In places the sandstones of the Bundock Creek Formation have been wholly or partly silicified, giving rise to quartzites and partly silicified sandstone. The origin of this silicification is not clear.

In the general area of Pandanus Creek Station the base of the Bundock Creek Formation is not as obvious as in the Broken River section. About 5 miles north-west of Pandanus Creek Station (Plate 2) the base of the Bundock Creek Formation has been placed at the base of a distinctive unit of current bedded, maroon conglomerate and conglomeratic sandstone. In the Martin's Well Syncline the base of the Bundock Creek Formation is marked by a bed of pebble conglomerate with sub-angular to sub-rounded pebbles - mainly of white vein quartz, but some of haematised siltstone - set in a silicified sandstone matrix.

A prominent conglomerate bed is exposed in Red [illegible] it has an outcrop length of about 10 miles and is up [illegible] t wide. Details of lithology are given in the type [illegible] the Bundock Creek Formation. The intense purple [illegible] lours of the sediments are its most striking feature; they gave rise to the name "Red Range".

A small isolated lens of limestone breccia is also known in the Bundock Creek Formation. It consists of fragments of limestone, and some red jasper, set in a limestone matrix that contains some sandy material.

On the eastern side of the synclinal structure near Catfish Mountain (Plate 5) limestone is exposed in a small creek, where it consists of thin beds of limestone, 1-2 feet thick, interbedded with soft, weathered, grey siltstone. A coral fauna (BRS16) from this locality has been determined to be Frasnian (Upper Devonian) in age.

On the western side of the syncline the limestone bed consists of a single thin band of limestone, interbedded with medium to coarse-grained sandstone and siltstone, some of which are maroon.

Palaeontology and Age of the Bundock Creek Formation.

On the fossil evidence available the Bundock Creek Formation ranges in age from Upper Devonian to probably Lower Carboniferous.

The limestone lens (Frasnian) near Catfish Creek is believed to be fairly high in the sequence. The highest stratigraphic horizon in which marine fossils (BRS68, Plate 3) have been found is about 3,000 feet below the top of the measured section and about 1½ miles north of it. Several thin beds of black limestone (up to 1 ft. thick) are interbedded with very weathered micaceous siltstone at this locality. The fauna collected from the limestone beds have been determined as probably Lower Carboniferous (Tournaisian).

Plant fossils from the Bundock Creek Formation consist of a lepidodendroid plant which was preserved in a "floater" found near the junction of the Gregory and Clarke Rivers. Also Psilophyton type plants were observed in 1956 (White and Hughes, 1957) in the Bundock Creek Formation near the Hann Highway.

CARBONIFEROUS

Clarke River Formation

The Clarke River Formation crops out over an extensive area on the Porphyry, Niall and Montgomery Range 1-mile sheets, and to a less extent on the Phantom Creek and Yering 1-mile sheets. The three main areas of exposure are:

(i) in the Blue Range, west of Blue Range Station (Plate 6).

(ii) in the high country forming the divide between Porphyry and Gill Creeks on the north and the Clarke River on the south, and extending south-eastward to Maryvale Creek and under the Tertiary basalt to Emu Creek, on Bluff Downs Station (Plate 6)

(iii) in two smaller areas between Porphyry Creek and Gray Creek (Plates 2 and 6).

The Formation generally gives rise to rugged country crossed by erosion ridges (hogbacks) of coarse

The type section is along the Clarke River from 3 miles above the junction of Yates Creek to the Clarke River Telegraph office; the formation is named after the Clarke River. The sediments were first described by Saint Smith (1922), who proposed the name Clarke River Series and ascribed a Lower Carboniferous age to the sequence.

The Formation consists essentially of coarse-grained quartz sandstone, quartz greywacke, siltstone and quartz conglomerate, with a basal greywacke conglomerate or calcareous sequence.

There are three areas where the basal calcareous sequence is exposed:

(i) Blue Range Area

In the Blue Range area a calcareous marine sequence unconformably overlies the Perry Creek Formation either directly or separated from the unconformity by about 30 feet of quartz greywacke.

The sequence consists of grey calcareous siltstone and fine sandstone with rare thin beds of algal limestone. The member is richly fossiliferous; it contains coral, brachiopod, gastropod, lamellibranch and crinoid fossils, indicating a probable Tournaisian age. The calcareous beds commonly contain Lepidodendron which are proportionally more abundant towards the top of the beds, where the sequence passes through fine quartz siltstone and sandstone into coarse sandstone and fine conglomerate, apparently of freshwater origin.

The thickness of the calcareous sequence varies considerably, from one to two feet in the area of Blue Range east of Mt. Dudley, to several hundred feet in the lower Francis Creek area. On Blue Range, east of Mt. Dudley, the member lies directly on the steeply dipping Perry Creek Formation, except where it overlies one small doubtful exposure of the Gowrie Conglomerate(?) which infills a depression in the old land surface. At a point on the range 5.8 miles north-east of Blue Range Station the succession is separated from the unconformity by 30 feet of well-bedded fine quartz conglomerate and coarse arenite. In the lower Francis Creek area the unconformity was not observed but the calcareous sequence lies conformably above quartz-jasper conglomerates similar to those occurring elsewhere in the Clarke River Formation. It seems reasonable to assume that the Blue Range Member thins out in a northerly direction and overlaps a basal quartz conglomerate.

(ii) Gill Creek Area

A calcareous sequence similar to that in the Blue Range area occurs in the right hand branch of Gill Creek, 2 miles above its junction with Gill Creek proper. Only a small thickness (30 feet?) of calcareous sediments, consisting of calcareous siltstone, quartz siltstone and calcareous quartz greywacke, with rare limestone pods is exposed.

The calcareous sequence is conformably underlain by coarse quartz sandstone and fine quartz-jasper conglomerate of the Clarke River Formation, which are downfaulted against the Perry Creek Formation. It is conformably overlain by a sequence of micaceous and feldspathic sandstone and siltstone, micaceous quartz greywacke and fine quartz pebble conglomerate.

The marine fossil evidence suggests an Upper [illegible]ver Carboniferous age for the calcareous beds in the area. Lepidodendron is a common associate with the marine brachiopods and is also occasionally found in the overlying sediments.

(iii) Burnt Coat Area

Limestone crops out in the Burnt Coat section of Greenvale holding near Gray Creek (Plate 2). It is exposed in the core of a small anticline and is both underlain and overlain by quartz conglomerate and quartz greywacke of the Clarke River Formation. The limestone is up to 50' thick and is well bedded and blue-grey, and is interbedded with calcareous sandstone. The limestone is abundantly fossiliferous it contains brachiopods, gastropods, pelecypods and nautiloids,

which on preliminary examination (locality No. 2259), plate 2 and Appendix I) suggest a Devonian or Lower Carboniferous age.

The limestone is similar in lithology and stratigraphic position to the calcareous beds in the Blue Range and Gill Creek areas and represents a marine intercalation near the base of the Clarke River Formation.

The conglomerate of the Clarke River Formation contains abundant red, pink, or black jasper pebbles, together with white quartz and small fragments of kaolinitic material which was possibly originally of feldspathic origin. The coarser sediments of the Formation are well bedded, and generally current-bedded, on a large scale. The finer, micaceous, commonly red to lavender sandstone and siltstone are readily fissile. In places they are ripple marked.

In the upper New Chum Creek area north-west of Niall 1 mile sheet (Plate 6) pebble conglomerate occurs. It is composed of weathered rhyolite and quartz porphyry. Many of the interbedded sediments are arkosic and/or appear to be tuffaceous. These sediments probably lie slightly above the horizon represented by the calcareous beds of Gill Creek. In the north-eastern area of Blue Range Tweedale and Bush (1958) report that rhyolite associated with the "Star Beds" (Jack, 1879) of the same age as the Clarke River Formation, unconformably overlie "the Kangaroo Hills Series". The Kangaroo Hills Series is probably equivalent to the Perry Creek Formation. Also, in the area from Tomahawk Creek to the Burdekin River, a few miles below the junction of the Douglas River, the "Kangaroo Hills Series" is overlain unconformably by tuff and rhyolite, which are, in turn, conformably overlain by conglomerate of the "Star Beds".

Gowrie Conglomerate Member

The Gowrie Conglomerate Member lies unconformably on the Tribute Hills Formation in the Gowrie Hills, south of the Clarke River Telegraph Office (Plate 6).

The sediments consist of pebble and cobble greywacke conglomerate, showing little bedding and no sorting of material. The pebbles are of quartz, chert, quqrtz greywacke siltstone, quartz greywacke, quartzite and quartz siltstone; in fact almost all the rock types, except limestone, of the older Perry Creek and Tribute Hills Formations may be recognized as boulders in the conglomerate.

The sequence varies greatly in thickness, and is a [illegible] valley-fill type deposit probably of piedmont origin. [illegible]erate is confined to the Gowrie Hills, except for a [illegible]currence on Blue Range.

From this evidence it seems probable that acid vulcanicity occurred early in the deposition of the Clarke River Formation. Possibly this activity took place during the period of emergence from marine conditions to fresh water terrestrial deposits, represented by the quartz conglomerate.

The Clarke River Formation is moderately folded, the major axial trends varying from north-east to north. Dips average 40° but are commonly less. The Formation is downfaulted against the Perry Creek Formation and the Pelican Range Formation.

The downfaulting is particularly noticeable along the western or northern margins of the sedimentary basins occupied by the Clarke River Formation. Folds commonly pass into faults, particularly in many of the coarser sediments. Near the upper reaches of the right hand branch of Gill Creek asymmetrical folds with axes dipping north and west suggest a relative thrust movement to the south-east or at right angles to the fault between the Clarke River Formation the old Siluro-Devonian sediments. This thrust movement may be due to compressive forces (acting in this direction) or to a thrust movement of the sediments near the margin of the downfaulted block, the asymmetry then being largely the result of faulting, while the major portion of the folding was caused by other tectonic forces acting prior to block faulting.

MESOZOIC

Mesozoic freshwater and marine sediments form the eastern margin of the Great Artesian Basin. Small outliers of sandstone, with some conglomerate, are exposed on the western part of the Castle Hill One Mile Sheet (Plate 5). These sediments are unfossiliferous and unconformably overlie the southern margin of the Forsayth Batholith (White and Hughes, 1957). They are tentatively regarded as representing the eastern limit of Mesozoic sedimentation and as part of the intake beds for the Great Artesian Basin - the "Blythesdale Group" of Whitehouse (1955). The age of the Blythesdale Group ranges from the Upper Jurassic to the Lower Cretaceous.

TERTIARY

BASALT

Little mapping was carried out on the basalts, which crop out in two main areas in the region mapping. These are the Nulla Nulla area (the "Nulla Province" of Twidale, 1956) and the Chudleigh area (the "Chudleigh Province" of Twidale, 1956) (Plates 5 & 6). Twidale (1956) divided the Chudleigh Province into the Newer Chudleigh Basalt of early to middle Pleistocene age, and the Older Chudleigh Basalt of Pliocene to early Pleistocene age.

The basalt of the Chudleigh Province forms a broad plateau, which is part of the divide between the west-flowing [illegible] and Einasleigh Rivers and the Clarke River, a tributary [illegible]ekin River, which flows east into the South Pacific

Outliers of basalt exposed as fillings of old river valleys and crop out as mesas in the Lucky Creek and Wyandotte area (Plate 2); they are probably part of the basalt of the "Mcbride Province" (Twidale, 1957), which crops out farther north in the Mt. Surprise-Conjuboy area.

Stevens (1956) has described some of the basalt from the "Mcbride Province" as an iddingsite-olivine basalt.

LATERITE

Laterite crops out as deposits capping Tertiary and Palaeozoic sediments and serpentinite. Only that part of the

laterite which overlies the serpentinite in the Hall's Reward Mine and Gray Creek areas was investigated in 1957. It contains small amounts of nickel - up to 0.5% Ni - and has been described by White, Branch and Green, 1958.

Recently Simonett (1957) has described the laterite and other ironstone soils from this area. He considers the laterite to be Tertiary, Pleistocene, and Recent in age, and the ironstone soils to be Post-Tertiary in age.

I G N E O U S R O C K S

Serpentinite, gabbro and related basic rocks, rhyolite, and granitic and dioritic rocks have been intruded into the Precambrian and Palaeozoic successions.

SERPENTINITE AND RELATED GABBRO

Intrusions of these rocks are restricted to the Hall's Reward Mine (Plates 2 and 7) and the Gray Creek areas (Plate 2). In addition to serpentinite there are other ultrabasic and basic rocks, such as dunite, peridotite, and pyroxenite (diallagite).

The serpentinite and gabbro intrusions of the Hall's Reward Mine area have been described by White, Branch and Green (1958). The petrology of the serpentinite, gabbro and related basic intrusions (Gray Creek Complex, Boiler Gully Complex and Sandalwood Serpentinite) of the Gray Creek area have been described in detail by Green (1958).

Previous geologists, including Bryan and Jones (1945) and Hill (1951), considered that the main serpentinite intrusion in Queensland took place in Middle Devonian. Wilkinson (1953) suggested the possibility of two ages of Palaeozoic serpentinite intrusion in Southern Queensland.

The 1957 mapping has shown that there are two ages of serpentinite and gabbro intrusion in North Queensland: one intrusion probably towards the end of the Precambrian, and the other early in the Carboniferous. None of the ultrabasic and basic rocks intrudes the Lower to Middle Carboniferous Clarke River Formation.

RHYOLITE AND PORPHYRY

Rhyolite and porphyry crop out throughout the area. [illegible]mplaced in Palaeozoic sediments, probably commencing [illegible]r Devonian and attaining their maximum development in [illegible]rous or Permian time. They are considered to be of similar age to other rhyolites and porphyry suites in Northern Queensland, such as the "Croydon Felsites" (Honman, 1937), the "Newcastle Range Porphyries" (Jensen, 1923) and the "Featherbed Range Porphyries" (Jensen, 1920).

The largest mass is exposed in the Newcastle Range near Einasleigh. A detailed study of this mass has been started by C.D. Branch.

Both intrusive and extrusive porphyritic rhyolites can be recognized. They are generally genetically related to granite. In places such as in the Gregory Range mass, rhyolite

is exposed as granite hoods and grades into underlying granite. In other places, such as the Newcastle Range, thick rhyolite flows have been emplaced probably by cauldron subsidence of the country rock accompanied by ring dykes; extrusion was closely followed by intrusion of granite of similar composition into the core of the subsided volcanic area.

NEWCASTLE RANGE VOLCANICS

The Newcastle Range is near Einasleigh, 160 miles south-west of Cairns; it rises as an arid, U-shaped block, 500'-600' above the surrounding countryside. This mass, which measures 60 by 26 miles (maximum), is composed mainly of extrusive porphyritic rhyolite with which is associated some fragmental material and thin basal sediments. The succession has been tentatively named the Newcastle Range Volcanics.

In 1892 Jack and Etheridge described the rocks composing the range as an altered ash. Cameron (1900) considered them to be porphyry. The volcanics of the Newcastle Range were named the "Newcastle Range Porphyry" by Jensen (1923). Hills (1946) suggested that the porphyry was intruded along a line of weakness coinciding with a change in trend of the Precambrian metamorphics. Later Denmead (1947a) described rhyolite and breccia from the range about 4 miles south of Eveleigh Station. During the 1956 survey marine sediments were mapped at the base of the range near Einasleigh (White and Hughes, 1957), which together with the volcanics were included in the "Croydon Complex" of Upper Palaeozoic age. The Newcastle Range Volcanics include some intrusive granite, and also surrounding porphyritic rhyolite dykes (Plate 8).

The Newcastle Range Volcanics form into two physiographic and geological units:

(i) The Eastern Newcastle Range : a near circular area approximately seven miles in diameter, centred 13 miles north-west of Einasleigh.

(ii) The Main Newcastle Range : a north-south elongate area, 60 miles by 12 miles, the centre of which is near the western side of the Eastern Newcastle Range.

(i) Eastern Newcastle Range

The strata form a shallow structural basin in which marginal dips range from 70° in the north to 20-30° in the east, west and south, and dips in the centre near-horizontal. The geological record, subsequent to the emplacement of granite, [illegible] with a basal arkosic conglomerate, which is exposed on [illegible] side of the range, and which unconformably overlies [illegible] weathered muscovite granite of the Forsayth Batholith [illegible] Hughes, 1957). A typical section of the sediments in the Newcastle Range Volcanics is detailed below from the base to the top:

(a) Massive muscovite granite of the Forsayth Batholith.

(b) A transition zone of weathered granite averaging 20 ft. in thickness.

-----Unconformity-----

(c) Basal, reddish-purple arkosic conglomerate, 6 feet thick, composed mainly of muscovite granite cobbles, in a matrix of feldspar, quartz, and mica, clastic grains. Above this

for 40 feet are graded beds, 2-3 feet thick, of arkosic pebble conglomerate which pass upward into arkose or in a few places into ferruginous shale. All pebbles are poorly rounded and have poor to medium sphericity which, with the angular grains in the matrix, suggest little transport.

(Total thickness 46 feet).

(d) Ferruginous shale and grit : 10 feet thick.

(e) Massive, white, arkosic pebble conglomerate with some poorly rounded quartzite cobbles of medium sphericity, and rare arkose: 60 feet thick.

(f) Interbedded quartz sandstone, arkose and grey shale with three thin (6-7 feet) glassy rhyolite flows and a small lens of silicified, unfossiliferous, limestone, 15 feet below the top: 80 feet thick. The upper 20 feet of this sedimentary sequence has been silicified by an overlying 100 feet thick porphyritic rhyolite. A few small lenses of sediments are found above the flow.

Conformably overlying this basal sedimentary sequence are volcanics composed of extrusive acid lavas and interbedded fragmental ejecta. Seven flows have been mapped: they are similar in mineralogical composition but as each contains 50-60% glass and no chemical analyses are available, uniformity in chemical composition has not been proved. The colours of the interstitial glasses range from pink in flows No. 1 and 2 as shown on Plate 8, through purple (No. 3, 4) to pink (No. 5, 6) and finally grey (No. 7) and may reflect some chemical dissimilarity between the flows.

The flows range in thickness from 100' to 300'. In each flow differentiation is lacking, as suggested by their uniform porphyritic texture, except in the upper 20'-30' of some flows where the texture becomes glassy, and viscous flow structure is found. In thin section the rhyolites are porphyritic, with phenocrysts (0.5 mm.-4.0 mm.) of embayed, unstrained -quartz (20%), broken laths of sanidine (10%) and albite/oligoclase (5%) set in a devitrified glass matrix (65%). The glassy base is now represented by a microscopic intergrowth of quartz and feldspar, which is commonly spherulitic or perlitic, and contains accessory magnetite, epidote and kaolin. Flow banding in the glass is common and occasional amygdules are found, the vesicles of which are filled by clinozoisite and orthoclase.

Columnar jointing, with long axes normal to the flow margins, has been observed: the columns measure 5'-8' and 30'-50' in length. Another prominent joint is parallel to the surface of the flows, i.e. near-horizontal; the joints are spaced from 1 inch to 10 feet.

Metamorphism between flows has not been observed. The basal major flow on the eastern side of the Range has silicified underlying sediments to a depth of 20', probably because they were more permeable than igneous rock subjected to the same conditions. On the western side of the area, where the basal flow unconformably overlies quartz-feldspar-mica schist of the Precambrian ( ) Einasleigh Metamorphics (White and Hughes, 1957, p.7), the quartz of the schist has been recrystallized (due to metamorphism) by the flow.

Pyroclastic beds (C, D, E, F respectively in Plate 8) overlie the second, third, fourth and sixth flows. These beds vary from volcanic breccia to tuffaceous sandstone. Bed C, averaging 75' in thickness, is a rhyolitic crystal tuff. It contains broken crystals of quartz and sanidine, with a little albite, in a dusty, partially recrystallized matrix that contains occasional shreds of muscovite and chlorite.

Most heterogeneous pyroclastic is bed D (50-125 ft. thick). South of Eveleigh Station it is a coarse volcanic breccia, with angular fragments, up to 5 cm. across, of a purple-grey flow-banded porphyritic rhyolite set in a tuffaceous and siliceous matrix. To the south, on the eastern side of the range, similar rhyolite blocks, which resemble the underlying flow, are founded, probably by water transport. On the western margin a similar volcanic agglomerate is interbedded with, and grades into, a tuffaceous sandstone. These variations in the one bed suggest that while sub-aerial deposition took place in the north, submarine or lacustrine sedimentation continued sporadically to the south. This is further evidenced by bed E, which is confined to the south of the area, and is a 30' bed of tuffaceous sandstone, with graded beds 1-6 inches thick. The total thickness of volcanics in this area ranges from 2,500-3,000 feet.

The volcanics of the Eastern Newcastle Range are intruded by a stock of porphyritic grey granite that crops out over an area of twenty square miles in the central northern portion of the Range. The granite, which contains some xenoliths of rhyolite and also intrudes the country rock, contains subhedral phenocrysts of quartz, orthoclase, and partly zoned albite/oligoclase, of an average diameter 5 mm. and a maximum of 5 cm. The phenocrysts are set in a groundmass of similar material with an average diameter of 0.2 mm. and a subgraphic texture. Accessory minerals (2%) are biotite and muscovite. The mineralogical composition of the granite is essentially the same as that of the lavas it intrudes, except for the accessory mafic minerals in the granite.

(ii) Main part of Newcastle Range (Plate 9)

The structure here is also basinal, with all dips round the periphery directed (20^{o}-45^{o}) towards the centre. In the region south of Dagworth Station the basal bed of the Newcastle Range Volcanics is a flow-banded rhyolite which contains well-rounded quartzite pebbles with a high sphericity. The pebbles were picked up from the land surface over which the rhyolite flowed. Above the flow is a purple sandstone similar to the arkose towards the base of the eastern part of the Newcastle Range.

Thirteen porphyritic rhyolite flows are exposed above the sandstone. The flows range from 10-300 ft. thick and show little differentiation, although in some of the thinner flows fluid banding is present. The 175 ft. thick flow No. 9 (numbered from the bottom) contains pillow structure in the upper 20 feet, which suggests that the flow was poured out under water. Vesicles in flow No. 13 are lined by concentric layers of chalcedony and orthoclase; the centre of each is occupied by clear quartz. The extremely altered surrounding glass suggests that fillings are of hydrothermal origin.

Overlying rhyolite flows No. 3, 5, 6, 7 are 15 to 50 feet thick flows of quartz-pyroxene and quartz-pyroxene andesite. The youngest and most widespread of these is a grey-green rock, which is amygdaloidal in its upper part, porphyritic near the

base, and has a combination of these two textures in the centre of the flow. The groundmass (45%) is trachytic in texture although flow alignment of the feldspar and biotite microlites is generally lacking. Irregular patches of granular quartz make up 8-10% of the groundmass. The remainder of the andesite consists of randomly orientated phenocrysts of labradorite/bytownite (30%) up to 2 cm. long, rare occasional subhedral augite crystals (5%), and calcite and chlorite (20%), which fill vesicles of average diameter 1 cm.

Volcanic agglomerate, breccia and tuff crop out above flows No. 4, 11, 12, 13 and are similar to those in the eastern part of the Newcastle Range. Vitric tuffs have not been observed in any of the areas examined, but fragments of this type of tuff have been found in thin sections of rhyclitic volcanic breccia above flow No. 13.

Granite intrudes the volcanics adjacent to the eastern margin of the basin, about 12 miles north-west of Talaroo Station (Plate 9). Away from the contact with the volcanics the granite is a medium-grained, pink, rock with up to 10% biotite, and against the contact it is chilled to an aplite composed of quartz and kaolinised orthoclase with a semi-graphic intergrowth, and interstitial mica shreds. Evidence of the intrusive nature of the granite in the adjacent porphyritic grey rhyolite is the presence of magnetite pseudomorphs after biotite which are lacking away from the contact.

Fractures and dykes are irregularly distributed around the periphery of the Newcastle Range. The fractures are steeply dipping, up to eight miles long and 300 yards wide, and are partly filled by massive porphyritic rhyolite identical with that in the thick lava flows of the Newcastle Range Volcanics (Plate 9). The lack of strain or flow in the dykes and chilling on the margins suggests they were intruded into a zone of tension. The margins of the Newcastle Range in many places appear to be faults. This is evidenced by the truncation of successive beds.

Three prominent joint directions are found in the Newcastle Range Volcanics:

North-south joints parallel to the long axis of the range.

Two groups of mutually perpendicular joints which trend north-west and north-east.

These joints control the drainage on top of the range, where they can be traced across flow boundaries for up to four is thought they are related to the later structural t of the Range, rather than the colling of the lava

Similar porphyritic rhyolite to the Newcastle Range Volcanics is found in other structural environments in North Queensland. For example, the gradation between rhyolite porphyry and granite in the Gregory Range as described by White and Hughes (1957, p.15), suggests that the porphyry represents a hood over the underlying granite. These rhyolite porphyries are probably part of the "Croydon Felsites" (Queensland Geological Map, 1953) exposed on the western margin of the Gregory Range. Similar conditions may have existed two miles west of Dagworth Station where porphyry grades downward into a normal coarse granite.

Similar porphyries to the Newcastle Range Volcanics occur in ring dykes exposed between Bagstowe and Ten Mile Homesteads as described by White and Hughes (1957, p.17); rhyolite porphyries in the Broken River area intrude the Bundock Creek Formation of Upper Devonian/Lower Carboniferous age.

The Newcastle Range Volcanics are similar to the "Featherbed Range Porphyry" (Jensen, 1923), which conformably underlies Permian coal measures in the Mount Mulligan area. Also at Gilberton similar rhyolite conformably overlies the Gilberton Formation of Devonian(?)-Carboniferous age, which suggests that the Newcastle Range Volcanics are of Upper Palaeozoic age.

Also rhyolite porphyries intrude the Lucky Creek Formation in the Balcooma Creek area (Plate 2). The porphyries consist of quartz-feldspar porphyry, quartz porphyry and felsite. Some crop out as dykes but mostly as a large mass measuring about 12 miles long and 3 miles wide. This body trends north-north-east and conforms to the trend of the Lucky Creek Formation.

AGATE CREEK VOLCANICS

Volcanics crop out in a small body, about 32 aquare miles in area, near Agate Creek - about 30 miles south-south-west of Forsayth. The volcanics have been recorded and described by Cameron (1900).

The Agate Creek Volcanics consist of about 4,000 feet of rhyolite, agglomerate, tuff and amygdaloidal basalt, with some shale and quartz greywacke. The sediments are about 15 feet thick and crop out at the base and towards the top of the succession. Fossil plants were collected from the sediments. Determinations of the plant remains by Mary E. White (Appendix II) suggest a Permian age. The volcanics unconformably overlie the Forsayth Batholith. They are considered to be the same age as the Newcastle Range Volcanics.

Similar volcanics have been described by White and Hughes (1957) in the Percy River area, where they conformably overlie a freshwater sequence, the Gilberton Formation, of Upper Devonian(?)-Lower Carboniferous age. These volcanics probably represent the southern extension of the Agate Creek Volcanics.

MONTGOMERY RANGE RHYOLITE

The Montgomery Range Rhyolite Porphyry consists of pink to grey porphyritic to flow banded rhyolite. It intrudes the Upper Devonian/Lower Carboniferous Bundock Creek Formation in the north-western part of the Mongomery Range One Mile Sheet (Plate 3).

The flow-banded rhyolite is restricted to the top of the Formation and conforms to the bedding of the formation. Farther south in the formation the rhyolite is porphyritic and intrudes the beds as stock-like bodies. The flow-banded rhyolite is probably genetically related to the rhyolite porphyry stocks and are considered to be sills.

Oriented specimens of the flow rhyolite were collected for magnetic determinations; as yet no results are available.

OTHER PORPHYRIES AND RHYOLITES

Quartz porphyry and spheroidal rhyolite are associated with the Silure-Devonian succession in the Perry Creek and Mt. Dudley areas (Plate 6).

(i) Mt. Dudley, about 11 miles north-north-east of Blue Range Homestead, is formed by the largest body of quartz porphyry that intrudes the Perry Creek Formation. The porphyry is intruded parallel to the trend of the country rock and appears to occupy the nose of a flexure with axial trend north-west. This mode of occurrence - as small dykes occupying the noses of folds - is quite common over the whole area and may also be observed in the Four Mile Creek Formation.

The porphyries of Mt. Dudley are fine-grained and light-coloured. Phenocrysts range up to 1.5 mm. across and are set in an extremely fine groundmass.

The genetic relationship of these porphyries to granite to the north and east is unknown.

Iii) Small porphyry sills occur in the Perry Creek Formation in Perry Creek and also west of Camel Creek. Texture of these intrusives varies considerably from extremely fine-grained quartz porphyry and felsite to (feldspar) porphyry, with phenocrysts up to 35-40 mm. across.

The porphyries are considered to belong to the same igneous phase as the Mt. Dudley porphyries.

(iii) In the lower Camel Creek area spheroidal rhyolite and associated porphyry are interbedded with the Perry Creek Formation. The rhyolite is very weathered and is poorly exposed. The spherulites vary from a few millimetres diameter to 0.5 centimetres.

The rhyolite is contemporaneous with the Perry Creek Formation, i.e. Upper Silurian to Lower Devonian.

Because of their lithological resemblances and similarity of occurrence it is considered that porphyry and rhyolite are comagmatic and are related to the same period of emplacement, which probably continued from Lower Devonian (i.e. contemporaneous with deposition) to post Lower Devonian (i.e. contemporaneous with folding).

OTHER VOLCANICS

Both acid and basic volcanics are exposed in the Carboniferous Clarke River Formation; acid rocks are the more abundant.

Tuffaceous sediments occur in the Upper New Chum Creek area and rhyolite covers extensive areas to the east of theBlue Range and east of Black Gin Creek, a tributary of the Burdekin, south-east of Blue Range Homestead. These volcanics occur near the base of the Clarke River sequence.

In Emu Creek, on Bluff Downs Station, rare flows of basaltic or andesitic lava occur interbedded with coarse grained arkose. Their position in the stratigraphic sequence is not known.

GRANITIC ROCKS

In the course of the 1956 reconnaissance mapping of the area, White and Hughes (1957) recognized at least two ages, and possibly three, of granitic intrusion. Pre-Silurian and

Post-Silurian granite was recognized and they also considered the largest intrusion, the Forsayth Batholith, to be Pre-Silurian in age, since along its southern margin near Gregory Springs Station (Plate 5) the batholith was thought to be unconformably overlain by the Siluro-Devonian succession of the Broken River Beds. However, it now appears that the Siluro-Devonian succession is intruded by granite in this area and hence the age of the main part of the Forsayth Batholith is in doubt.

As a result of the 1957 mapping evidence was obtained for possibly three ages of granitic intrusion; Precambrian, Upper Devonian(?)-Lower Carboniferous and Carboniferous. However until radioactive age determinations of the granitic rocks are available, it is impossible to date accurately the upper age limit of these intrusions. The three ages of intrusions possibly belong to the "Cloncurry Epoch" (Precambrian), "Herberton Epoch" (Late Devonian) and "Gympie Epoch" (Late Permian) respectively of Jones (1948).

PRECAMBRIAN(?) GRANITIC INTRUSIVES

Massive, medium-grained, muscovite granite exposed in the Bauhinia Creek area has given rise to boulders in the Siluro-Devonian Crooked Creek Conglomerate (Plate 2); it is possible that this granite is Precambrian in age.

The granite of the Bauhinia Creek area is similar to the muscovite granite in the Hall's Reward area, where the granite is generally pegmatitic and contains garnet. It intrudes Precambrian (?) metamorphics and could have been emplaced during a Precambrian(?) orogeny.

Massive medium to coarse-grained granite intruded the western margin of the Lucky Creek Formation (Plate 2) and formed a wide metamorphic aureole. Until evidence for a Lower Palaeozoic age of the Lucky Creek Formation is obtained, this granite could either be Precambrian(?) or Devonian in age, assuming the granite is related to one of these two orogenies.

UPPER DEVONIAN(?)-LOWER CARBONIFEROUS GRANITIC INTRUSIONS

Granite intrudes the southern margin of the Broken River Formation in the Gregory Springs and Craigie areas (Plate 3). It covers an area of about 700 square miles, and extends south to Reedy Springs and Cangron, on the southern margin of the Clarke River Four Mile Sheet. Here it is unconformably overlain by Tertiary basalt.

Other granitic rocks of this age have been described from Chillagoe and the Perry Wolfram Diggings by White and Hughes (1957).

POST LOWER CARBONIFEROUS GRANITIC INTRUSIVES

The Carboniferous Clarke River Formation is intruded by diorite and granite.

Emu Creek Diorite

Diorite crops out over a small area in Emu Creek on Bluee Downs near the eastern margin of the Clarke River Four Mile Sheet; it has been named the Emu Creek Diorite. The diorite occupies the core of a shallow north-pitching anticline in coarse arkose and fine quartz conglomerate of the Clarke River Formation.

It is generally coarse-grained and in many places contains large rounded xenoliths, with indefinite margins, of gabbroic texture, but apparently of the same composition as the host. Alignment of mineral grains is fairly common and suggests that the diorite may have been intruded during folding of the sediments or that they represent flow lines.

The enclosing sediments have been silicified at the contact. The diorite does not appear to have transgressed the sediments as theupper contact conforms to the bedding.

In the area between the headwaters of Cleanskin Creek and Expedition Creek, on Mitchell Vale Block of Blue Range Station (Plate 6), medium-grained, deeply weathered, diorite apparently intrudes the Clarke River Formation. The extent of the intrusion and is genetic relationship is not known. The only similar diorite in the area is about 16 miles to the north-east, where medium grained diorite with a strongly "felted" texture occurs on the divide between Douglas Creek and Tomahawk Creek; it intrudes the Perry Creek Formation, but cannot be dated more precisely than post-Perry Creek Formation. It is intruded by porphyry associated with the Oweenee Granite.

The above mentioned occurrences of diorite occur several miles east of longitude 145°30'E or south of latitute 19°30'S, the eastern and southern margins of the Clarke River Formation, and do not appear on the Porphyry or Niall 1-mile sheets (Plate 6).

Oweenee Granite

In the south-eastern portion of the Niall 1-mile sheet (Plate 6), granite crops out near Mt. Oweenee (Lat. 19°26'S. Long 145°32'E). The granite is named from Mt. Oweenee. The granite covers a rectangular area which lies between Long 145°30'E. and the Burdekin River and trends in north-north-east.

The granite is coarse-grained, and grades into pegmatite, granite porphyry and quartz porphyry. These textural variations, together with remant contact metamorphosed sediments in the higher levels, suggest that the present land surface is close to the top of the batholith.

The granite is composed of large, well-developed, feldspar crystals, set amongst quartz and scattered mafic minerals. Its colour is normally pale pink to cream. Xenoliths of more basic material are common but are usually small, e.g. 3"-6" in diameter. In a few places feldspar crystals are aligned.

On the south-east margin of the main granite mass there is a small boss of quartz porphyry which is apparently genetically related to the Oweenee Granite. The porphyry is typically developed on Malmsbury block, Birdbush holding, parish of Hayes, County of O'Connell.

Tongues of porphyry are intruded along bedding planes of the Clarke River Formation and also intrude the Emu Creek Diorite.

Both the Oweenee Granite and the porphyry at Malmsbury are post Lower Carboniferous, but no upper limit to their age has been been determined.

S T R U C T U R E

The area has probably been affected by three orogenies: Precambrian, Upper Devonian(?)-Lower Carboniferous and a post-Carboniferous orogeny, whose precise age is not known, but which probably took place towards the end of the Palaeozoic. During these orogenies the sediments were folded, faulted and intruded by igneous rocks.

The most important feature produced by these orogenies was the lineament, which bounds the Siluro-Devonian sediments on the west. This lineament is about 80 miles long and extends from the headwaters of the Einasleigh River in the north. Its trend is slightly arcuate, from north-east in the south to north-north-east in the north. The northern part of the lineament coincides with the course of the Burdekin River, which bends sharply along the lineament. Physiographically the lineament is generally marked by a scarp. The scarp is a fault scarp along the southern part of the lineament, where Siluro-Devonian sediments are faulted against older metamorphics and granite; alongs its northern part the scarp is an erosional scarp between Tertiary basalt of the "Mcbride Province" (Twidale, 1956) to the west and Palaeozoic sediments of the Tasman Geosyncline to the east.

The central part of the lineament consists of a ridge of Precambrian(?) metamorphics along which serpentinite and gabbro were emplaced. This ridge formed a mobile tectonic welt and was active in early Palaeozoic time; it provided detritus for the Tasman Geosyncline. In the Hall's Reward Mine area (Plate 7) the eastern and western margins of the ridge are faults.

Another important lineament in the area is the fault which separates the Carboniferous sediments to the east from the Siluro-Devonian sediments to the west. This fault is here named the Spring Creek Fault, from Spring Creek, which is a tributary of Gray Creek (Plate 2). The trend of the Spring Creek Fault is arcuate, from north-north-east in its norther part, near Gray Creek, to north-north-west in its southern part, near the junction of the Broken and Clarke Rivers. The faults is about 35 miles long. Movement along the fault was probably vertical, although a change to a north-north-east trend in its central portion may suggest some transcurrent movement.

Folding in the area ranges from tight complex folds in the Precambrian, through both tight and broad folds in the Siluro-Devonian, to broad, open folds in the Carboniferous. Folding is complicated in the Precambrian by intense shearing, with the formation of numerous drag folds. The trend of the folds is generally north-north-east, with local variations to north and north-east.

A major anticlinal cross fold axis trends north-north-west from near the junction of Spring and Gray Creeks to the Boiler Gully area. North of this axis, folds generally plunge at moderate angles to the north, and south of it the plunge is about 40 degrees to the south. Overturning to the west is common along the western margin of the Broken River Formation.

The folding of the Siluro-Devonian succession in the eastern part of the area is difficult to determine owing to the lack of marker beds. It is probably tightly folded, with steep dips and trends ranging from north to east-north-east.

GEOLOGICAL HISTORY

The following reconstruction is based on the fact that the Lucky Creek, Paddys Creek and Perry Creek Formations were essentially contemporaneous and that they interfinger one with the other; and on the premise (not proven) that they were deposited in early Palaeozoic time. No fossils have been found in the metasediments west of the major lineament of the Burdekin River and Hall's Reward Mine area, therefore the age of the metamorphics of the Lucky Creek and Paddys Creek Formations remain in doubt.

Little is known of the Precambrian history. The relationship between the Stenhouse Creek Amphibolite and the Hall's Reward Metamorphics in the Hall's Reward Mine area suggest that in Precambrian(?) time impure calcareous sediments were deposited, partly contemporaneous with quartz sandstone and quartz siltstone, in a shallow crater environment.

After the deposition of the Precambrian(?) sediments they were folded and regionally metamorphosed to the albite-epidote-amphibolite facies. During the waning phase of this metamorphism serpentinite and gabbro (Sandalwood Serpentinite) were intruded, followed later by post-kinematic granite.

The Sandalwood Serpentinite was probably intruded along a Precambrian anticline. Also the serpentinite intrusion is restricted to a linear zone trending south-west from the Hall's Reward Mine to Bauhinia Creek. This intrusion coincided with a welt which later in the Palaeozoic became active and separated two discrete areas of sedimentation, one, an early Palaeozoic calcareous-quartz sandstone facies to the west and the other a later Palaeozoic geosynclinal facies to the east.

In early Palaeozoic or late Precambrian time quartz sandstone and quartz siltstone (Paddys Creek Formation) were deposited in a shallow sea in the Hall's Reward Mine area. The deposits were laid down unconformably on Precambrian(?) Stenhouse Creek Amphibolite and Hall's Reward Metamorphics. To the west of the basin the quartz sandstone and siltstone sequence interfingered with impure calcareous sandstone and siltstone, with some limestone lenses (Lucky Creek Formation); to the east they interfingered with fine-grained sandstone and shale with lenses of conglomerate and limestone (Perry Creek Formation). The interfingering took place approximately along the line of emplacement of the Sandalwood Serpentinite (Plate 10).

These conditions continued until Upper Ordovician or Lower Silurian, when calcareous sediments and biohermal limestone reefs (Carriers Well Limestone) were deposited farther south in the Spring Creek area. Also at this time conditions in the Dinner Creek-Crooked Creek area became unstable, with the uplift of a mass of Precambrian(?) metamorphics (Bauhinia Creek Metamorphics) and the associated Sandalwood Serpentinite and granite. As a result of this uplift a tectonic land mass was formed with a linear geosynclinal trough on its eastern margin and a broad shelf on its western margin (Plate 11).

Possibly contemporaneous, or slightly preceding the uplift, basic volcanics were extruded and some basic intruded (Everetts Creek Volcanics) to the east of the tectonic land mass and near Gray Creek. Here the volcanics intermingled with the calcareous sediments of the Carriers Well Limestone. Possibly in this area small volcanic islands were formed along a line parallel to the uplift in the Bauhinia Creek area. The

In Late Upper Devonian or early Carboniferous time the main orogenic deformation of the area took place. This consisted of folding of the Siluro-Devonian sequence and was accompanied by the emplacement of ultrabasic and basic igneous rocks, and some granitic rocks. Serpentinite and gabbro (Boiler Gully Complex) were emplaced adjacent to the Precambrian serpentinite (Sandalwood Serpentinite) in the Hall's Reward Mine area. The intrusion may have assisted the uplift of the Precambrian basement in the area, with the formation of the Lucky Downs and Hall's Faults along its western and eastern margins. Other serpentinite and gabbro, with related ultrabasic and basic rocks (Gray Creek Complex) were intruded in the Gray Creek area along the line of the earlier Silurian basic vulcanism (Everetts Creek Volcanis). During the period of the main Siluro-Devonian sedimentation differentiation may have taken place in the basic magma chamber, that supplied the Everetts Creek Volcanics and intrusives, and have given rise to a differentiated magma that was later forcibly intruded during the late Devonian or early Carboniferous Orogeny. It is suggested that the ultrabasic and basic suite of the Gray Creek Complex (Plate 12), was formed from the differentiated magma.

During the epi-Devonian orogeny granitic rocks were intruded into the Siluro-Devonian succession in the Gregory Springs area. Granite that intrudes the Lucky Creek Formation may have been emplaced then.

Freshwater sedimentation continued in the Lower Carboniferous but was restricted to an area between the Gray Creek and the Clarke River, and to isolated basins in the Blue Range area. Some marine intercalations occurred in the Blue Range, Gill Creek, and Burnt Coat areas and local scour deposits (Gowrie Conglomerate) were laid down near the base of the freshwater sequence. The advent of freshwater conditions in the Lower Carboniferous, following the freshwater conditions in the Upper Devonian, suggest that the Upper Devonian or early Carboniferous orogeny had little effect on sedimentation. The Carboniferous freshwater sediments were mainly crossbedded conglomerate and sandstone.

In some areas rhyolite, with some andesite, was extruded during the Carboniferous freshwater sedimentation.

Probably in the Late Carboniferous the freshwater sediments were gently folded and intruded by granitic (Oweenee Granite) and dioritic (Emu Creek Diorite) rocks. Also probably during the same period widespread rhyolite and porphyry were emplaced, in some places, e.g. Newcastle Range, this vulcanism was accompanied by caldron subsidence and the formation of ring dykes.

Sediments in Mesozoic and Tertiary time were laid down in freshwater and were largely restricted to the Gregory Springs area, where they form the western edge of the Great Artesian Basin. Some Tertiary(?) shale and conglomerate were deposited in small areas to the north.

In Tertiary time great quantities of basalt were extruded in the northern and southern parts of the region; the main bulk of the basalt was extruded from volcanoes and part probably from fissures. In the central part of the area now covered by flows the basalt filled up the old river valleys of the Einasleigh and Burdekin Rivers, thereby producing twin streams along parts of the river courses.

Sediments which were probably contemporaneous with, or later than, the basaltic extrusion are extensively lateritized. The laterite must therefore have formed in Mid-Tertiary times, or later.

M I N E R A L I Z A T I O N

The Gray Creek/Broken River area is situated near the junction of the Etheridge and Kangaroo Hills Mineral Fields. Mineral production from this part of the field has practically ceased; the Hall's Reward Copper Mine is the main producer in the field with a production each year of about 300 tons of ore and 40 tons of copper during 1956 and 1957.

COPPER

Copper is the most abundant base metal in the area. It is mainly contained in small shears, and ferruginous and siliceous veins, in the Precambrian(?) metamorphics of the Hall's Reward Mine area. These occurrences, together with the copper mineralization of Hall's Reward Mine, have been described by White, Branch and Green (1958). Two other small copper prospects situated about 20 miles south-south-west of the Hall's Reward Mine, are contained in shears in gabbro. The copper mineral is mainly malachite; some pitting has been carried out on these prospects.

NICKEL AND COBALT

Geochemical testing of the serpentinite in the Hall's Reward area has shown that it contains small amounts of nickel and cobalt. Extensive sampling of the serpentinite was not undertaken, but grab samples from the northern part of the Sandalwood Serpentinite, near the Hall's Reward Mine, average 0.2% nickel. Cobalt is present in smaller amounts, generally less than 0.1%.

Higher nickel values (2.55%) occur with manganese (24.75% Mn) and chromium (0.19% Cr_2O_3) in a lens of serpentinite, about 75 feet long and 25 feet wide, one mile south of the Hall's Reward Mine (Plate 7).

As described by White, Branch and Green (1958), nickel and cobalt were detected in laterite overlying the Boiler Gully Complex.

A small area of laterite overlying part of the serpentinite of the Gray Creek Complex was samples, as shown in Plate 13. The results of the analyses are as follows:

Sample No.	Rock Type	% Ni	% Co
1	Pisolitic laterite	0.09	Trace
2	"	0.09	"
3	"	0.18	"
4	"	0.21	"
5	"	0.09	"
6	Lateritic soil	0.11	"
7	"	0.06	"
8	"	0.10	"
9	"	0.12	"

Sample No.	Rock Type	% Ni	% Co
10	Lateritic soil	0.04	Trace
11	"	0.14	"
12	"	0.06	"
13	"	0.07	"
14	"	0.11	0.05
15	"	0.05	Trace
16	"	0.03	"
17	"	0.11	0.06
18	Serpentinite	0.20	Trace
19	"	0.20	0.08
20	Leached serpentinite	0.09	0.06
21	Soil	0.19	0.06
22	Serpentinite	0.12	Trace
23	Serpentinite	0.09	"
24	Amphibolite	Not detected	Not detected

COBALT AT ORTONA COPPER MINE

During the year a recent cobalt find at the Ortona Copper Mine was inspected.

The Ortona Copper Mine has been described by Ball (1915), and by White and Hughes (1957). It is situated on the western bank of the Percy River, about sixty miles south of Forsayth, which is the westerly terminus of the railway from Cairns.

Cobalt and nickel in the form of gersdorffite (Ni, Co, Fe) As S) - identified by W.M.B. Roberts - is exposed in several pits. The pits were sunk to a depth of about 4 feet alongside the No. 1 West Shaft of the Ortona Copper leases. The workings are now inaccessible.

The gersdorffite occurs as 4-inch wide veins over a total width of 6 feet; the veins make up about 20 per cent of the total width of 6 feet. The veins are exposed in surface pits over a total length of 30 feet, between a footwall of diorite and a hangingwall of altered sandstone, which dip at about 60° to the north.

The mineralized cobalt veins occupy a shear zone, which is one of the en echelon shears that contain the siliceous copper lodes at Ortona.

W.M.B. Roberts has described a cobalt specimen from Ortona as follows:-

"The specimen is roughly 5 cm. x 3 cm. and appeared to consist mainly of an iron oxide and a silivery white, fairly hard sulphide mineral.

Two sections were polished and the opaque minerals identified were: gersdorffite ((Ni Co Fe) As A), hematite, a hydrated iron oxide, probably goethite, and very minor amounts of pyrite.

Gersdorffite forms approximately 30% of the specimen, occurring as large irregular areas and as typical

cubes having a good cleavage developed in two directions at 90°. Etching with HNO_3 produced a clearly defined zonal texture also typical of this mineral. Its identity was confirmed by X-ray powder photographs.

Microchemical tests on the mineral gave positive results for Ni, Fe, As, and Co, in that order of abundance.

The only other sulphide present is pyrite, observed only once in this examination as a small irregular area enclosed in the hydrated iron oxide. This hydrated oxide is the principal iron mineral present in the specimen; in places it has formed along the cleavage planes in the gersdorffite, obviously replacing this mineral. It also commonly occurs as large stellate areas and fine-grained aggregates. Within the hydrated oxides, and having the same forms developed, are small masses of hematite, which are probably residuals of the original iron oxide mineral of the rock.

Patches of yellow earthy material coating parts of the surface of the specimen are probably "yellow earthy cobalt", a name given to the decomposition product of certain cobalt minerals".

A specimen of this ore wasfractionated by J.R. Beevers, first by panning and then by electromagnetic separation in the laboratory. The non-magnetic fraction was taken as the pure gersdorffite. The results of the chemical analysis of the ore and pure gersdorffite are:

	Ore	Gersdorffite
Ni	5.04%	17.18%
Co	6.32%	13.37%
Fe	24.01%	5.47%
As	24.86%	45.37%
S	4.29%	18.71%
SiO_2	10.50%	Trace

CHROMIUM

Chromium occurs as chromite in two places in serpentinite intrusions.

The larger of the two chromitite deposits crops out in the eastern valley of Gray Creek, about 20 miles south-south-west of the Hall's Reward Mine (Plate 2). The deposits with some assay results, are shown in Plate 14.

The southern prospect (locality "A" of Plate 14) in this are consists of about seven chromitite lenses which crop out in a serpentinite, gabbro and pyroxenite complex close to the margin of the serpentinite and gabbro. They are exposed discontinuously over a total length of about 1,800 feet, the chromitite comprising about 50 per cent of the total length. The average width of the chromitite deposits is 25 feet. The chromite reserves are estimated at about 6,000 tons of 33% Cr_2O_3 per vertical foot.

The northern prospect (locality "B" of Plate 14) is located about 3 miles north-north-east of the southern prospect, in a separate serpentinite mass. Chromitite is exposed intermittently over a length of about 1,200 feet and an average width of 45 feet. Chromitite occupies about 60% of the total area.

Smaller chromitite deposits occur on the eastern boundary of the Boiler Gully Complex and near the contact between gabbro and serpentinite (Plate 7). The deposits are rarely more than a few feet long, or wide.

GOLD

On the western margin of the Lucky Creek Formation and near the contact of a large intrusive granitic mass, several abandoned shafts and other workings of the Lucky Creek Goldfield were located (Plate 2). Most are sunk on quartz and pegmatite reefs in the metamorphics of the Lucky Creek Formation.

ANTIMONY

Antimony in the form of cervantite and stibnite has been described by Morton (1944) from the headwaters of Gray Creek, about four miles north-east of Pandanus Creek Homestead (Plate 3).

Another small deposits has also been recorded by Morton (1944) in the Broken River Formation, near the confluence of Dosey Creek and the Broken River, about 19½ miles south-west of the Pandanus Creek Homestead (Plate 3).

GEOCHEMICAL TESTING

COPPER

Geochemical sampling and testing for copper of the carbonaceous Stockyard Creek Siltstone (White and Hughes, 1957), in the Langdon River area, Georgetown, were carried out. Tests were confined to the river silts derived from the carbonaceous silstone in the headwaters of Stockyard Creek. The method used was a crude semi-quantitative analysis by the dithizone technique. Unfortunately the green dithizone reagent was extremely unstable under the conditions of heat and light experience in this area. Samples were then tested in the laboratory: the results were discouraging, values ranged between 10 and 25 parts per million of copper.

Geochemical tests for copper were made near the Hall's Reward Copper Mine. Results of these tests have been discussed elsewhere (White, Branch and Green, 1958).

NICKEL

Tests for nickel, using dithizone, were made on serpentinite and overlying laterite in the Hall's Reward Mine and Gray Creek areas. This work has been discussed by White, Branch and Green (1958).

RECOMMENDATIONS FOR FUTURE WORK

GEOLOGICAL

In view of the possibility of a Lower Palaeozoic age for the metamorphics of the Etheridge Goldfield, the following critical areas should be mapped in detail.

(a) The area between the Robertson and Gilbert Rivers, in the southern part of the Georgetown Four Mile Sheet. This should provide evidence for the relationship between the Bernecker Creek Formation and the Etheridge Group.

(b) The Gilberton area. Mapping should be concentrated on the boundary between the Bernecker Creek Formation and the metamorphics along its southern margin. The metamorphics may form part of the westerly extension of the Precambrian(?) metamorphics exposed in the Hall's Reward Mine and Bauhinia Creek areas.

(c) The Woolgar Goldfield, on the central southern portion of the Gilberton Four Mile Sheet. The area is important because it contains the western limit of outcrop of metamorphics. To the west the metamorphics are separated from the Cloncurry/Mt. Isa Precambrian area by about 160 miles of Mesozoic to Recent deposits of the Great Artesian Basin. Two small bodies of Precambrian(?) strata crop out about midway between the Gilberton and Cloncurry areas at Mounts Brown and Fort Bowen.

The three areas recommended for further mapping together with the area between the Burdekin and Herbert Rivers, on the eastern boundary of the Einasleigh Four Mile Sheet, would complete the geological mapping of the Georgetown, Einasleigh, Clarke River and Gilberton Four Mile Sheets.

Detailed mapping should be carried out in conjunction with the geophysical testing of the Gray Creek chromitite deposits.

GEOPHYSICAL

(a) A combined gravity and magnetometer survey should be carried out over the chromitite deposits of the Gray Creek area (Plate 14). This should be extended for about 1½ miles south and 1 mile east of locality "A" (Plate 14), to include the limit of outcrop of the ultrabasic and basic rocks.

In view of the common occurrence of chromite adjacent to the serpentinite-gabbro transition in layered ultramafic complexes, other favourable geophysical prospecting areas are within the serpentinite near the serpentinite-gabbro contacts of both the Boiler Gully Complex and the northern part of the Gray Creek Complex.

(b) An aerial magnetometer and radiometric survey of the Gray Creek area. This area should extend from Pandanus Creek Homestead in the south to about Wairuna Homestead on the Burdekin River in the north. This will test the important north-north-east lineament along the western margin of the Palaeozoic sedimentation.

GEOCHEMICAL

(a) Further geochemical testing of the nickeliferous laterite overlying the serpentinite of the Boiler Gully Complex in the Hall's Reward Mine area, should be carried out. This should aim at testing samples deeper in the lateritic profile than those tested in 1957.

A C K N O W L E D G M E N T S

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APPENDIX I

PRELIMINARY DETERMINATION OF CORAL FAUNAS IN THE PALAEOZOIC SUCCESSION OF THE BROKEN RIVER AND CLARKE RIVER AREAS, NORTHERN QUEENSLAND

by

Dr. D. Hill, University of Queensland.

The following determinations are made on examination of hand specimens without any assistance from thin sections. Thin sections will be prepared for the final determinations.

CARRIERS WELL LIMESTONE MEMBER (Plate 2)

Locality 1209: Polyzoan
Small solitary rugosa
?Propora as from G.S.D.2
?Favosites
Streptelasma sp.

Age: Silurian with a possibility of Ordovician correlatable with G.C.D.2.

Locality 1266: Oolitic limestones, unfossiliferous.
Age: Unknown.

Locality 1671: Heliolites sp.
Age: Ordovician, Silurian or Devonian.

Locality 1209 (Gray Creek area)
?Propora sp.
?Dalmanophyllum sp. or Streptelasma sp.
Small solitary Rugose
?Tryplasma sp.
?Favosites or Multisolenia sp.

Age: Silurian.

Locality 1266: Oolitic limestone
Age: Indeterminable.

Locality C.C.D.1:
Polyzoa or Stromatoporoidea
Favosites sp.
?Tryplasma sp.
?Phaulactis sp.
Halysites sp.
Heliolites sp.

Age: Silurian

Locality C.G.D.2:
Favosites sp.
Halysites 2 species at least
?Heliolites
Tryplasma or Holomophyllum
?Nyctopora
?Propora or ?Calapoecia
Propora
Plasmopora

Age: Silurian probably, though there are some indication of an Ordovician age.

Locality G.C.D.3:

Tryplasma sp.
Plasmopora sp.
[illegible]opora sp.
Heliolites sp.
?Alveolites sp.
Streptelasma sp.
Algae
?Phaulactis sp.

Age: Silurian probably, butlike G.C.D.1 and 2 appear to be older than the Broken R. Silurian Limestone.

GRAVEYARD CREEK FORMATION

Locality B.R.S.17, Point 20, Run 5, Photo 5075, Clarke R.

Halysites (2 species)
Stromatoporoid
Heliolitid
Alveolites sp.
Favosites sp.

Age: Silurian

Locality G.C.D.2090:

Tryplasma or Streptelasma sp.
Favosites or Alveolites
?Albeolites sp.
Favosites sp.
?Disphyllum
Finely branching Stromatopora
Slenderly phaceloid Rugosa
Cerioid Rugosa

Age: Silurian or Lower Devonian, younger than G C.D.1, 2 and 3 and 2104.

Locality G.C.D.2104

Favosites sp.
Halysites (at least 2 species)
Phaulactis sp.
Heliolites sp.
Plasmopora sp.

Age: Silurian. Older than G.C.D.2090.

PERRY CREEK FORMATION

Locality G.C.D.2168

Favosites sp. (at least 2 species)
Propora sp.
Cystiphyllum sp.
?Heliolites sp.
?Halysites sp.

Age: Silurian. Older than G.C.D.2090.

Locality B.R.W.35. From Point 16, Run 4, Photo 5187 Clarke R. Limestone 2.4 miles S.S.W. of Clarke R. Homestead (Eastmost of 3 collections).

Branching Stromatoporoids, probably same as B.R.W.34.
Branching Favosites
Massive Favosites
?Cladopora
?Spongophylloides
Spongophyllum ? halysitoides

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.36. From Point 17, Run 4, Photo 5187 Clarke R. Limestone 2.4 miles S.S.W. of Clarke R. Homestead (southmost of 3 collections).

Tryplasma sp.
Branching Favosites
Branching Stromatoporoid

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.34. From Point 15, Run 4, Photo 5187 Clarke R. Limestone 2.4 miles south-south-west of Clarke R. Homestead (northmost of 3 collections).

Dominated by branching stromatoporoids and Cladopora or Thamnopora. Apparently no Rugosa.
Favosites spp. (branching and massive)

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.31. From Point 8, Run 4, Photo 5187 Clarke R. which is northwestmost of 3 collections nearly 4 miles east-south-east of Clarke R. Homestead. Oolitic in one specimen.

Slenderly fasciculate Cystiphyllum sp.
Favosites spp. (massive and branching)
Ceroid ?Entelophyllum or Xystriphyllum
Slender fasciculate ?Disphyllum of mesa
?Macgreea?
Small brachiopods, crinoid columnals
Rhizophyllum. moderately large species
Tryplasma sp.
Heliolites or Plasmopora

Age: Probably Lower Devonian.

Locality B.R.W.32. From Point 8A, run 4, Photo 5187 Clarke R., which is eastmost of 3 collections from nearly 4 miles south-south-east of Clarke R. Homestead. Oolites.

Cladopora sp. or Thamnopora sp.
Small brachiopod.

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.33. Possibly 8B/4/5187 C.R., which is southmost of 3 collections, about 4 miles east-south-east of Clarke R. Station.

Branching Favosites. Crinoid columnals.

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.41. From Point 23, Run 4, Photo 5187, Clarke R., 4 miles east-south-east of Clarke R. homestead (near B.R.W.31 and B.R.W.32).

Cystiphyllum sp.
Favosites sp.

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.42. From Point 21, Run 4, Photo 5187, Clarke R., 1.6 miles south-east of Clarke R. Homestead.

Slenderly fasciculate Rugose coral - sections required.
Cladopora sp.
Tryplasma sp.
Favosites spp.

Age: Upper Silurian or Lower Devonian.

Locality B.R.W.37. From Point 2, Run 2, Photo 5087, Clarke R., i.e. 2.4 miles west of Christmas Ck. Homestead.

Favosites sp.
Cystiphyllum sp.
Stromatoporoids, crinoid columnals
Tryplasma sp.
Cladopora sp.
?Halysites sp.

Age: Upper Silurian or Lower Devonian, possibly Upper Silurian.

Locality B.R.W.38. From Point 2, Run 2, Photo 5087 Clarke R., i.e. 2.4 miles west of Christmas Ck. Homestead.

Stromatoporoids, crinoid columnals, and agl algae in limestones.
Favosites sp.
Thamnopora sp.
Cladopora sp. or polyzoan
Cystiphyllum sp.
Spongophyllum sp. (phaceloid)
Tryplasma sp.
Plasmopora sp.
?Halysites sp. (thin section required for certainty)
?Fasiphyllum sp.

Age: Upper Silurian or Lower Devonian, possibly Upper Silurian.

Locality B.R.W.47. Point 1, Run 2, Photo 5087, Clarke R.

Favosites spp.
Favosites or Striatopora sp.
?Cystiphyllum sp.
Tryplasma sp.

Age: Silurian or Devonian, probably Silurian.

B.R.W.39. From Point 1, Run 3, Photo 5103 Clarke R., 2.4 miles south-south-west of Christmas Ck. Homestead.

Favosites sp.
Favosites or Alveolites sp.
Solitary Rugose corals seen in oblique section (thin sections needed, including ?Holmophyllum).
?Halysites

Age: Upper Silurian or Lower Devonian, possibly Upper Silurian.

B.R.W.40. From Point 2, Run 3, Photo 5103 Clarke R., 2.8 miles south-south-west of Christmas Ck. Homestead.

Streptelasma sp.
Fasciculate Tryplasma or Pycnostylus
Favosites spp.
Halysites sp.
Tryplasma sp. large, solitary.
Oblique sections of solitary Rugosa, requiring thin sections.
Alveolites sp.
Encrusting Stromatoporoids.
The large brachiopod Conchidium

Age: Probably Upper Silurian.

B.R.W.44. From Point 6, Run 1, Photo 5011, Clarke R.
Favosites sp.
?Alveolites sp.
Pseudamplexus or Mucophyllum sp.
Halysites sp.
Favosites or Striatopora
Solitary Rugose coral
Cystiphyllum sp.
?Tryplasma sp.

Age: Silurian. Correlation: with B.R.W.45 & 46.

B.R.W.45. From Point 5, Run 1, Photo 5011, Clarke R.
Alveolites sp. (very fine)
Favosites spp.
Halysites sp.
Solitary Rugose coral
Favosites or Striatopora sp.
Ceroid ?Entelophyllum sp.

Age: Silurian Correlation: with B.R.W.44 & 46.

B.R.W.46. From Point 3, Run 1, Photo 5011, Clarke R.
?Tryplasma sp.
Heliolites sp.
Halysites sp.
Favosites spp.
Cystiphyllum sp.
Favosites or Striatopora sp.
Solitary Rugose coral
?Propora sp.

Age: Silurian Correlation: with B.R.W.44 & 45.

BROKEN RIVER FORMATION

B.R.S.69
Favosites sp.
Heliolites or Plasmopora
Branchiopods
Alveolites sp.
?Rhizophyllum sp.
Halysites sp.
Tryplasma sp.
?Phaulactis sp.

Age: Silurian

B.R.S. 70
Heliolites or Plasmopora
?Tryplasma or ?Pycnostylus
Favosites sp.
Small brachiopods as for 69?

Age: Silurian or Devonian. Nothing very diagnostic.

B.R.S.71 Cladopora or fine Thamnopora

Age: Silurian or Devonian.

B.R.S.72
Favosites sp.
Xystriphyllum or Spongophyllum
Alveolites sp.

Age: Silurian or Devonian, probably the latter.

B.R.S.42
Favosites sp.
?Radiophyllum or Phaulactis sp. solitary
?Pseudamplexus or ?Kodonophyllum
?Tryplasma or ?Disphyllum
Cystiphyllum
?Xystriphyllum or ?Prismatophyllum

B.R.S.42 (cont'd) ?Columnaria or ?Pleurodictyum slides required.
?Tryplasma sp.

Age: Doubtful - Silurian or Devonian; possibly Lower Devonian.

B.R.S.63
Heliolites
Favosites
Tryplasma
Leptaenid brachiopod
Rhynchonellid

Age: Silurian or Lower Devonian. A good deal older than 55-62.

B.R.W.48
Trochoid dissipimented Rugose coral
Cystiphyllum? sp.
Alveolites
Very small solitary Rugosa
?Fasciphyllum or Spongophyllum but ?solitary
Heliolites or Plasmopora
Thamnopora sp.
?Acanthophyllum sp.
T. cf. angulata
Favosites
Massive stromatoporoid
Branching stromatoporoid
?Disphyllum

Age: Possibly Lower Devonian.

B.R.W.49
Branching stromatoporoid
Tryplasma
Favosites
Slender fasciculate Rugosa ?Disphyllum
?Fasciphyllum
Slender fine Thamnopora

Age: Possibly Lower Devonian.

B.R.S.18, Point 28, Run 5, Photo 5075, Clarke R.
Favosites spp.
Pseudamplexus ?Princaps
Heliolites or Plasmopora
Acanthophyllum sp.

Age: Possibly Lower Devonian.
Correlation: I think it very probable that when thin sections are cut this limestone will correlate with that on Gray Ck. 5 miles east-north-east of Pandanus Ck. Homestead.

B.R.S.19, Run 5, Point 39, Photo 5075, Clarke R.
Favosites spp.
?Acanthophyllum sp.

Age: Devonian either Lower or Lower Middle Devonian. Thin sections are required before correlation can be indicated.

B.R.S.51
?Acanthophyllum
Heliolites
?Pseudamplexus

Age: Probably Devonian.

Point 5, Run 4, Photo 5163, Clarke River.
Nos. given to specimens, 167-170; conglomerate.
Fauna: Pebble with calice or large solitary Rugosa; stromatoporoid pebbles; and pebbles of Alveolites, and Disphyllum.

Age: Probably Devonian.

Correlation: Doubtful.

B.R.S.49

Acanthophyllum
?(Rhopalophyllum)
?Blothrophyllum or Omphyna
?Metriophyllum
?Disphyllum
Cystiphyllum
Heliolites

Age: Devonian, possibly early Couvinian.

B.R.S.58

Digonophyllum (Mochlophyllum) sp.
Thamnopora
Alveolites
Heliolites

Age: This small assemblage is certainly Middle Devonian and suggests either the top of the Eifelian or the base of the Givetian, i.e. Middle Middle Devonian.

Point 15B, Run 7, Photo 5167, Clarke River.

Nos. given to specimens, 192, 193 (100 yards north of 192 apparently).
Fauna: Xystriphyllum sp.; Favosites sp. (193)

Age: Middle Devonian.
Correlations: Too small a fauna for safe correlation.

B.R.S.62

Gastropods (bellerophons and others)
Columnaria (Favistella) cf. rhenana
Endophyllum sp. small cerioid as for 59, 60 and 52 and 25.
Heliolites porosa
?goniatite
Acanthophyllum or Pseudochonophyllum
Cystiphyllum sp.
Thamnopora sp.

Age: Middle Devonian (Givetian) same as or close to 61.

B.R.S.55. Non coralline specimens (in Bulk Store Drawers).

Fenestellid
Spiriferids
Stropheodontid with Aulopors
Atrypa 2 species (dominant)
Orthid (Szhizophoria?)
Pentamerid (smooth)
Stromatoporoid
Crinoid cup
Gastropods (3)
Bellerophontid gastropod
Trilobite (one)
Corals
Calceola (common) 2 species
Cystiphyllum (?Zonophyllum)
Thamnopora
Litophyllum
Heliolites
Alveolites (massive) 2 species
Large solitary, Acanthophyllids with encrusting Aulopora
Metriophyllum
Grypophyllum or Leptoinophyllum
?Dohmophyllum very large, funnel shaped.

Age: Middle Devonian. Early Givetian or Late Couvinian.

B.R.S.60

Heliolites sp.
Amphipora sp.
Cystiphyllum sp.
Endophyllum sp.(small cerioid species cf.59 and 52)

Age: Middle Devonian, probably at overlap of Couvinian and Givetian.

B.R.S.13, Point 4, Run 8, Photo 5047, Clarke R. on Broken R. 6.4 miles west of Broken R. Crossing on road from Wandovale to Pandanus Ck. Station.

Alveolites sp.
Heliolites porosus
?Litophyllum
Solitary Rugosa
Thamnopora sp.
Stromatoporids

Age: Middle Devonian, possibly Upper Middle Devonian.

B.R.S.43

Favosites sp. large solitary
Cystiphyllum sp.
Endophyllum sp. different from B.R.S.38 etc. - placoid.
Alveolites sp.
Disphyllum (?Megaphyllum)
Heliolites sp.
Large ?Acanthophyllid.
Stromatoporoid

Age: Devonian, probably Upper Middle Devonian (Givetian).

B.R.S.44

Numerous brachiopods of Givetian aspect, but no Stringocephalus
Trilobites (rather poor)

B.R.S.12, from Point 1, Run 3, Photo 5047, Clarke R. Calcareous shales on Broken R. 5.4 miles west of Broken R. Crossing on road from Wandovale to Pandanus Ck. Station.

Atrypa sp.
Metriophyllum sp.
Spirifer large, smooth
Leioclema sp.
?Productella sp.
Pentamerid brachiopod
Trilobite
?Fish scale
Chonetes

Age: Middle or Upper Devonian, probably Middle Devonian.

B.R.S.67.

Frond of Archaeopteris possibly. Archaeopteris is a Devonian plant, but its fronds are very similar to those of the Carboniferous Rhacopteris, and I do not know whether a specialist could be sure to which form genus this infertile frond should be ascribed.
Heliolites sp.
Favosites sp.
?Stringophyllum sp.
Stromatoporoids - massive and slenderly branching Columnaria ?Favistella cf. rhenana
?Disphyllum sp.
?Xystriphyllum or Hexagonaria

Age: Devonian, probably Upper Devonian.

B.R.S.31 Unidentifiable ?crustacean fragments.
Age: Indeterminable.

B.R.S.56 Small black gastropods.

B.R.S.54 Chitinous or carbonaceous problematica.

JACK LIMESTONE - B LENS

B.R.S. 26
Halysites, 2 species
Favosites
Pseudamplexus or Tryplasma
?Phaulactis

Age: Silurian.

JACK LIMESTONE - D LENS

B.R.S.46
?Dalmanophyllum sp.
Phaulactis or Entelophyllum sp.
Favosites gothlandica
Propora sp.
Heliolites or Plasmopora
Cystiphyllum sp.
Tryplasma sp.
Heliolites sp.
Alveolites sp.
Large gastropod
Favosites ?maximus

Age: Silurian.

B.R.1, Point 1, Run 8, Photo 5049, Clarke River.
Favosites, 2 species
Heliolites, possibly daintreei, and possibly a second species.

Age: Silurian or Devonian. Fauna not diagnostic in hand specimens. Slides will be cut.

B.R.2, Point 2, Run 8, Photo 5049 Clarke River.
Entelophyllum vassense (Eth).
Favosites
Heliolites or Plasmopora
Tryplasma

Age: Upper Silurian or Lower Devonian.
Correlation: Cannot be far in horizon from G.35 and G.36, and could be identical.

BROKEN RIVER LIMESTONE - C LENS

B.R.S.7, from Point 34, Run 8, Photo 5049 Clarke R., eastern edge of 'Pinnacle' Limestone, on north bank of Broken R.
Heliolites sp.
Favosites sp. (massive and branching)
Tryplasma sp. cf. lonsdalei
Tryplasma sp. cf. congregationis Etheridge
?Cladopora sp.
Large solitary Streptelasmid Rugosa

Age: Upper Silurian probably.

B.R.S.8, Point 1, Run 8, Photo 5050 Clarke River, western edge of 'Pinnacle' Limestone, on north bank of Broken River.

Entelophyllum yassense
Heliolites daintreei
?Plasmopora sp.
Favosites spp.
?Alveolites sp.
Massive stromatoporoid
Large solitary Rugosa, section required
Tryplasma congregationis or liliiformis
?Hercophyllum sp.

Age: Upper Silurian.

B.R.S.9, Point 7, Run 8, Photo 5049, Clarke River Middle of 'Pinnacle' Limestone on south bank of Broken River.

Favosites sp. (massive)
Heliolites daintreei
Tryplasma sp.
Propora sp.
Stromatoporids
Cystiphyllum ? siluriense
Small solitary Rugosa

Age: Upper Silurian.

B.R.S.27

Favosites sp.
Heliolites sp.
Cystriphyllum sp.

Age: Silurian or Devonian, material not diagnostic.

B.R.S.50

Ketophyllum sp.
Entelophyllum yassense sp.
?Pseudamplexus sp.
Favosites sp.
Cystiphyllum sp.

Age: Silurian.

JACK LIMESTONE - A LENS

B.R.S.20, Point 40, Run 5, Photo 5075, Clarke R.

?Tryplasma sp.
Gastropods
Stromatoporoids
Favosites spp.
Solitary Rugose coral

Age: Silurian or Devonian.

JACK LIMESTONE - B LENS

B.R.S.37

?Acanthophyllum sp.
Favosites 3 species
Pseudamplexus princeps
Atrypa sp.
Xystriphyllum or Hexagonaria, small celled species.
Gastropods (3 genera)
Thecia or Stromatoporoid
Heliolites or Plasmopora
Cystiphyllum
?Radiophyllum
Crinoid calice
Nautiloid (2 genera)
?Omphymana sp.
Pandanophyllum new gen et sp.
Alveolites
?Spongophyllcides cf. thonasi.

Age: Lower Devonian (?Emsian).

B.R.S.34, Broken River Formation, Limestone Breccia Bed.

Xystriphyllum sp.
Amphipora ramosa
Stromatoporoid
Pselophyllum
Heliolites porosa
Thamnopora or Cladopora
Alveolites sp.
Phillipsastraea ?aperta
Calceola sandalina
Favosites
?Sinospongophyllum

Age: Middle Devonian, near top of Couvinian or base of Givetian.

Point 4, Run 4, Photo 5167, Clarke River.
Nos. given to specimens, 194-204, limestone conglomerate.
Fauna: Phillipsastraea sp., solitary Rugosa (2 specimens requiring thin sections, Alveolites, Heliolites.

Age: Middle Devonian.
Correlation: Lithology suggests correlation with collection 3/4/5167 of last year. There is nothing in either fauna against this.

BROKEN RIVER FORMATION - D LENS

B.R.S.21, Point 43, Run 5, Photo 5075, Clarke R.

Favosites spp.
Heliolites sp.
Solitary ?Disphyllid
Very large solitary Cystiphyllum, seemingly of Devonian type.
Pseudamplexus sp.
Acanthophyllum sp. or Radiophyllum sp.

Age: Lower or Lower Middle Devonian probably. Can tell better from thin sections.

B.R.S.22, Point 44, Run 5, Photo 5075, Clarke R.

Phillipsastrea ?ocellata
Acanthophyllum or Dohmophyllum sp.
Cystiphyllum sp.
Favosites spp.
?Stringophyllum sp.
Calceola sp.
Phacellophyllum sp.
Alveolites sp.
Coenites sp.

Age: Middle Devonian.

B.R.S.41. Phillipsastrea ?ocellata as for 38, 24 & 40.
Calceola sandalina
Stringophyllum sp.
Phacellophyllum small species and large species
Coenites sp.
?Sinospongophyllum sp.
Cystiphyllum sp.
Heliolites porosa
Acanthophyllum sp. large solitary
Xystriphyllum or Dohmophyllum weakly compound, cerioid
Favosites or Alveolites (moderately thick branches)
Alveolites sp.
Thamnopora sp.
Favosites sp.

Age: Middle Devonian, probably Upper Couvinian.

B.R.S.40, Broken River Formation, D Limestone Lens.

Cladopora sp.
Cystiphyllum sp. (large solitary)
Favosites sp.
Phillipsastraea - Pachyphyllum
Stromatoporoid
Thamnopora sp.
?Striatopora sp.
Acanthophyllum sp.
Heliolites sp.
?Pseudamplexus sp.
?Trapezophyllum sp.
Alveolites sp.
Phillipsastrea ?ocellata
Syringopora 2 spp.
Xystriphyllum magnum?

Age: Middle Devonian, probably Lower Middle Devonian (Couvinian).

B.R.S.59, Broken River Formation, I Limestone Lens

Calceola sp.
Spongophyllum (cerioid species)
Spongophyllum cf. torosum
Alveolites sp.
Stringophyllum cf. isactis.
Mesophyllum sp.
Heliolites porosa
?Dohmophyllum
Acanthophyllum (?Rhopalophyllum)
Grypophyllum
"Camophyllum"
?Endophyllum (small, cerioid species)
as from 52)
Atrypa
?Grunewaladtia
Rhynchonella
Crinoid calyx

Age: This assemblage in Germany characterises the top of the Eifelian and the base of the Givetian. That is, it is Middle Middle Devonian.

B.R.S.57, Broken River Formation. J Limestone Lens

Heliolites sp.
Cystiphyllum sp.
?Dohmophyllum sp.
Thamnopora sp.
?Stringophyllum ?isactis
Small Endophyllum as at 52 and 25.
Acanthophyllum sp.
Endophyllum schluteri?

Age: Middle Devonian, probably early Givetian.

B.R.S.10, Front Point 36, Run 8, Photo 5049, Clarke R., Limestone. In Broken R. 2.8 miles west of Broken River Crossing on road from Wandovale to Pandanus Ck. Stn. (west of Pinnacle Limestone).
Broken River Formation, G Limestone Lens.

Moderately small smooth brachiopod
Favosites sp.
Alveolites sp.
Stromatoporoids
?Thamnopora or ?striatopora
Solitary Rugosa

Age: Silurian or Devonian, probably Devonian.

B.R.5 - Point 17, Run 8, Photo 5049, Clarke River.
Alveolites sp.
Favistella sp. ?rhenana

Age: Possibly Upper Middle Devonian.
Correlation: Since it contains Favistella sp. cf. rhenana it may well be Upper Middle Devonian like the limestone on either side of Gray Creek.

B.R.S.25, Broken River Formation, E Limestone Lens.
Acanthophyllum
Stromatoporoid
Alveolites
?Stringophyllum cf. isactis
Thamnopora
Cystiphyllum
Small cerioid ?Endeophyllum
?Amphipora ramosa
Heliolites porosa

Age: Devonian, possibly Middle Devonian.

B.R.S.52 =25
Sanidophyllum colligatum
Spongophyllum cf. Künthi or small celled Endophyllum
Disphyllum cf. goldfussi
Alveolites
Cystiphyllum sp.
Thamnopora sp.
?Temnophyllum sp.
Heliolites sp.
?Amphipora sp.
Stromatoporoid
?Columnaria (Favistella) cf. rhenana
?Stringophyllum sp.
?Phillipsastrea sp.
Litophyllum sp.
Acanthophyllum sp.
Xystriphyllum sp.

Age: Middle Devonian, probably mid-Givetian.

B.R.S.38. Broken River Formation. C Limestone Lens.
Endophyllum cf. abditum
Large solitary Acanthophyllum sp.
Cylindrical branches (thick) Alveolites or Favosites
Phillipsastraea ?Ocellata
Calceola sandalina
Disphyllum (Phacelophyllum) sp.
Acanthophyllum sp.
?Sinospongophyllum sp.
Alveolites sp.
?Dohmophyllum sp.
?Tipheophyllum sp.
Favosites 2 species
Heliolites porosa
Atrypa sp.
Syringopora sp.
?Grypophyllum sp.
Stromatoporoids
Alga or Amphipora?
Slenderly branching Alveolites

Age: Middle Devonian, probably Upper Couvinian.

Point 12, Run 6, Photo 5117, Clarke River.
Nos. given to specimens: 271-308. Brachiopod and Tabulate coralline limestone.
Fauna: Stringocephalus ventral valve only; Chonetes, Atrypa; smooth Spirifer; Alveolites, Alveolites, Thamnopora (2 species); small trilobite pygidium.

Age: Upper Middle Devonian (Givetian).
Correlation: Broadly with 5/4/5167, 10/5/5073, 1/5/5071 and 10/6/5117.

Point 13, Run 6, photo 5117, Clarke River.
Nos. given to specimens: 171-176; 183-191; coralline stromatoporoid and brachiopod limestone.
Fauna: Stringocephalus (doubtful), Mesophyllum, Calceola, Alveolites, Heliolites, Thamnopora or Coenites, Amphipora and other stromatoporoids.

Age: Upper Middle Devonian (Givetian).
Correlation: Broadly with 12/6/5117.

Point 10, Run 6, Photo 5117, Clarke River.
Nos. given to specimens: 205-270. Coralline limestone.
Fauna: Dominated by Favistella cf. rhenana; also has a few solitary corals, one being Stringophyllum bipartitum, others either Disphyllum or Macgeea; tabulata are ?Litophyllum, Favosites goldfussi, Thamnopora (rare, Alveolites (rare), Xystriphyllum or Hexagonaria, gastropods (both turreted and planispiral, branching and dense stromatoporoids (?Idiostroma).

Age: The dominance of F. rhenana indicates an Upper Middle Devonian (Givetian) age.
Correlation: Broadly with 5/4/5167 and 10/5/5073. Broadly also with 1/5/5071, though there may be differences of horizon within the Givetian between these.

B.R.S.24
Phillipsastrea compare with that from B.R.S.38)
Sinospongophyllum? sp.
Favosites sp.
Alveolites sp.
Disphyllum

Age: This assemblage is Devonian, probably Middle Devonian.

B.R.S.39
Calceola sp.
Heliolites sp.
Disphyllum (Phacellophyllum) larger species
?Grypophyllum or Tipheophyllum sp.
Cystiphyllum sp.
Favosites sp.
?Sinospongophyllum
Acanthophyllum large species

Age: Middle Devonian, probably Upper Couvinian.

Point 5, Run 4, Photo 5167, Clarke River.
Broken River Formation, A Limestone Lens (Plate 3).
Nos. given to specimens: 151-166, coralline limestone.
Fauna: Amphipora ramosa, Thamnopora, Alveolites, Disphyllum sp. and hemispherical stromatoporoids.

Age: Middle Devonian.
Correlation: If one assumes that the fauna in last year's collection is from the same locality, it can be regarded as Upper Middle Devonian (Givetian), since the latter has Favistella cf. rhenana present, a form characteristic of the Reid R. Limestone at Calcium.

Point 10, Run 5, Photo 5073, Clarke River.
Nos. given to specimens: 177-182, Dark brachiopod and coral limestone.
Fauna: Stringocephalus burtini; a new genus of thick-shelled lamellibranch; and Favistella cf. rhenana.

Age: Upper Middle Devonian (Givetian).
Correlation: The same lamellibranch (and also possibly Stringoceochalus) appears to occur in specimens 82 and 111 from Point F, Run 1, Photo 5037 Atherton, 2 miles south-east of Rookwood, which should therefore be Givetian.

B.R.S.35.
Temnophyllum sp.
Alveolites sp.
Calceola sp.
Stringocephalus sp.
Amphipora ramosa
Stromatoporoidea
Thamnopora

Age: Middle Devonian; probably Upper Givetian.

B.R.S.36.
New genus and species of lamellibranch, same as from Point 10, Run 5, Photo 5073.

Age: Upper Middle Devonian (Givetian).

BUNDOCK FORMATION (Plate 5)

B.R.S.16, Point 1, Run 11, Photo 5183, Clarke R., 1. e. 4.8. miles northeast Gregory Springs.
Thamnopora sp.
Macgeea or Disphyllum sp.
Fish spine or bone
Disphyllum spp. (slender, fasciculate)
Romingeria? sp.
Stromatoporid

Age: Middle or Upper Devonian, probably Upper Devonian (Frasnian).

B.R.S.68, Bundock Formation
Brachiopods in matrix
Fish tooth
Small Eumophaloid gastropods
Small turreted gastropods.

Age: Devonian or Lower Carboniferous. These want brooding over after development. I am going to try for conodonts.

S.G.1-9, Front Point 5, Run 4, Photo 5005, Clarke R., i.e. 11.2 miles north-east of Blue Range Homestead.

S.G.1 Lepidodendron australe

S.G.3 Small brachiopod

S.G.4 Small brachiopod
? Productella
Coral ?Cystiphyllum

S.G.5 Algal Limestone and small Emmonsia

S.G.6 Algal Limestone and Corals

S.G.7 Algal Limestone with Corals

S.G.8 ?Brachiopod?
Plant stems and Crinoid fragments

S.G.9	Gastropod
S.G. M1	Algal Limestone ? Small brachiopod ? Chonetid Plant stems Lepidodendron australe
S.G.1	9 and S.G.M1 and either Upper Devonian or Lower Carboniferous. Thin sections are necessary.

C.R.W.17 , Clarke River Formation.
Unidentifiable fossil vegetable matter.
Age: Unknown.

C.R.W.18; Unidentifiable plant fragments.
Age: Unknown.

C.R.W.19 Lycopod impression with leaf (or root basis) arranged in vertical series.
Age: Upper Devonian or Lower Carboniferous.

C.R.W.20 Lycopod impressions
Lepidodendron of Veltheimianum type.
Age:

C.R.W.21
Spiriferids
Small flat gastropods (at least 3 types; one with tubercles).
Crinoid columnals
Lepidodendron of Veltheimianum type
Chonetes sp.
Small lamellibranch
Concentrically ribbed lamellibranch.
Age: Upper Devonian or Lower Carboniferous.

This of these collections, two (B.R.W.48 and 49) could well be Lower Devonian, while the remainder are either Upper Devonian or Lower Carboniferous.

C.R.W.16 21/5/5082 Clarke R.
Lepidodendroid fragments
Age: Upper Devonian or Lower Carboniferous.

CLARKE RIVER FORMATION

2259
Chonetes
Lamellibranch with concentric ribbing
Gastropods (at least 2 types)
Straight nautiloid
?Productella (small, concentrically ribbed)
?Streptorhynchus (very small)
?Aviculopectenoid
?Productus
Smooth lamellibranch
Age: Devonian or Lower Carboniferous (Possibly some resemblance to B.R.S.68).

TABLE II

COMPARISON OF CORAL FAUNAS OF THE LIMESTONE MEMBERS OF THE SILURO-DEVONIAN PERRY CREEK AND FOUR MILE CREEK FORMATIONS

Formation	Perry Ck. Formation				Four Mile Ck. Formation		
Member / Fauna	Tin Hut	Clarke X'ing	Mary-vale Creek	Tele-graph	Thatch Creek	Marble Creek	Thatch Creek Western Outcrop
Favosites	x	x	x	x	x	x	x
Tryplasma	x	x	x	x	x	x	x
Thamnopora	?		?		x		x
Cladopora	?	x	x		x		
Halysites				x	x	x	
Cystiphyllum	x				x	x	?
Entelophyllum	?					x	
Heliolites	?					x	
Plasmorpora	?				x		
Disphyllum	?						?
Spongophyllum			?		x		
Xystriphyllum	?						
Alveolites				x		x	
Macgreea	?						
Rhizophyllum	x						
Fasiphyllum					x		
Holomophyllum				?			
Streptelasma				x			
Pycnostylus				?			
Pseudamplexus						?	
Mucophyllum						?	
Striatopora						?	?
Propora						?	
Fasciphyllum							?
Crinoid	x				x		
Brachiopods	x			x			
Stromatopora			x	x	x		x

x = Present ? = Possibly Present

Determinations made on hand specimens by Dr. D. Hill (Appendix I)

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

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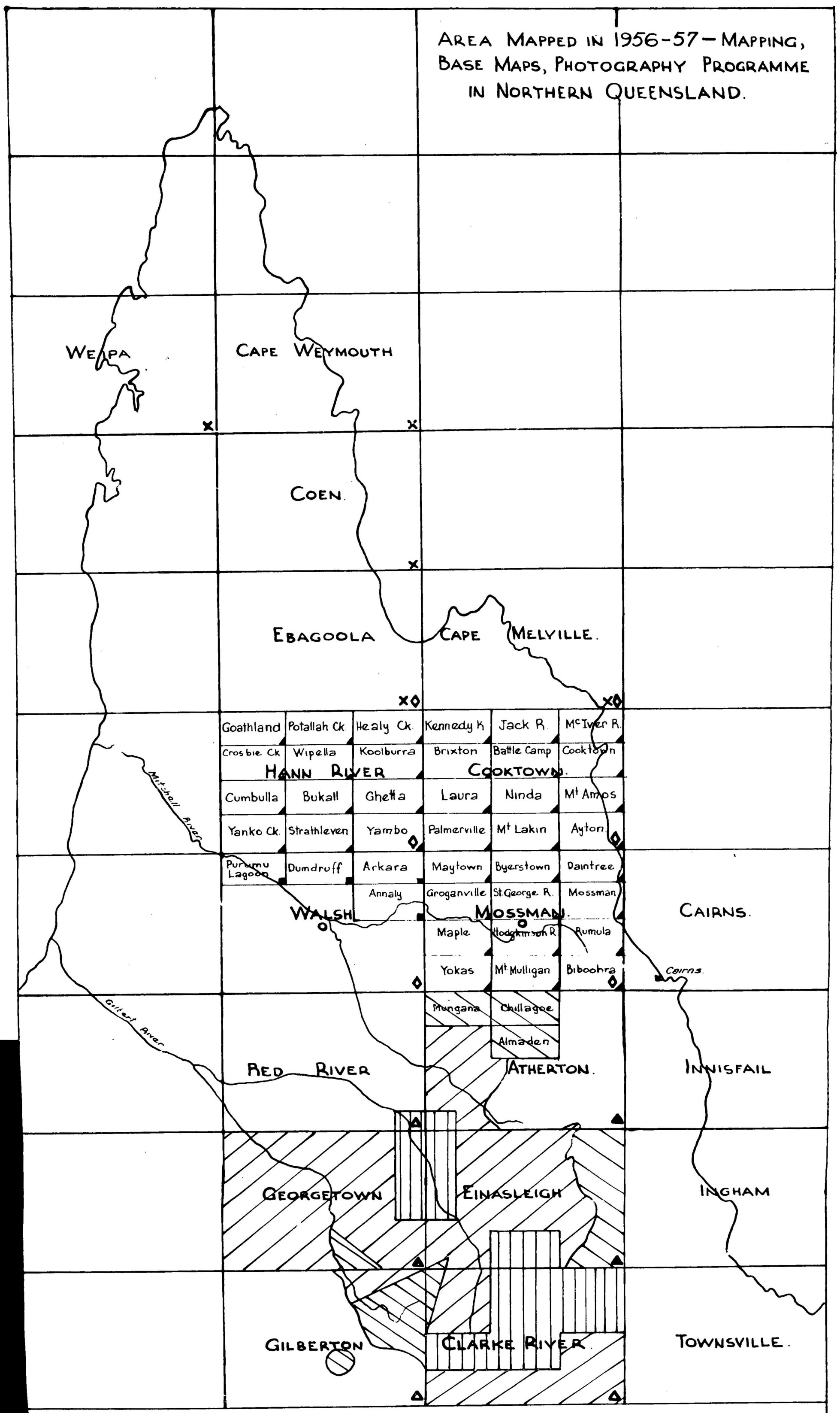
PLATES TO ACCOMPANY

PROGRESS REPORT ON REGIONAL GEOLOGICAL MAPPING OF NORTHERN QUEENSLAND, 1957. GRAY CREEK, BROKEN RIVER, AND CLARKE RIVER AREAS.

by

D.A. White, J.R. Stewart, C.D. Branch,
D.H. Green and D.H. Wyatt.

AREA MAPPED IN 1956-57 — MAPPING, BASE MAPS, PHOTOGRAPHY PROGRAMME IN NORTHERN QUEENSLAND.



Area covered by regional and reconnaissance mapping, 1956.

Area covered in detail, 1957.

Proposed mapping, 1958.

▲ Aerial photographs received 1957.

■ Aerial photographs ordered 1956-57.

○ Air photomosaics ordered 1957 season.

▲ Planimetric base maps received, Nov. 1957.

△ Planimetric base maps ordered Oct. 1958.

◇ Planimetric base maps ordered 1958/59.

× Photography 1957/58
1958/59

PLATE I

GEOLOGICAL FIELD SHEET - 1957
GRAY CREEK-LUCKY CREEK AREA, NORTH QUEENSLAND

WYANDOTTE

DAY RIVER

BURDEKIN RIVER

SANDALWOOD

BURDEKIN RIVER

LEGEND

RECENT:
- Alluvium
- Soil Cover

TERTIARY
- Tb — Basalt
- Tl — Laterite and Lateritic Soils

CARBONIFEROUS (Lower-Middle)
- Cc — CLARKE RIVER FORMATION (Quartz conglomerate and sandstone, feldspathic sandstone, rare siltstone. Mainly freshwater.)
  - Limestone Member (Brachiopod limestone with calcareous sandstone)

SILURO-DEVONIAN
- S-Dg — GRAVEYARD CREEK FORMATION (Greywacke sandstone & siltstone, limestone lenses, quartz-greywacke sandstone & siltstone, conglomerate; g-slight hornfelsing)
  - S-Dc — Crooked Creek Greywacke Conglomerate Member
  - Quartz-Greywacke
- S-Dp — PERRY CREEK FORMATION (Quartz sandstone & siltstone, calcareous siltstone, slate, jasper, limestone lenses, conglomerate, quartz-greywacke siltstone.)
- S-De — EVERETT'S CREEK VOLCANICS (Basalt, feldspar-porphyry, agglomerate, greywacke, probable tuffs.)

SILURIAN
- Sa — CARRIER'S WELL FORMATION (Quartz-greywacke siltstone & sandstone, red & green chert breccias.)
  - Sa — Limestone Member (Lenticular biohermal & oolitic limestones)

LOWER PALAEOZOIC (?)
- Pzlp — PADDY'S CREEK FORMATION (Quartz sandstone & siltstone, phyllite, quartzite.)
- Pzll — LUCKY CREEK FORMATION (Calcareous sandstone & siltstone, calcareous greywacke, limestone, locally metamorphosed to calc-silicate hornfels.)

PRECAMBRIAN?
- pC?s — STENHOUSE CREEK AMPHIBOLITE (Mainly amphibolite)
- pC?h — HALLS REWARD METAMORPHICS (Quartz-mica schist, quartzite.)
- pC?b — BAUHINIA CREEK METAMORPHICS (Hornblende-quartz hornfels, quartzite, phyllite)

IGNEOUS ROCKS
- Pzu — Quartz & quartz-feldspar porphyry (Upper Palaeozoic)
- Granite (Post-Lower Palaeozoic)
- Hornblende diorite – ranging to gabbro & to quartz-diorite
- se — Serpentinite – serpentinized dunite & peridotite
- Pyroxenite – serpentinized in part.
- Gabbros & other basic rocks (Amphibolites, gabbro, diorite, fine pyroxenites)
- Granite (Precambrian?)
- Dyke or vein (a=aplite; ab=albitite; b=basic; j=jasper; q=quartz)
- Quartzite marker bed
- Formation boundary – position accurate.
- " " " approximate.
- " " – inferred.
- " " " & concealed
- Fault
- Shear zone
- Trend lines
- Strike & dip of bedding.
- " " " foliation in metamorphics.
- " " " banding & platiness in gabbros.
- " " " cleavage in sediments.
- Drag fold with plunge
- Lava flows with direction in which flow tops face
- Trends in hornfels (b=biotite; e=epidote; h=hornblende; q=quartz.)
- Cu — Mine or prospect (Cu=copper; Cr=chromite)
- Fossil locality

APPROXIMATE SCALE
One Mile to One Inch
1 ½ 0 1 2 3

N — MILLARD GRID NORTH

Soil Cover on Granite?

Soil & Tl

MONTGOMERY RANGE

Geological Field Sheet 1959

LEGEND

CAINOZOIC

TERTIARY

	Tb	*Basalt*
	Tl	*Laterite*

PALAEOZOIC

UPPER PALAEOZOIC.

Montgomery Range Porphyry	Pzum	*Rhyolite and quartz-porphyry*

CARBONIFEROUS.

Clarke River Formation	Cc	*Mainly freshwater conglomerate, quartz greywacke, siltstone.*

DEVONIAN-CARBONIFEROUS

Yate's Creek Granite	D-Cgy	*Granite*

UPPER DEVONIAN

Bundock Creek Formation	Dub	*Mainly freshwater quartz greywacke, shale*
Red Range Conglomerate Member	Dur	

SILURO-DEVONIAN

Broken River Formation	S-Db	*Limestone, quartz greywacke, shale, with lenses of conglomerate.*
Pandanus Creek Limestone Member	Dmp	
Six-mile Yard Limestone Member	Dmy	
Jessie Springs Limestone Member	Dmj	
Dosey Creek Limestone Member	Dmd	
Lockup Well Limestone Member	Dml	
Flat Tyre Limestone Member	Dmt	
First Stop Limestone Breccia Member	Dmf	
Dorothy Hill Limestone Member	Dmh	
Martin's Well Limestone Member	Dlw	
Magpie Creek Limestone Member	Dlm	
Back Creek Limestone Member	Sub	
Caltex Limestone Member	Sul	
Jack's Limestone Member	Suj	
Graveyard Creek Formation	S-Dg	*Greywacke, greywacke siltstone with some quartz greywacke & lenses of limest…*
Crooked Creek Conglomerate Member	S-Dc	*Greywacke conglomerate.*
Everett's Creek Volcanics	S-De	*Basalt, agglomerate, porphyry with some greywacke*

Lyndhurst Granite	Pzgl	*Granite*

Marine Fossil Locality	BRS 37
Freshwater Fossil Locality	BRS 38

SCALE: ONE INCH = ONE MILE.

YERING

GEOLOGICAL FIELD SHEET 1958

LEGEND.

CAINOZOIC.
TERTIARY.

- Tb — Basalt
- Tl — Laterite

PALAEOZOIC.

UPPER PALAEOZOIC.
- Montgomery Range Porphyry — Pzum — Rhyolite & quartz porphyry.

CARBONIFEROUS.
- Clarke River Formation — Cc — Mainly freshwater conglomerate, quartz greywacke, siltstone

DEVONIAN-CARBONIFEROUS.
- Gregory River Granite — D-Cgg — Granite

UPPER DEVONIAN
- Bundock Formation — Dub — Mainly freshwater quartz greywacke, shale, locally metamorphosed & hornblende hornfels
- Red Range Conglomerate Member — Dur

SILURO-DEVONIAN.
- Broken River Formation — S Db — Limestone, quartz greywacke, shale, with lenses of conglomerate.
- Dosey Creek Limestone Member — Dmd
- Flat Tyre Limestone Member — Dmt
- Page Creek Limestone Member — Dmg
- Stewart's Limestone Member — Dms
- Calfex Limestone Member — Sul

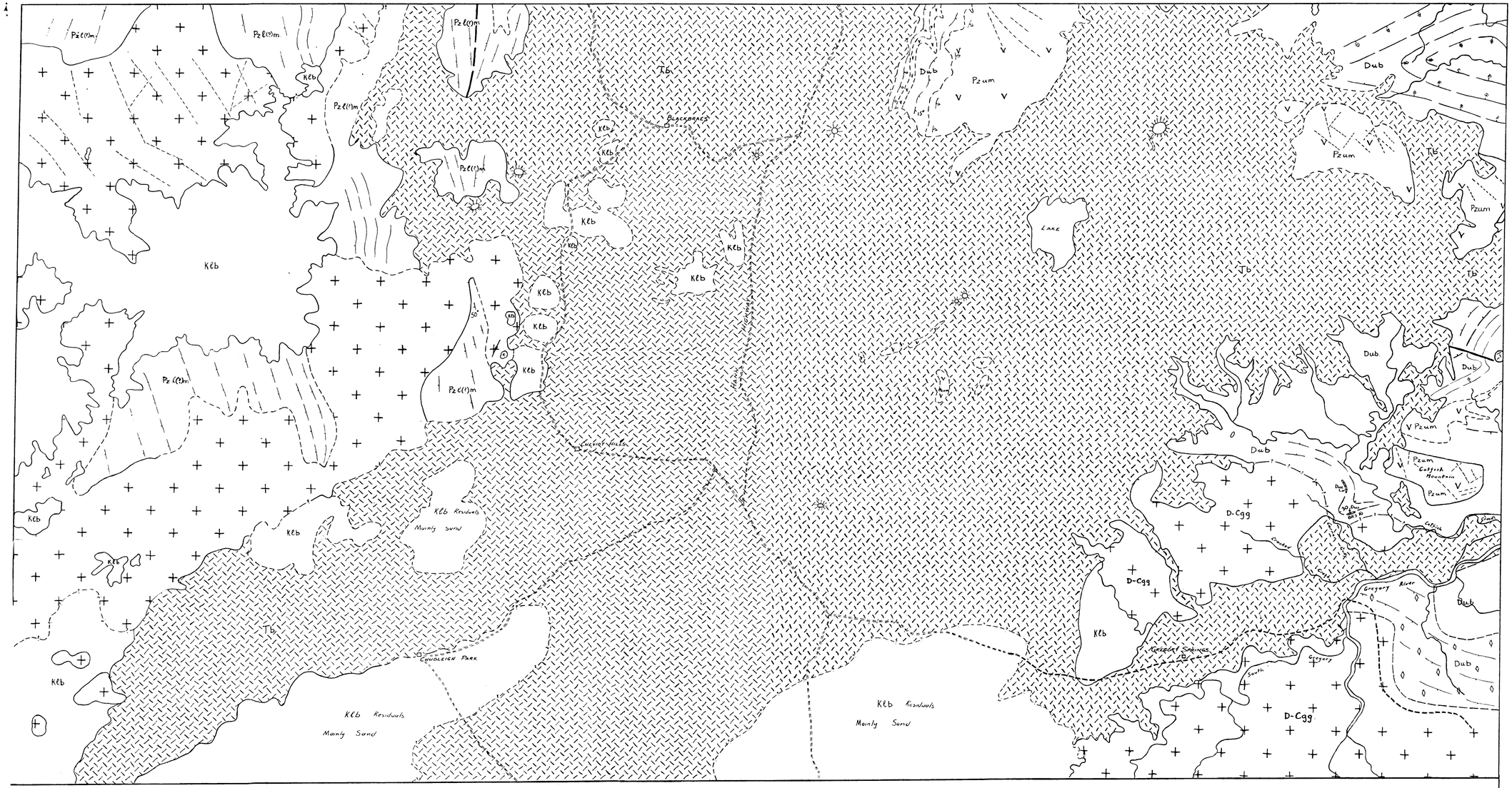
Marine fossil locality — BAS 37

Freshwater fossil locality — BAS 38

SCALE : ONE INCH=ONE MILE

CASTLE HILL

GEOLOGICAL FIELD SHEET 1958.



LEGEND

CAINOZOIC.
TERTIARY

Tb — Basalt ☼ Crater

MESOZOIC.
CRETACEOUS
Blythesdale Group

Kℓb — Conglomerate, quartz sand.

PALAEOZOIC.
UPPER PALAEOZOIC
Montgomery Range Porphyry

Pzum — Rhyolite, quartz porphyry

DEVONIAN- CARBONIFEROUS
Gregory River Granite

D-Cgg — Granite.

UPPER DEVONIAN
Bundock Formation

Dub — Mainly freshwater quartz greywacke shale locally metamorphosed to hornblende hornfels

Catfish Creek Limestone Member

DUC — Marine fossil locality

LOWER PALAEOZOIC
Mount Moran Formation

Pzℓ(?)m — Hornblende-epidote-plagioclase gneiss with some schist and quartzite.

GRANITE UNDIFFERENTIATED

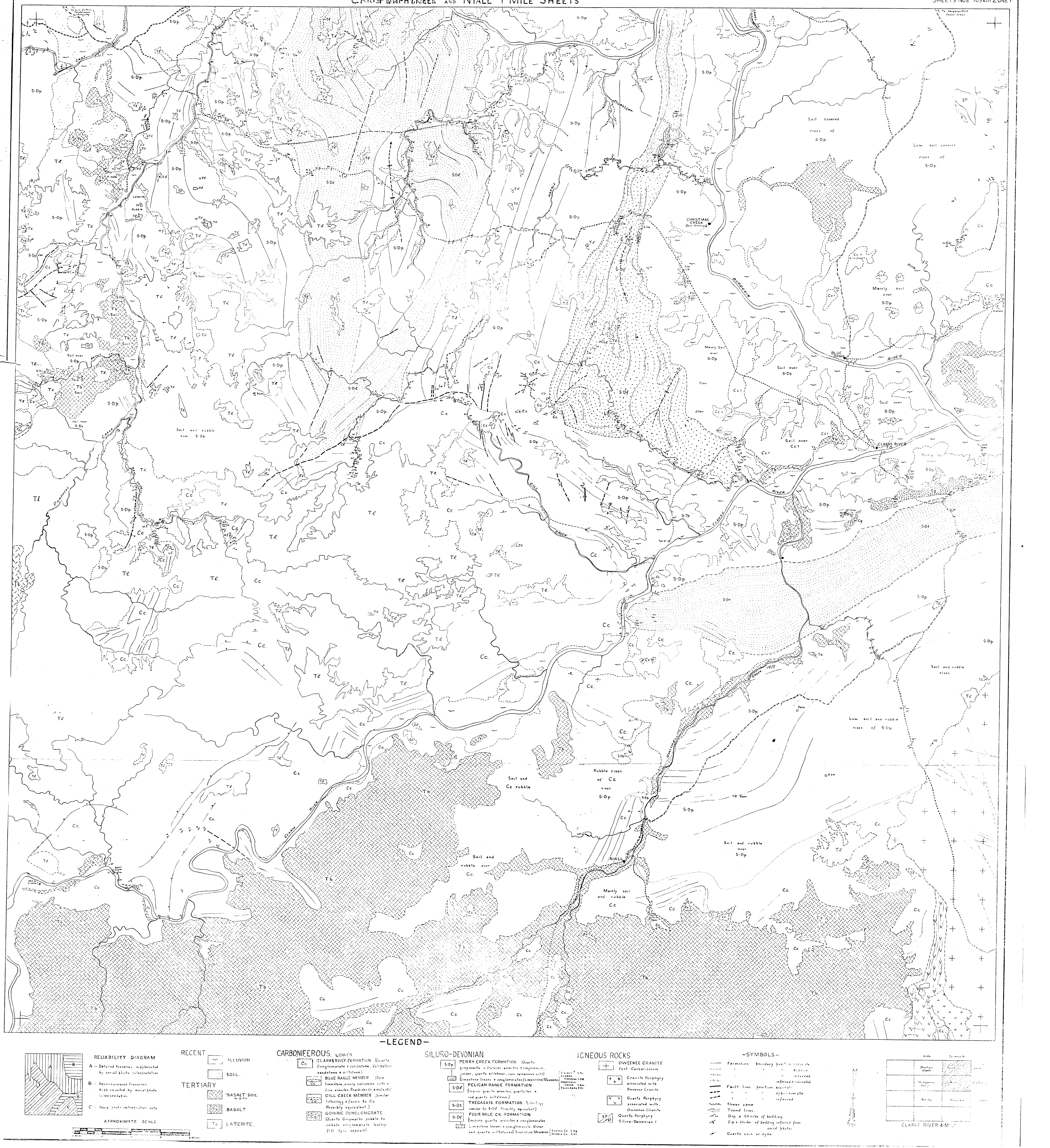
BAS 37

SCALE ONE INCH = ONE MILE

Geological Field Sheet - 1957

Christmas Creek and Niall 1-Mile Sheets

Sheets Nos. 103&111 Zone 7



GEOLOGICAL MAP OF THE EASTERN NEWCASTLE RANGE - NORTH QUEENSLAND.

PLATE 8

EVELEIGH

EVELEIGH MINE. Pb/Cu

LEGEND

RECENT.
- Alluvium
- Soil.

TERTIARY
- Basalt.

CRETACEOUS.
- Klb — Blythesdale Group.

UPPER PALAEOZOIC (Pzun)
- 7, 6, 5, 4, 3, 2, 1 — Porphyritic Rhyolite flows of the Newcastle Range Volcanics
- F, E, D, C — Tuff and tuffaceous agglomerate of the Newcastle Range Volcanics
- B, A — Arkosic conglomerate, Arkose & Limestone of the Newcastle Range Volcanics.
- Undifferentiated porphyry.

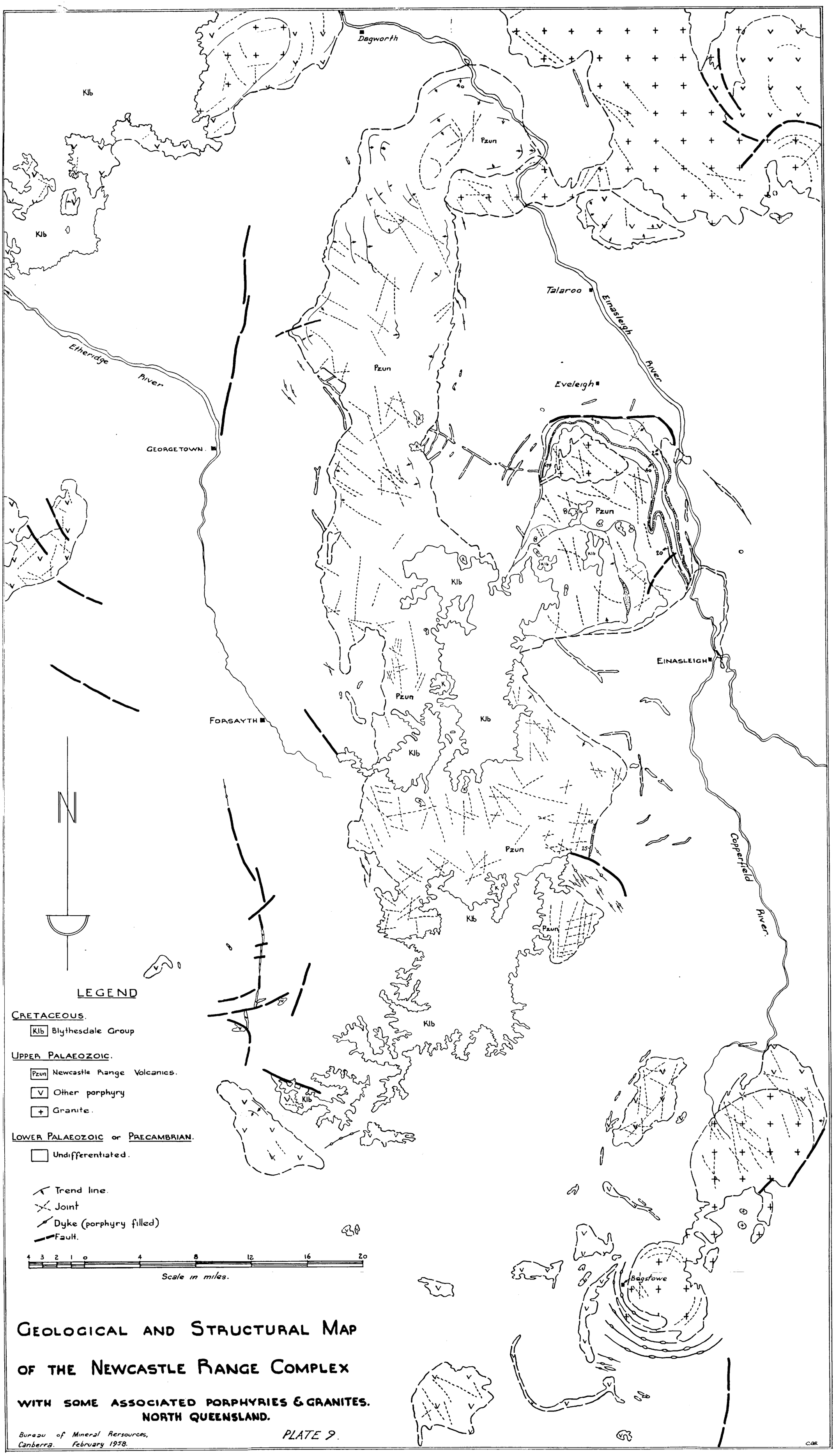
PRECAMBRIAN.
- pCm — Einasleigh Metamorphics.

INTRUSIVE IGNEOUS ROCKS.
- Granite boss of Newcastle Range.
- Forsayth batholith

Scale 1 ½ 0 2 3 miles.

EINASLEIGH.

B.M.R. Canberra Dec 1947



GEOLOGICAL AND STRUCTURAL MAP OF THE NEWCASTLE RANGE COMPLEX

WITH SOME ASSOCIATED PORPHYRIES & GRANITES. NORTH QUEENSLAND.

Bureau of Mineral Resources, Canberra. February 1958.

PLATE 9.

C.A.B.

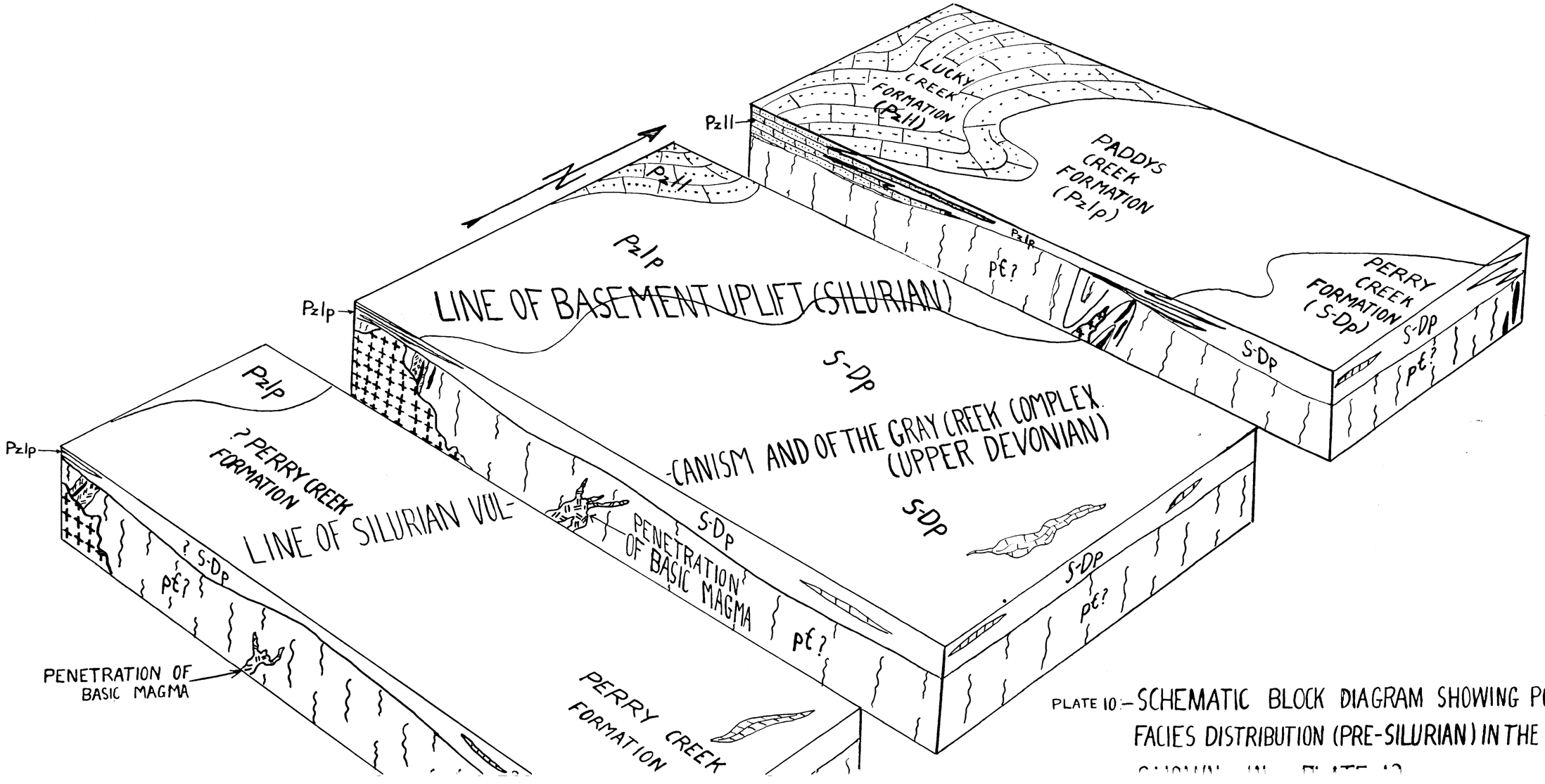


PLATE 10.—SCHEMATIC BLOCK DIAGRAM SHOWING POSSIBLE FACIES DISTRIBUTION (PRE-SILURIAN) IN THE AREA

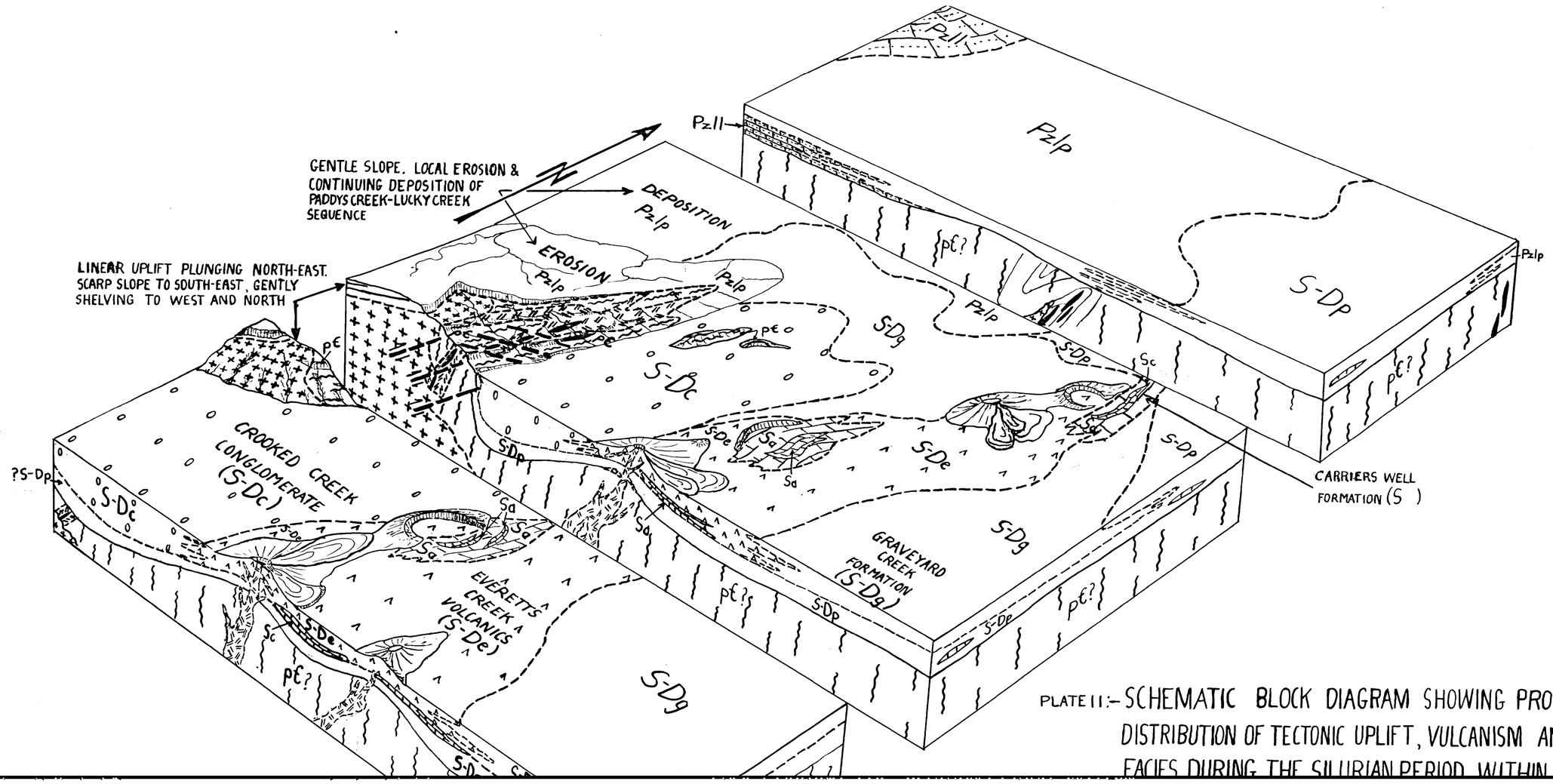


PLATE II:- SCHEMATIC BLOCK DIAGRAM SHOWING PROBABLE DISTRIBUTION OF TECTONIC UPLIFT, VULCANISM AND FACIES DURING THE SILURIAN PERIOD WITHIN

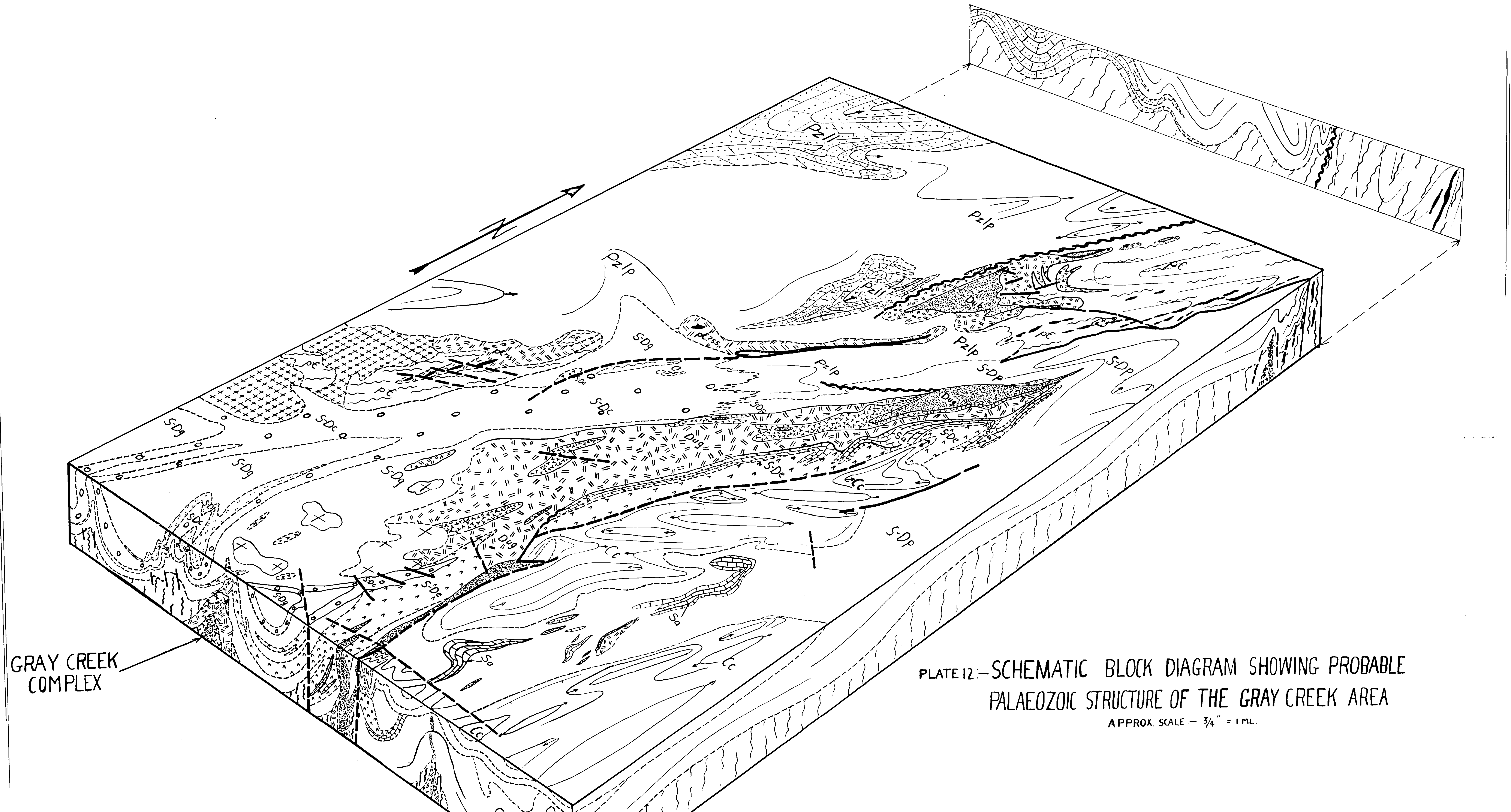


PLATE 12.—SCHEMATIC BLOCK DIAGRAM SHOWING PROBABLE PALAEOZOIC STRUCTURE OF THE GRAY CREEK AREA

APPROX. SCALE — 3/4" = 1 ML.

PLATE 14.

SKETCH PLANS OF THE GRAY CREEK CHROMITITE OUTCROPS.

LOCALITY 'B'

Specimen No 2042b
32·4% Cr_2O_3
12·8% Fe_2O_3

SERPENTINE AND BASICS (RUBBLE AND OUTCROP)

ALTERED GABBROS AND SERPENTINE

Specimen No 2043
33·6% Cr_2O_3
13·6 % Fe_2O_3

SERPENTINE AND BASICS INTRUDING DINNER CREEK VOLCANICS (SILURIAN)

MAJOR FAULT ZONE

CLARKE RIVER FORMATION (CARBONIFEROUS)

N

SCALE
Approx. 1" = 200'

CHROMITITE OUTCROP

LOCALITY 'A'

DARK GREEN AND BLUE FINE GRAINED ROCKS – PROBABLY BASALTS WITH CALCAREOUS SEDIMENTS

Specimen No 2044.
34·4 % Cr_2O_3
13·6 % Fe_2O_3

PYROXENITE

X Malachite staining in shear zone.

DARK GREEN FINE GRAINED BASIC VOLCANICS WITH SERPENTINE AND

Fine sheared greywacke conglomerate.

RUBBLE

Faleate serpentine & sheared chromitite.

COARSE, ALTERED GABBRO.

X Malachite staining in sheared serpentine

Fault zone in basalt. Common malachite on joint faces.

DOMINANTLY

Specimen No 2045 b
33·6% Cr_2O_3
10·4% Fe_2O_3

FAULT, POSITION APPROXIMATE

N

SCALE
Approx. 1" = 200'

CHROMITITE OUTCROP.

SERPENTINE AND GABBRO.

CHROMITITE OUTCROPS UNKNOWN

Cc Clarke River Formation (Carboniferous)

S-De Everetts Creek Volcanics.

S-Dp Perry Creek Formation

Serpentinite and basic intrusives.

Chromitite.

LOCALITY 'B'

GRAY CREEK

Quartz greywacke siltstone & sandstone

Cc

S-De

S-Dp

LOCALITY 'A'

N

LOCALITY MAP OF THE CHROMITE DEPOSITS IN THE GRAY CREEK AREA

(Photograph No 5173, Clarke River Run 4

SCALE APPROX 1" = 0·8 ML.