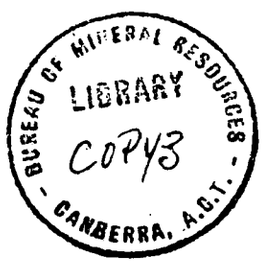
COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1963/142



SEDIMENTARY BASINS SECTION - SUMMARY OF ACTIVITIES, 1963.

SEDIMENTARY BASINS AND PALAEONTOLOGY SECTIONS

SUMMARY OF ACTIVITIES, 1963

RECORDS 1963/142

C O N T E N T S

SEDIMENTARY BASINS and PALAEONTOLOGY SECTIONS

SUMMARY of ACTIVITIES, 1963

S U M M A R Y

Geological field mapping continued in the Amadeus, Bowen, Georgina and Great Artesian Basins throughout the 1963 field season. In addition a field party commenced mapping in the Bonaparte Gulf Basin (see accompanying Index Map).

The mapping was supplemented in all areas, apart from the Bowen Basin, by a total of 138 hours of helicopter traverse. This method of mapping in areas with access problems proved to be very successful and will be utilized in future field seasons.

Core hole drilling in the Bowen and Great Artesian Basins was successfully completed while stratigraphic drilling in the Georgina Basin has been retarded by operating problems.

Approximately twelve 1:250,000 photogeological sheets were completed during the year.

Considerable progress in research and routine micro- and macro-palaeontology was made during the current year.

AUSTRALIA

GEOLOGICAL MAPPING AND DRILLING
1963 - 1964

Core hole drilling in Bowen and Great Artesian Basins for 1964

One party on specific problems in Bowen Basin 1964

Mapping completed 1963

Mapping programmed 1964

Helicopter reconnaissance - 1963

Core holes drilled 1963

Stratigraphic Hole drilled 1963

Phosphate drilling 1963

25-10-63

LK

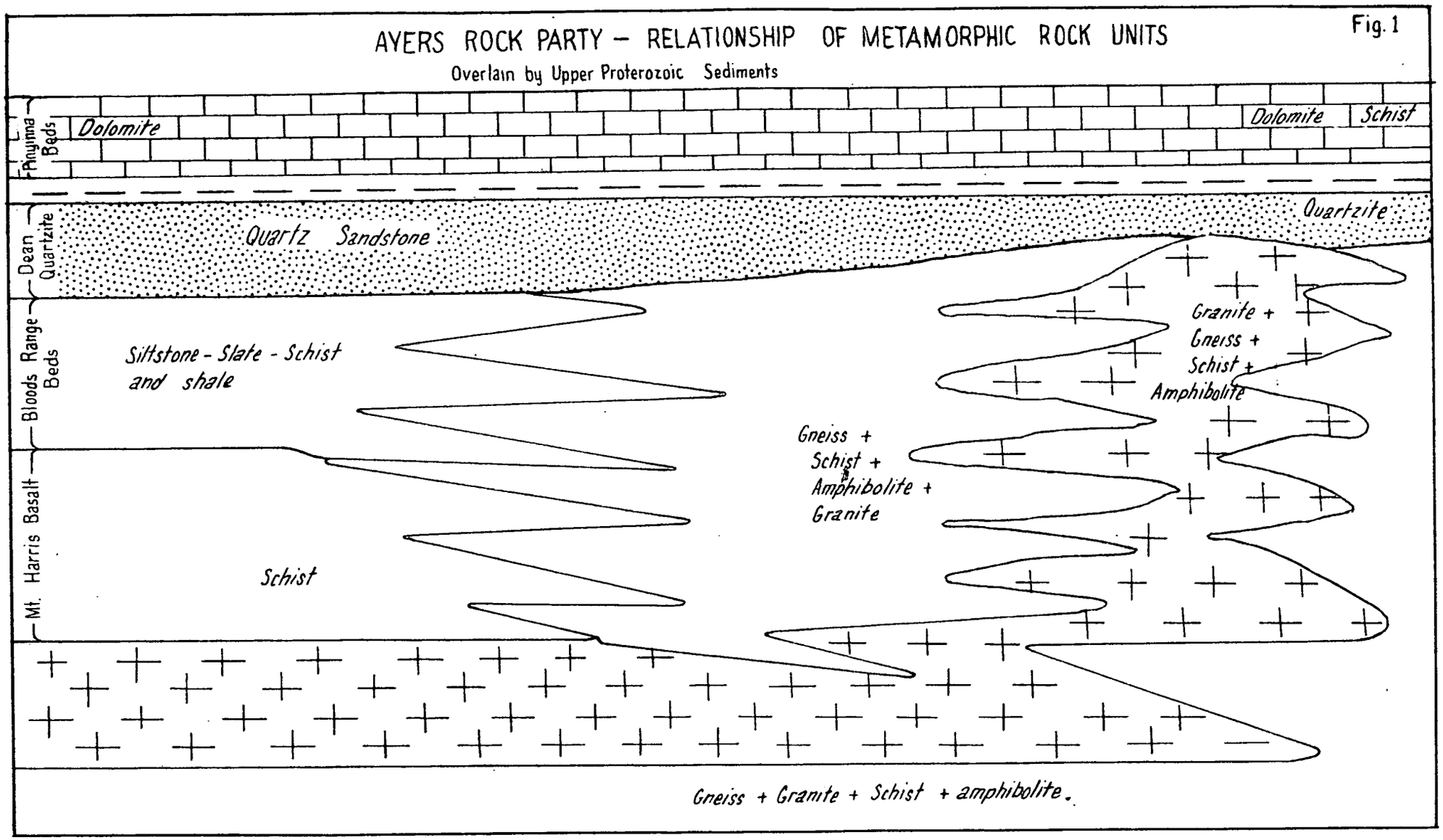
Bureau of Mineral Resources, Geology and Geophysics

A M A D E U S B A S I N

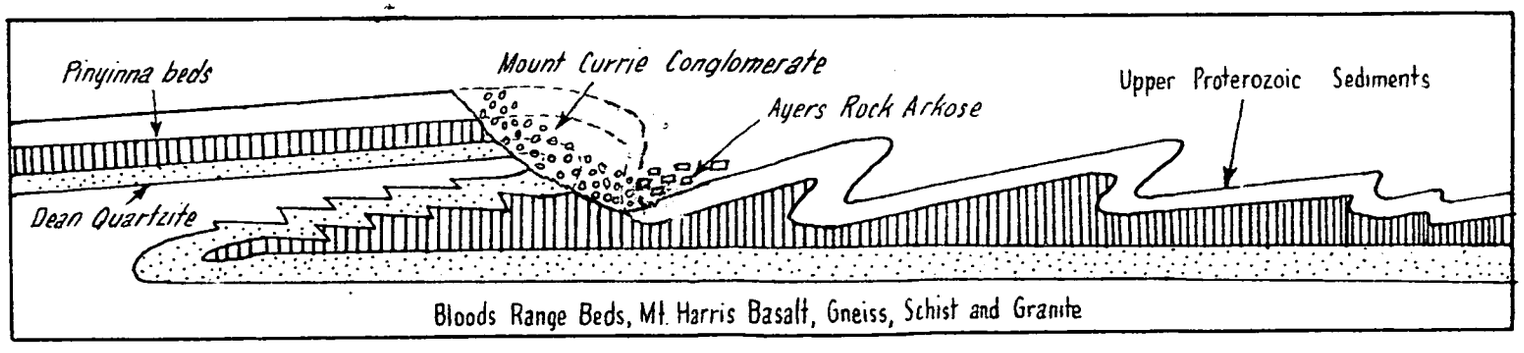
Fig. 1

AYERS ROCK PARTY – RELATIONSHIP OF METAMORPHIC ROCK UNITS

Overlain by Upper Proterozoic Sediments



POSSIBLE STRUCTURE – SOUTHERN MARGIN - AMADEUS BASIN



AYERS ROCK PARTY - LOCALITY MAP

LINSON

BLOODS RANGE

LAKE AMADEUS

MT HARRIS

BLOODS RANGE

REBECCA C.

DOCKER R.

BULL R.

LAKE AMADEUS

SCHWERIN MURAL CRESCENT

PETERMANN RANGES

CHRISTIE R.

SHAW C.

MT CURRIE

GILES

GILES C.

MT DEERING

MT CURDIE

MT FAGAN

IRVING C.

MT BOWLEY

MT PHILLIPS

MT McCULLOUGH

ARMSTRONG C.

MT OLGA

AYERS ROCK

CURTIN SPRINGS

KATAMALA CONE

TORNPAKURA HILL

STEVENSONS PEAK

NGALOARANNA HILL

FOSTER CLIFF

BUTLERS DOME

VON DOUSSA HILL

BENDA HILL

SCOTT

MURRAY RANGE

WESTERN AUSTRALIA

NORTHERN TERRITORY

DUFFIELD ROCKS

MT JENKINS

MT DAISY BATES

MT GOSSE

MT LE HUNTE

MT SAMUEL

MT COCKBURN

HECTORS PASS

MT MANN

MT CHARLES

FELTHAM HILL

BRITTEN

MULGA PARK

NORTHERN TERRITORY

SOUTH AUSTRALIA

MT WOODWARD

JONES C.

AYLIFFE HILL

MT MORRIS

MUSGRAVE RANGES

MT DAVENPORT

MT WOODROFFE

TOMKINSON RANGES

MT DAVIES

ACKSTONE RA.

COOPER

MANN

WOODROFFE

STRATIGRAPHIC TABLE PETERMANN RANGES

AGE	LITHOLOGY	UNIT	REMARKS
QUATERNARY	Sand, sanddunes, Alluvium, travertine	———	
TERTIARY	Conglomerate	———	Derived from high ranges and hills
	Sandstone	———	Flat lying sandstone with plant remains near Petermann Ranges
? ORDOVICIAN	Sandstone	———	Flat lying, clean white sandstone with pipe rock and diplocraterion
CAMBRIAN OR UPPER PROTEROZOIC	Arkose	Unnamed	Occurs at Ayers Rock Maybe laterally equivalent to Mount Currie Conglomerate
CAMBRIAN OR UPPER PROTEROZOIC	Conglomerate	Mount Currie Conglomerate	Several thousand feet thick
——— UNCONFORMITY ———			
? UPPER PROTEROZOIC	Sandstone and siltstone	Winnall Beds	Tightly folded. See fig. 1 for explanation of relationship to Pinyinna Beds
UNDIFFERENTIATED ? UPPER PROTEROZOIC	Sandstone and siltstone		May be Winnall Beds or Inindia Beds
? UPPER PROTEROZOIC	Dolomite, limestone, siltstone and schistose equivalents	Pinyinna Beds	Isoclinally folded Metamorphosed
? UPPER PROTEROZOIC	Quartzite	Dean Quartzite	Isoclinally folded Metamorphosed
UNDIFFERENTIATED PRECAMBRIAN	Siltstone, shale, sandstone, slate, quartzite, schist and feldspathised schist.	Bloods Range Beds	Isoclinally folded and metamorphosed to schist gneiss, amphibolite and granite
UNDIFFERENTIATED PRECAMBRIAN	Green, epidotized amygdaloidal ? basalt and green schists	? Mount Harris Basalt	Isoclinally folded and metamorphosed to schist amphibolite, quartz-epidote rock, gneiss and granite.

No rocks in the area have been definitely identified as older than the Mount Harris Basalt, but certain quartz-rich gneisses in the Musgrove Ranges, Kelly Hills and Mount Frazer may have formed from older quartz-rich sediments.

Bureau of Mineral Resources, Geology & Geophysics. October, 1963.

AYERS ROCK PARTY

by

D.J.Forman

Personnel: D.J.Forman, P.M.Hancock

Duration of fieldwork: 8th May 1963 to 12th September 1963

Area Mapped: A strip of country extending from Giles Meteorological Station in Western Australia to Mulga Park Station in the Northern Territory (see locality map). The strip comprised parts of the following sheet areas: south-eastern corner of Rawlinson, north-eastern corner of Scott, most of Petermann Ranges excepting the three most southerly one-mile sheets, and most of Ayers Rock excepting three one-mile sheets against the eastern side.

Geology: The work was a continuation of the study of the structure of the southern margin of the Amadeus Basin commenced in 1962 by the Bloods Range Party. Figure 1 shows the suggested structural and metamorphic relationships of rock units. The stratigraphy of the area is set out in the accompanying table.

The most important results of the season's mapping have been:

(1) Additional evidence to support the hypothesis of a regional near recumbent infold of Dean Quartzite and Pinyinna Beds. A new interpretation of the regional structure is to be made but until then the recumbent fold interpretation of the Bloods Range Sheet area is the best offering.

(2) The Bloods Range Beds and Mount Harris Basalt grade from practically unaltered sediment through schist to amphibolite, gneiss "porphyry" and granite. Much of the rock previously mapped as foliated porphyry is now believed to be porphyroblastic schist, slate or hornfels.

(3) No evidence (beyond a few pebble beds near the base of the Dean Quartzite) has been found to confirm the presence of an unconformity at the base of the Dean Quartzite. The contact between Dean Quartzite and granite, gneiss or schist appears to be gradational. Beneath the contact, siltstone and shale of the Bloods Range Beds and Mount Harris Basalt have been converted to amphibolite, schist gneiss and granite "in situ" but above it the Dean Quartzite has acted as a metamorphic barrier.

(4) The schist, gneiss, granite and amphibolite were apparently formed during the regional folding of the area and in a number of cases, the foliation has been proved to parallel the axial planes of minor folds, and the lineation trends parallel to the axial lines of the folds.

(5) At least two, and possibly three or four, directions of folding have been recognized. The earliest of these is believed to be a recumbent folding and the later cross folds are recumbent, isoclinal or tight in many localities. The presence of these cross folds makes an interpretation of the earlier folding difficult.

(6) The Mount Currie Conglomerate overlies the Winnall Beds with apparent unconformity. The Mount Currie Conglomerate and Ayers Rock Arkose are interpreted as wedges of sediment deposited in the Amadeus Basin adjacent to a tectonically unstable area. Stratigraphic and structural evidence suggests a Cambrian age may be tentatively assigned to them.

HENBURY

Figure 1

132°00'
24°00'

133°30'
24°00'

RANGES

KRICHAUFF

Areyonga Mission

Palm Ck

PALM VALLEY

WATERHOUSE RA.

JAMES RANGES

Boggyhole Ck

Log Hole Ck

HUGH RIVER

MT KEARTLAND

JAMES RANGES

Poison Ck

BLACK OPAL HILL

TEMPE TENT HILL

MT CALDWELL

Tidenvale Ck

MIDDLE RA.

MT SHADY

MT LEWIS

ILLARA ROCK

Walker Ck

McMinn Ck

FINKE

MT HOLDER

"Orange Creek"

PETERMANN HILLS

"Tempe Downs"

HOUSEHILL

Deception Ck

RA.

Petermann Ck

McLoney Ck

MT LEVI

LEVI RA.

AYERS LOOKOUT

CHANDLERS RA.

Storm Ck

Meteorite Craters

RIVER

"Henbury"

BACON RA.

Yaua Bore

MT ORMEROD

PALMER

SEYMOUR RA.

MT REGINALD

MT QUIN

THE SISTERS

"Palmer Valley"

RIVER

Horse Paddock Well

BRISCOE TENT HILL

LIDDLE HILLS

25°00'
132°00'

25°00'
133°30'

SCALE

5 0 5 10 15 MILES

Reference

Bureau of Mineral Resources, Geology and Geophysics, October 1963.

G53/A1/2

A.M.

(7) Seven samples of granite and gneiss were taken for age determination.

HENBURY PARTY

by

L.C.Ranford

Personnel: Geologists - L.C.Ranford, P.J.Cook

Palaeontologists - J.G.Tomlinson (1.8.63. - 21.8.63)
C.G.Gatehouse (14.6.63. - 17.8.63)

Draftsman - A.Mikolajczak (7.7.63. - 21.7.63)
(8.8.63. - 11.9.63)

Duration of Field Season: 25th May to 2nd October, 1963

Area Mapped: Henbury Sheet area as far south as latitude 24°45' (See Fig.1)

General: The stratigraphy of the Henbury Sheet area is outlined in the accompanying table.

Stratigraphic columns at selected localities are shown in Fig.2 and tentative correlations of the rock units across the northern part of the area are shown in Fig.3.

Some of the points which have arisen from the mapping done this year are outlined below:-

1. The southern limit of deposition of the Pacoota Sandstone and Horn Valley Siltstone was probably close to latitude 24°50' South. There is no evidence of these sediments being eroded south of this line and the presence of the Stairway Sandstone further south is considered to be the result of a Middle Ordovician marine transgression.

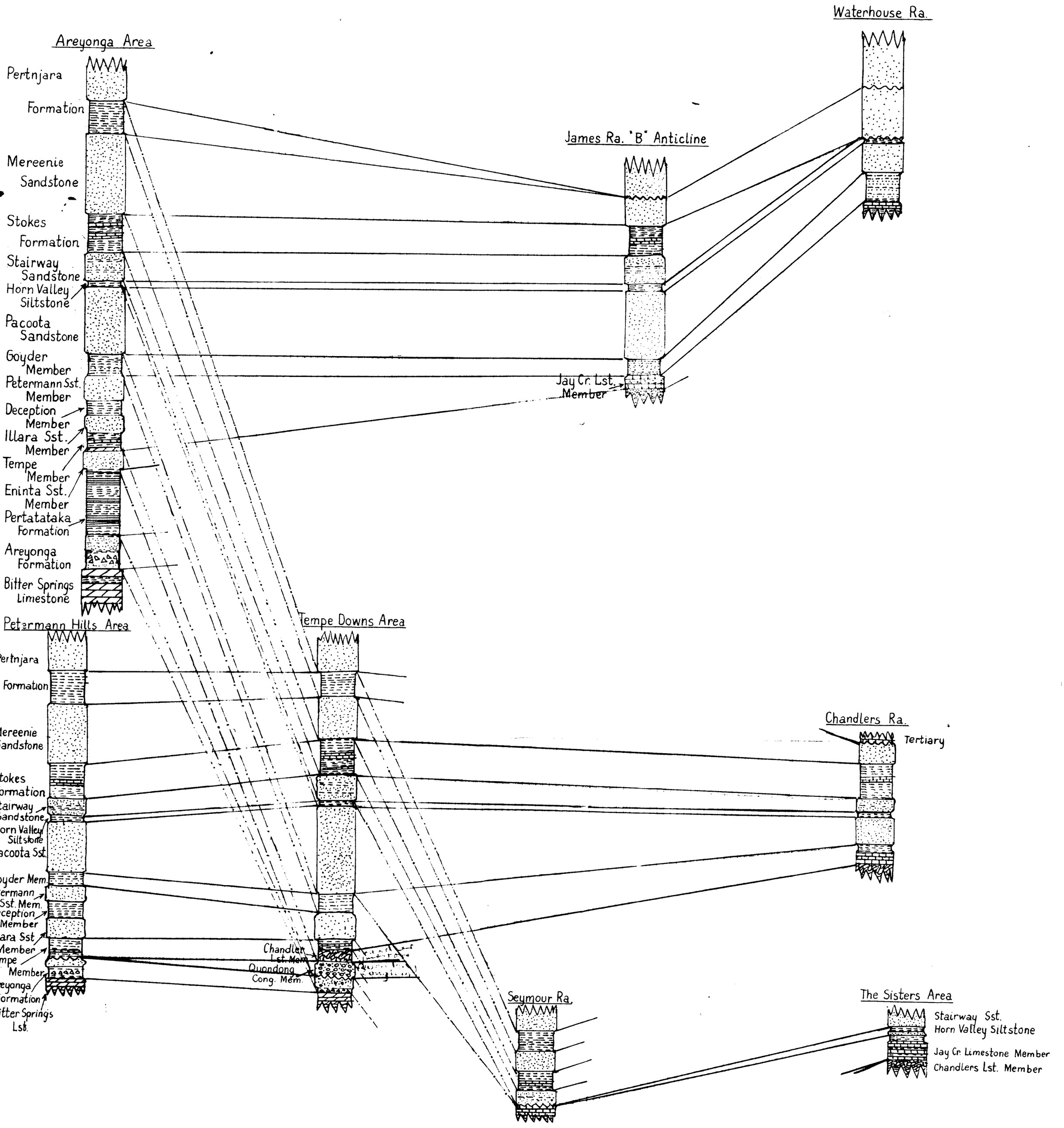
2. On the western half of the Henbury Sheet area the Mereenie Sandstone is divisible into two units. The basal unit (Pzm(1)) is up to 350' thick and the upper unit (Pzm(2)) is up to approx. 2000' thick. "Cruzianas" of distinctly Ordovician aspect are common in the basal unit and are now known from Stokes Pass (Western MacDonnell Ranges) in the north, to the Inindia Bore area (south east corner of the Lake Amadeus Sheet area) in the south.

   The upper unit contains some problematic tracks and trails and some worm burrows but no diagnostic fossils have been found.

   The Mereenie Sandstone conformably overlies the Larapinta Group sediments over most of the area mapped. However, in the Waterhouse Range Anticline the upper unit of the Mereenie Sandstone lies unconformably on the Pacoota Sandstone in the northern limb and on the Horn Valley Siltstone in the southern limb. In the

STRATIGRAPHIC COLUMNS AT SELECTED LOCALITIES ON THE HENBURY SHEET AREA

Fig 2.



Gardiner Range east of Areyonga, in the James Ranges near Mangatatara Rockhole, and at the western end of the Seymour Range, the Mereenie Sandstone rests with apparent unconformity on older units. At each of these localities there is evidence of structural disturbance and it is not certain whether the apparent unconformities are due to the structure or to the stratigraphic relationships. The three localities lie along a line which, if extended to the north, would pass through Gosses Bluff and close to the 'Goyder Pass Diapir'.

3. Further work near the eastern margin of the Lake Amadeus Sheet area has indicated that the thin sequence of sediments, assigned last year to the Pertatataka Formation, in the core of the Parana Hill Anticline, probably belong in the Pertaoorrta Formation. These sediments, plus the overlying sandstone, are now considered to be part of the Tempe Member.

4. In the Gardiner Range, the basal member of the Pertaoorrta Formation (the Eninta Sandstone Member) unconformably overlies the Pertatataka Formation and probably also the Areyonga Formation. Approximately 6 miles north-east of Tempe Downs Homestead, the Quondong Conglomerate Member (new name) unconformably overlies the Areyonga Formation. The Quondon Conglomerate Member is considered to be laterally equivalent to the Eninta Sandstone Member. A conglomerate unit exposed in the core of the James Range B Anticline and another unconformably overlying the Winnall Beds near Angas Downs airstrip are both tentatively correlated with the Quondong Conglomerate.

5. On the eastern half of the Henbury Sheet area, three members have been mapped within the Pertaoorrta Formation. The youngest of these, the Goyder Member, can be traced right across the Sheet area.

   The Jay Creek Limestone Member underlies the Goyder Member and is only known east of longitude 132°55'.

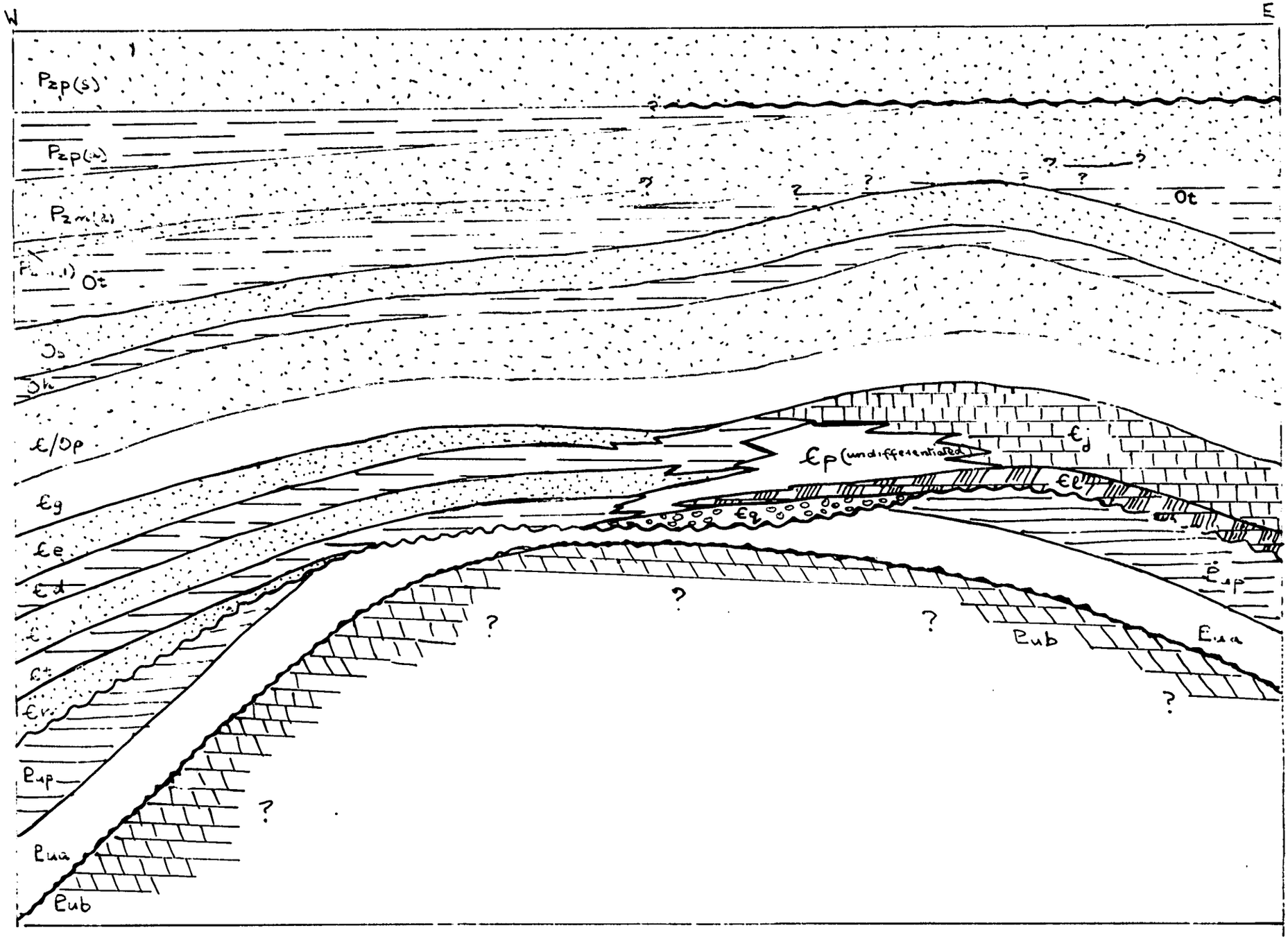
   The third member, the Chandler Limestone Member (new name) has been mapped as far west as the Tempe Downs area and as far south as the Sisters. This Member consists of limestone and dolomite with interbedded chert laminae and lenses. It is intricately folded and contorted and normally has a strong foetid odour. The incompetent folding of the Chandler Limestone Member is thought to be due to the presence of interbedded evaporites. No evaporites have been seen at the surface but they have been recorded above the Arumbera Greywacke Member in the Alice No.1 Well.

6. Gastropods collected from the Tempe Member are considered to be of Middle Cambrian age (J.G.-Tomlinson - pers.comm.) and the unit is therefore laterally equivalent to part of the Jay Creek Limestone Member.

7. Lenses of sandstone in the Areyonga Formation in the Gardiner Range contain some vertical 'pipes' of suspected organic origin. The pipes are about one third to one half an inch in diameter and up to 2 feet long. The 'pipes' are regularly spaced and have a similar appearance to the vertical worm tubes in the Larapinta Group sediments.

CORRELATION OF ROCK UNITS NORTHERN PART OF THE HENBURY SHEET AREA

Figure 3



8. Several strongly deformed zones have been mapped and in every case the associated faults are high angle reverse faults, or thrusts, which trend parallel to the major fold axes. The disturbed areas are characterised by overturned sequences and obliteration of most of the sedimentary structures and fossils. The movement probably occurred during the last major period of folding (i.e. post-Pertnjara Formation and pre-Mesozoic).

9. Glauconite samples have been collected for radioactive age determination work from Proterozoic, Cambrian and Ordovician units on the Henbury Sheet area.

10. Phosphatic pellets have been found concentrated in thin beds and also scattered irregularly throughout the Stairway Sandstone. Similar beds and scattered pellets have been found in the upper part of the Horn Valley Siltstone, parts of the Pacoota Sandstone and the lower part of the Stokes Formation. The Stairway Sandstone contains the most phosphatic pellets in the area studied.

STRATIGRAPHY OF HENBURY SHEET AREA

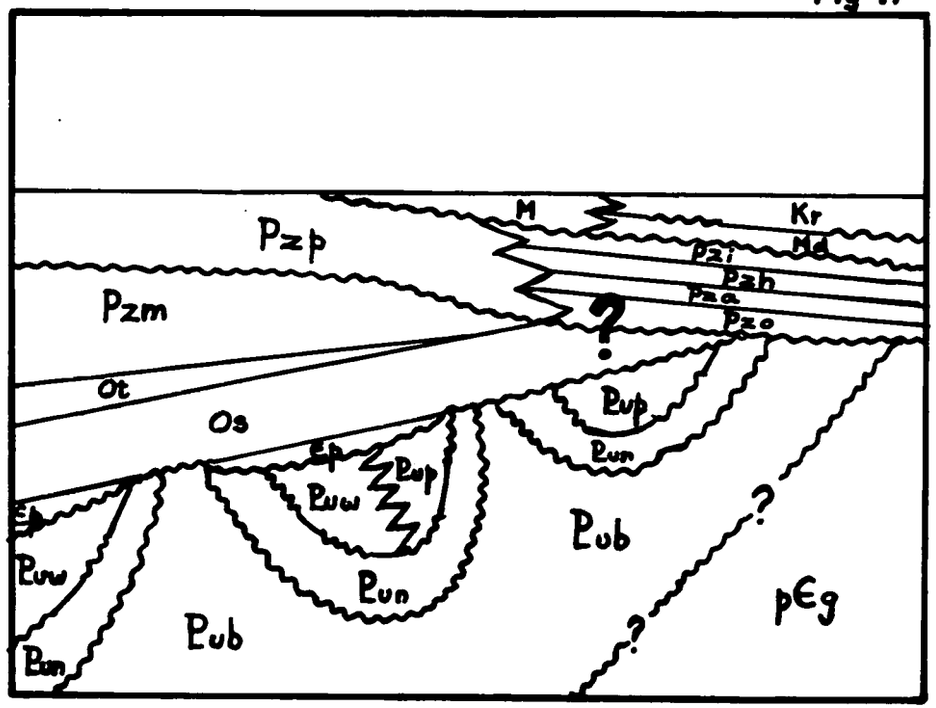
AGE	FORMATION	MAP SYMBOL	LITHOLOGY	REMARKS
Quaternary		Qa	Alluvium and river gravels	
		Qs	Aeolian sand	
		Ql	Travertine	
		Qg	Gypsum	
		Qc	Conglomerate	
Tertiary		T	Calcareous silty sandstone, conglomerate and limestone	
		Tl	Limestone. Freshwater fauna	
		Tc	Conglomerate	
		Tb	'Grey Billy'	
		Ta	Laterite, ferricrete	
Mesozoic		M	Kaolinitic sandstone and sandy claystone	Flatlying - forms mesas - usually carries a capping of "grey billy"
PALAEOZOIC	Undifferentiated	Pertnjara Formation Pzp(S)	Sandstone and silty sandstone - some scattered pebbles and cobbles	Overlies Pzp(a) apparently conformably in western and southern parts of Henbury. Possibly unconformably overlies Pzm(2) in N.E. quadrant.
		Pzp(a)	Siltstone, fine silty sandstone and some limestone	Poorly exposed in most areas. Not present in north-eastern quadrant of Henbury Sheet area
		Mereenie Sandstone Pzm(2)	Sandstone with large scale cross-bedding. Some problematic structures and markings.	Present throughout area. Conformably above Pzm(1) on western half of area. Unconformably overlies Larapinta Group in the Waterhouse Range.

AGE		FORMATION		MAP SYMBOL	LITHOLOGY	REMARKS
Palaeozoic (Undifferentiated) continued.....						
PALAEOZOIC		Moreenie Sandstone		Pzm(1)	Silty sandstone, sandstone and minor siltstone. "Cruziana" and problematic fossil.	Contains 'Cruzianas' of 'Ordovician aspect' and is known to be present over western half of Henbury Sheet area
	Ordovician	LARAPINTA GROUP	'Stokes'Formation	Ot	Siltstone, shale, limestone and silty sandstone Marine fossils	Poorly exposed in general. Some thin pelletal phosphate beds near base of unit.
			Stairway Sandstone	Os	Sandstone, silty sandstone and siltstone with minor limestone. Marine Fossils.	Contains numerous thin pelletal phosphate beds and scattered pellets.
			Horn Valley Siltstone	Oh	Siltstone and shale with characteristic blue grey or grey green limestone. Marine Fossils	Thins markedly to south. Southernmost exposures occur approx.along latitude 24°40'south
			Pacoota Sandstone	Ꞓ/OP	Sandstone and silty sandstone - partly conglomeratic. Marine Fossils.	Thins markedly to south. Southernmost exposures occur approx. along latitude 24°40' south
		Ꞓ/Ol				
	CAMBRIAN	PERTAOORRTA FORMATION	Petermann Sst.Member	Ꞓe	Sandstone and silty sandstone with minor siltstone	Present in north-western quadrant of Henbury Sheet area. Grades laterally into siltstone and shale.
			Deception Member	Ꞓd	Siltstone and shale with minor fine sandstone	Has been mapped only in north-west quadrant of Henbury Sheet area
			Illara Sst.Member	Ꞓi	Sandstone and silty sandstone	Has been mapped only in north-west quadrant
			Jay Creek Limestone Member	Ꞓj	Limestone, shale and dolomite Marine Fossils	Largely shallow water calcarenites and algal limestone. Present on eastern half of Henbury Sheet area.

AGE		FORMATION	MAP SYMBOL	LITHOLOGY	REMARKS
CAMBRIAN (Pertaoorrta Formation)...continued					
CAMBRIAN	PERTAOORRTA FORMATION Cp	Tempe Member	Ct	Siltstone, shale, limestone and sandstone - very rich in glauconite. Marine Fossils.	Has been mapped only in north-west quadrant of Henbury Sheet
		Chandler Limestone Member	Cl	Limestone and dolomite with chert laminae. Usually has foetid odour	This unit is generally contorted and incompetently folded. It lies above the Quondong Conglomerate Member and beneath the Jay Creek limestone member.
		Eninta Sst.Member	Cn	Sandstone, silty sandstone and siltstone. Some scattered pebbles and cobbles.	Lies unconformably above Pertatataka Formation in the Gardiner Range. Contains some fragments derived from the Pertatataka Formation.
		Quondong Conglomerate Member	Cq	Conglomerate and conglomerate sandstone with fragments largely of chert	Locally developed conglomerate unit. Unconformably overlies Areyonga Formation 6 miles N.E. of Tempe Downs Homestead.
UPPER PROTEROZOIC		Winnall Beds	P_uw	Sandstone, siltstone	Present on southern half of Henbury Sheet area - grades laterally into Pertatataka Formation.
		Pertatataka Formation	P_up	Siltstone and shale with minor sandstone and limestone	Present in Gardiner Range and near Orange Creek Homestead. Was eroded during?Lower Cambrian in some areas
		Areyonga Formation	P_ua	Sandstone, tillitic textured claystone and siltstone, minor conglomerate and limestone	Present on northern half of Henbury Sheet area - grades l laterally into Inindia Beds to the south

AGE	FORMATION	MAP SYMBOL	LITHOLOGY	REMARKS
UPPER PROTEROZOIC....continued				
UPPER PROTEROZOIC	Inindia Beds	P_un	Siltstone, bedded chert, chert breccia and sandstone	Generally poorly exposed in cores of anticlines in southern part of Henbury Sheet area
	Bitter Springs Limestone	P_ub	Dolomite with minor siltstone, limestone and sandstone. Chert biscuits, nodules etc.	Known to contain evaporites in some areas

Fig 1.



DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS

UNCONFORMITY

KULGERA PARTY

by

A.T.Wells

Area Mapped: The Kulgera Party mapped the Charlotte Waters and Kulgera Sheet areas, the north-east part of the Ayers Rock Sheet area and the southern quarter of the Henbury Sheet area. These sheets cover the south-eastern part of the Amadeus Basin.

Personnel: A.T.Wells (Party Leader), A.Stewart and S.Skwarko. J.G.Tomlinson and C.Gatehouse visited the party for about a week and collected fossils from the Cambrian and Ordovician sequences.

Duration of Field Work: The field mapping commenced in late May and continued to the end of October. Geological reconnaissance by helicopter, principally on the Charlotte Waters Sheet area, occupied about 10 days.

Geology: The sediments in the south-east part of the Amadeus Basin include about 4,500 feet of Upper Proterozoic dolomite, siltstone and sandstone, about 2,000 feet of Palaeozoic siltstone, sandstone, conglomerate, and greywacke and 1,200 feet of Mesozoic sands and silts. Fig.1 shows diagramatically the relationship of the formations, Fig.2 is a geological sketch map and locality map and Table I shows the stratigraphy. The formation names in inverted commas and their map symbols in the stratigraphic table are tentative and may not be issued in the final report on the area.

The most pertinent points of the geology, new discoveries and conclusions are as follows:-

1. The oldest rocks mapped in the area are a complex sequence of granitic and aplitic intrusions with dykes of dolerite and pegmatite which are exposed on the southern parts of the Charlotte Waters and Kulgera Sheet areas. The relationship between these basement rocks and the oldest sediments is obscured and they are unconformably overlain by Mesozoic and undifferentiated Palaeozoic sediments. One isolated outcrop of quartzite and schist occurs on the south-west part of the Kulgera Sheet area.

2. The Bitter Springs Limestone crops out in the Curtin Springs area and as far east on the Black Hill Range. The formation is overlain apparently conformably by the Inindia Beds and with an angular unconformity by the Winnall Beds, the Pertaoorta Formation, the Stairway Sandstone and the Langra Sandstone.

3. The presence of varves and striated pebbles in the siltstone of the Inindia Beds indicates that it is in part glacial in origin and confirms the correlation of at least the upper arenaceous part of the beds with the Areyonga Formation. Scattered pebbles of dolomite chert, siltstone and some metamorphic rocks occur in a silty poorly sorted matrix near the top of the Inindia Beds, but there is neither the abundance nor variety of fragments that are characteristic of the Areyonga Formation. The upper sandstone members of the Inindia Beds contain abundant pebbles and grains of chert similar to the chert found in the lower part of the Beds. No other evidence of disconformities or unconformities was found within the Beds.

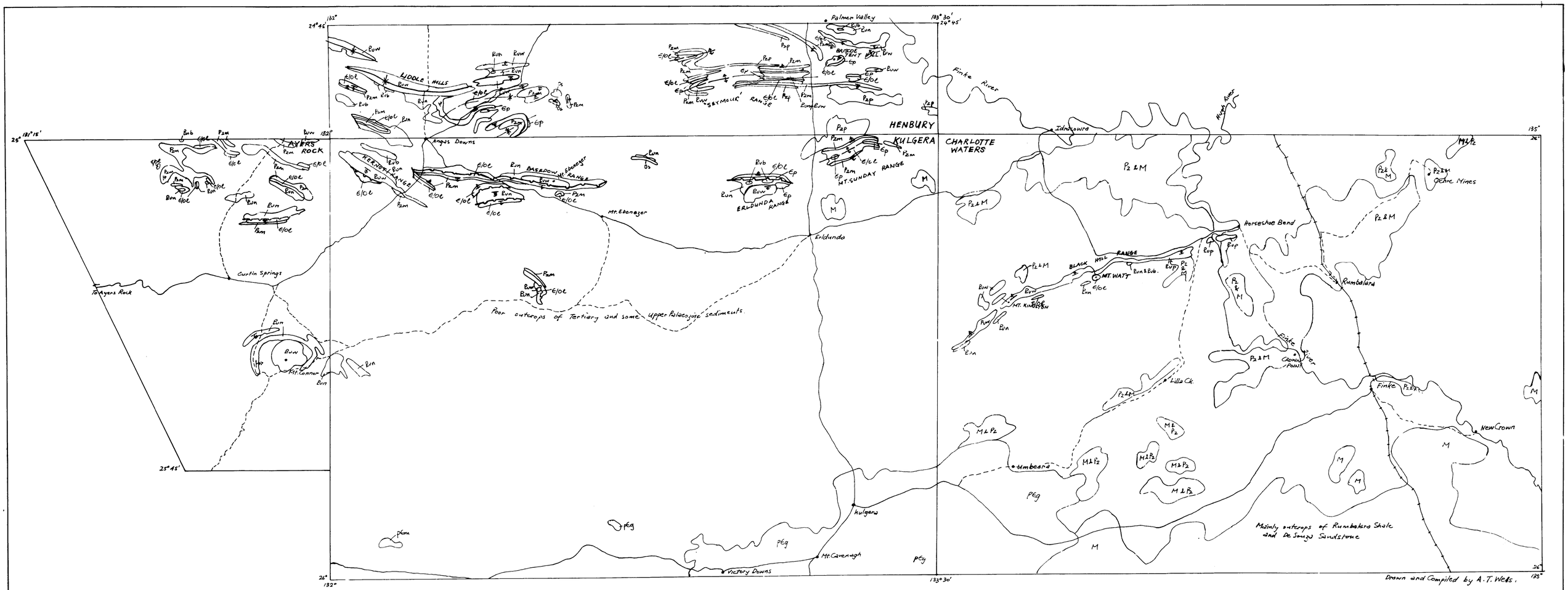


Fig. 2. Generalised Geology of the South-East Amadeus Basin

4. The Winnall Beds are predominantly sandy in the western partof the area but in the Black Hill Range glauconitic siltstone and fine sandstone predominates. The sediments in this eastern area show more affinities to the laterally equivalent Pertatataka Formation than to the Winnall Beds.

5. The southern limit of Cambrian sedimentation probably lay close to a line drawn between Curtin Springs and the Erldunda Range. The rocks close to this line are boulder beds with rounded phenoclasts mainly of Winnall Beds. Cambrian dolomite, which is in places fossiliferous crops out in the Seymour Range and near Briscoe Tent Hill. Thin beds of dolomite, with interbedded shale overlain by arkosic sand and thin granite pebble beds, occur in the Mt.Sunday Range. The incomplete sequences in the Cambrian rocks does not allow precise correlation with the thicker sections present in the northern part of the Amadeus Basin.

6. Over most of the area the only sediments of the Larapinta Group deposited were the upper part of the Stairway Sandstone and the Stokes Formation. The HornValley siltstone is present as a thin fossiliferous limestone near Briscoe Tent Hill and is possibly represented by pisolitic ironstone rubble south of the Liddle Hills. Elsewhere the Stairway Sandstone rests unconformably on the Pertaoorrta Formation or Upper Proterozoic rocks. The most southerly outcrops of the Larapinta Group are in the central part of the Kulgera Sheet area and at Mt.Watt. The sediments may have transgressed a good deal further south than these outcrops.

7. The thickness of the Larapinta Group is only about one tenth of the total thickness of the Group exposed on the northern margin of the Amadeus Basin.

8. In several outcrops through the area the Stairway Sandstone contains thin coarse sandstone beds rich in phosphate and in places the basal conglomerate contains large phosphate pellets.

9. About 10 miles south of Angas Downs Homestead the Mereenie Sandstone unconformably overlies the Winnall Beds. Elsewhere the sandstone follows conformably on the Larapinta Group. The most southerly outcrop of the Mereenie Sandstone is in the central part of the Kulgera Sheet area.

10. The lower siltstone unit of the Pertnjara Formation is probably laterally equivalent to the Palaeozoic Horseshoe Bend Shale and the upper sandstone unit to the Idracowra Sandstone. The interfingering of these units is evident on the south-east corner of the Henbury Sheet area.

11. The Langra Sandstone and Polly Conglomerate are probably regional coarse conglomeratic phases of the Palaeozoic sediments where they overlap Precambrian rocks.

12. The Crown Point Beds exhibit many of the charqcteristics associated with glacial beds. The beds contain large striated erratics and large scale slumps caused by overriding ice masses.

13. The Mesozoic sediments cover a large part of the Charlotte Waters Sheet area and occur as far west as Mt.Ebenezer and farther north on the Henbury Sheet area. Sediments identified as the Rumbalara Shale were mapped on the central part of the Hale River Sheet area.

The unconformities and structures present in the sediments in the south-east Amadeus Basin indicate three periods of diastrophism of varying intensity.

1. The Inindia Beds and older sediments were gently folded and eroded before the deposition of the Winnall Beds.

2. A major orogeny uplifted large blocks of the Winnall Beds and older sediments. These uplifted areas of thick sequences of Proterozoic rocks were the major source of sediments for the Cambrian and Ordovician sequences.

   The linear nature of the major unconformity between the Palaeozoic and Proterozoic rocks suggests that east-west trending block faulting uplifted large masses of Proterozoic rocks in late Upper Proterozoic or early Cambrian time. The unconformities are probably of an abutment type with the Palaeozoic sediments deposited against the uplifted fault blocks.

3. The last major orogeny occurred during and after the deposition of the Pertnjara Formation. In places there is an angular unconformity between the Pertnjara Formation and the Mereenie Sandstone but the fold patterns in the Pertnjara Formation follows that present in the older sediments. The fold axes generally trend east-west. In some places the limbs of the folds are overturned.

   Some of the movements that uplifted the large block of Upper Proterozoic sediments in the Mt. Kingston and Black Hill Range occurred after the deposition of the Palaeozoic Langra Sandstone and Polly Conglomerate. In places these formations are vertical next to the uplifted block. The orogeny is probably related to the late Palaeozoic orogeny that folded the Amadeus Basin sediments.

TABLE 1: STRATIGRAPHY OF THE KULGERA, CHARLOTTE WATERS AND PARTS OF THE AYERS ROCK AND HENBURY SHEET AREAS

AGE	FORMATION	MAP SYMBOL	APPROX. THICKNESS	CORRELATION	LITHOLOGY	REMARKS
QUATERNARY		Qa			Alluvial gravel, sand and clay and red earth plains	
		Qs			Aeolian sand	
		Qt			Salt lake evaporites	
		Ql			Travertine	
		Qg			Earthy gypsum	
TERTIARY		T			Undifferentiated sandstone and siltstone	One outcrop of fossiliferous siltstone on the Kulgera Sheet area
		Tb			Grey billy	
		Tc			Conglomerate and breccia	
		Tl			Lacustrine limestone	
MESOZOIC CRETACEOUS	RUMBALARA SHALE	Kr	900'		Porcellanite and shale with lenses of sandstone and glauconitic sandstone.	Contains marine macro and micro fossils of Aptian Age. Formation is ochreous at Rumbalara
MESOZOIC UNDIFFERENTIATED	DE SOUZA SANDSTONE	Md	300'		Kaolinitic and conglomeratic medium to coarse sandstone coarsely cross-bedded with bands and lenses of claystone and siltstone.	Contains poorly preserved plant fossils. Plant fossils from a similar sequence at Mt.Anna in S.A. are U.Jurassic-L.Cret.
?PERMIAN	CROWN POINT 'BEDS'	PzC	100'		Tillite, boulder beds with interbedded claystone and siltstone. Striated and facetted boulders and large slump structures.	Artinskian spores in Malcolms Bore, McDills Sheet area.

AGE		FORMATION	MAP SYMBOL	APPROX. THICKNESS	CORRELATION	LITHOLOGY	REMARKS
PALAEOZOIC	UNDIFFERENTIATED	"IDRACOWRA SANDSTONE"	P_{zi}	500'	Laterally equivalent in part to the Pertnjara Formation	Fine and medium kaolinitic sandstone, conglomeratic and cross-bedded near the base.	
		"HORSESHOE BEND" SHALE	Pzh	200-300'		Red-brown and green biotitic and gypsiferous shale and some medium sandstone	
		"LANGRA FORMATION"	Pza	400-500'		Fine and coarse sandstone with conglomerate beds and isolated pebbles of granitic and metamorphic rocks. Some interbedded red-brown siltstone.	
		"POLLY CONGLOMERATE"	Pzo	200'		Pebbles, boulders and cobbles of granitic and metamorphic rocks and Stairway Sandstone in coarse sand matrix.	
		PERTNJARA FORMATION	Pzp			Fine and medium silty red-brown and fawn sandstone overlying red-brown, fine, micaceous sandstone and siltstone	Red-brown sandstone is interbedded with white kaolinitic sandstone (?Idracowra Sandstone on S.E. part of Henbury Sheet area)
	?ORDOVICIAN	MEREENIE SANDSTONE	Pzm			White and red-brown, medium sandstone, with interbedded gypsiferous red and yellow siltstone near base	Formation is noticeably coarser grained on S.E. part of Henbury Sheet area.

AGE		FORMATION	MAP SYMBOL	APPROX. THICKNESS	CORRELATION	LITHOLOGY	REMARKS
PALAEOZOIC (ORDOVICIAN)....continued							
PALAEOZOIC	ORDOVICIAN	LARAPINTA GROUP — STOKES FORMATION	Ot	30-300'		Grey-green, thin bedded dolomite with abundant worm tracks, and varigated shale and siltstone with halite pseudomorphs	Poorly preserved fragmentary fossils.
		STAIRWAY SANDSTONE	Os	200-400'		White, thin-bedded, medium & fine sandstone, minor siltstone. Coarse sandstone and fine conglomerate in basal part of formation.	Only upper part of Stairway Sandstone deposited. Formation has thin nodular phosphate beds. Richly fossiliferous
		HORN VALLEY SILTSTONE	Oh	10'±		Grey and yellow-brown limestone and poor outcrops with pisolitic ironstone rubble.	Only two occurrences - one near the Liddle Hills and the second near Briscoe Tent Hill
		PACOOTA SANDSTONE	C/Op	20'±		Medium orange-brown sandstone	One outcrop near the Liddle Hills mapped as doubtful Pacoota Sandstone
	CAMBRIAN	PERTAOORRTA FORMATION	Cp	400'		Boulder conglomerate, arkose, siltstone, silty sandstone grey-wacke, and fine, grey dolomite	Fossils present in dolomite from the S.E. part of Henbury Sheettarea
UPPER PROTEROZOIC		WINNALL BEDS	P_uw	3000'+	Pertatataka Formation	Silicified, thin to thick bedded sandstone, glauconitic shale and siltstone. Abundant flow casts, cut and fill structures, silt pellets and ripple marks.	

AGE	FORMATION	MAP SYMBOL	APPROX. THICKNESS	CORRELATION	LITHOLOGY	REMARKS
UPPER PROTEROZOIC...	.continued					
UPPER PROTEROZOIC	ENINDIA BEDS	P_un	1000'+	In part equivalent to the Areyonga Formation	Coarse cross-bedded sandstone, medium silicified sand, thin beds of dolomite, varved siltstone and pebble beds in upper part of the formation. Red-brown and grey siltstone, chert breccia, haematite breccia in basal part of formation.	Pebbles in upper part of formation contain striated and facetted erratics.
	BITTER SPRINGS LIMESTONE	P_ub	-		Dark grey and pink fine to coarse dolomite, interbedded siltstone and minor sandstone. Stromatolites abundant in places.	Some chocolate sandstone at top of formation at Ippia Hill has halite pseudomorphs
PRECAMBRIAN		pCg			Complex sequence of granitic and aplitic intrusions, and dykes of dolerite and pegmatite. One outcrop of quartzite and schist on SW. part of Kulgera Sheet area.	Confined to Southern part of Kulgera and SW part of Charlotte Waters Sheet area

PHOSPHATE DRILLING PARTY

by

J.Barrie

During the period 22nd July to 28th October, 1963, a program of core drilling to evaluate bedded phosphate rock was completed in the Amadeus Basin under the supervision of J.Barrie.

Four holes were drilled during the period as follows:-

DDH/AP1, Johnny Creek Anticline, T.D.918 feet

DDH/AP2, Near Yana Bore, George Gill/Mt.Levi Range, T.D.544'6"

DDH/AP3, Southern flank James Range, T.D.772 feet

DDH/AP4, Inindia Bore area west of Angas Downs, T.D.338'8"

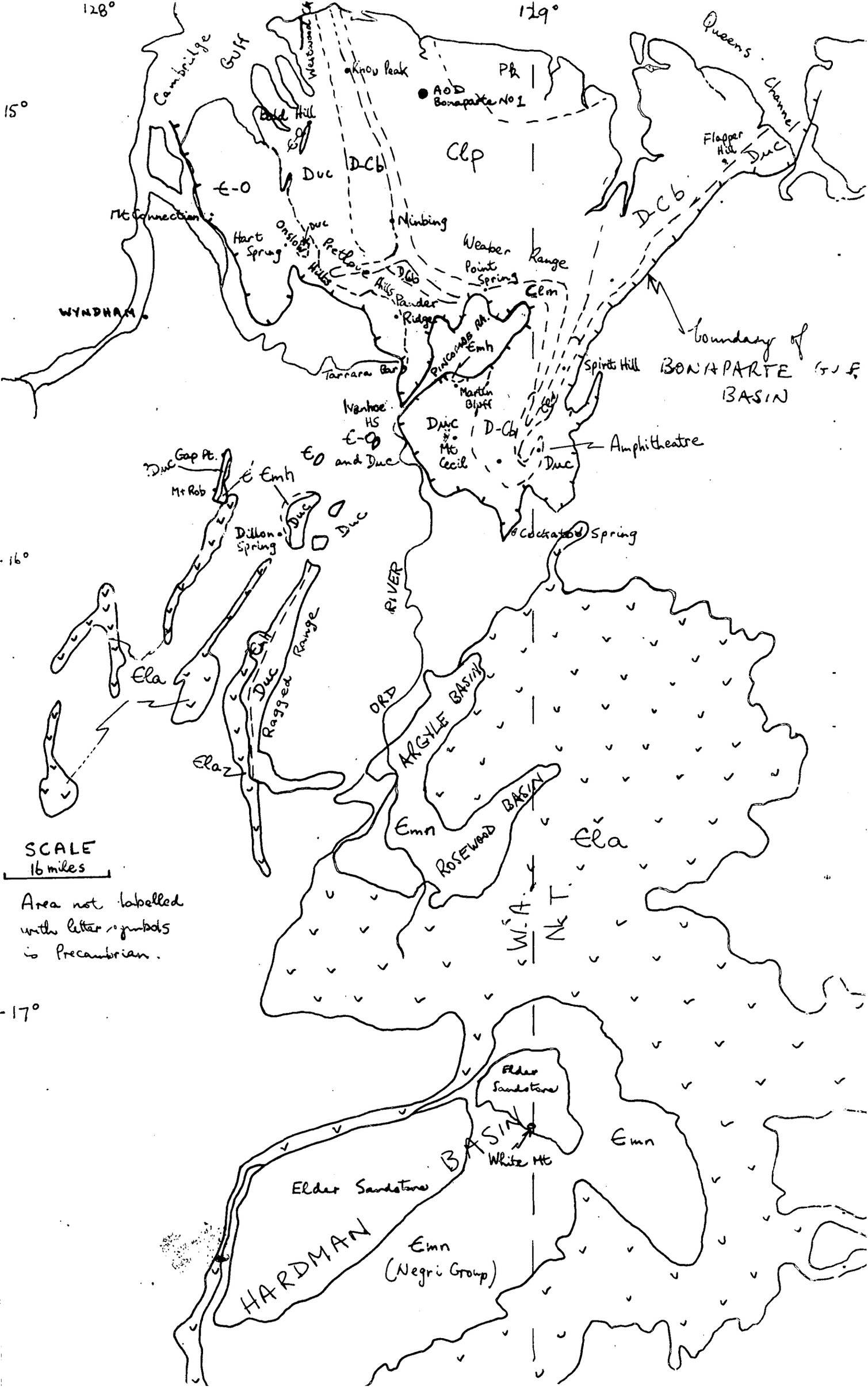
The objective was to test the Ordovician Stairway Sandstone (a formation in the Larapinta Group) in which phosphatic beds were detected in outcrop by Bureau field parties.

Of particular interest was the recovery of an oil saturated core in the Stairway Sandstone from 652-660 feet, which contained oil of approximately 16° API gravity.

Analysis of core samples has indicated a range of P_2O_5 from less than 1% to 15% in contrast to surface samples which ranged from less than 1% to about 25%.

Information so far available indicates that no deposits of economic significance have been penetrated in the four core holes, although a 7 ft. intersection of pellet phosphate sandstone in AP4 may warrant further investigation when chemical analyses are known.

BONAPARTE GULF BASIN


128°
129°
15°
16°
17°
Cambridge Gulf
Westwood Ck
Know Peak
AOD Bonaparte No 1
Pk
Bold Hill
Clp
Duc
D-Cb
€-O
Mt Connection
Ninbing
Hart Spring
Onslow Ck
Prettlove Hills
Weaber Point Spring
Range
Pander Ridge
Emh
WYNDHAM
Tarrara Bar
Pincombe Rd
Martin Bluff
Spirits Hill
Boundary of BONAPARTE GULF BASIN
Ivanhoe HS
Mt Cecil
Amphitheatre
Gap Pt.
Mt Rob
Dillon Spring
Ela
Ragged Range
Elaz
ORD RIVER
ARGYLE BASIN
ROSEWOOD BASIN
Emn
WAT
Queens Channel
Flapper Hill
DCb
Elder Sandstone
White Mt
HARDMAN
(Negri Group)
SCALE
16 miles
Area not labelled with letter symbols is Precambrian.

BONAPARTE GULF PARTY

by

J.J.Veevers

J.J.Veevers, J.Roberts, and J.A.Kaulback carried out field work in the southern part of the Bonaparte Gulf Basin and environs (South of Queens Channel) from 9th May to 30th September, 1963; P.J.Jones joined the party for the months of June and July.

The area was mapped prior to 1963 by Traves (B.M.R.Bull.27) and by oil company geologists, and our work was directed to the study of problems that had arisen out of this mapping. We established close liaison with the Australian Aquitaine Petroleum Company geological party led by Dr.M.Zimmerman, and consequently many of the facts reported below were discovered jointly.

The problems, and our attempts to solve them, are as follows:*

1. Before the 1963 season, the Cambrian and Ordovician rocks of the Bonaparte Basin were known from isolated fault blocks only. An unbroken sequence, 2800 feet thick, of shale (150'), sandstone (600'), Biconulites limestone (50'), red sandstone and siltstone (600'), limestone (200'), red sandstone (800') and glauconitic sandstone (400') overlying Antrim Plateau Volcanics has since been found south of Pander Ridge; a section starting with the Biconulites limestone and ending before the glauconitic sandstone was found in the Onslow Hills. This sequence confirms that established by Traves and Opik on the basis of fossils.

2. Outcrops (exposed stratigraphical thickness in brackets) hitherto regarded as Precambrian and newly recognised as Cambrian are Mount Connection (700 feet), the westernmost known outcrop of Cambrian rocks in the Basin; the Mount Rob Outlier (3500 feet), Gap Point Outlier (1200'), and the bed of the Ord River from Tarrara Bar three miles upstream (700'). Outcrops of volcanics overlain concordantly by the Devonian Cockatoo Sandstone were found along the eastern edge of the Basin north of Cockatoo Spring, and these are identified as Antrim Plateau Volcanics.

3. The following outcrops, hitherto regarded as Devonian, were found to contain Cambrian fossils: a line of outcrop from a point 5 miles north of Hart Spring to Bald Hill; two hills 5 miles south-west of Point Spring (400'); the basal 300 feet of the Dillon Spring Outlier; Biconulites limestone (5 feet) and red sandstone (200 feet) 7 miles south-west of Ivanhoe Homestead; and Martin Bluff (200 feet).

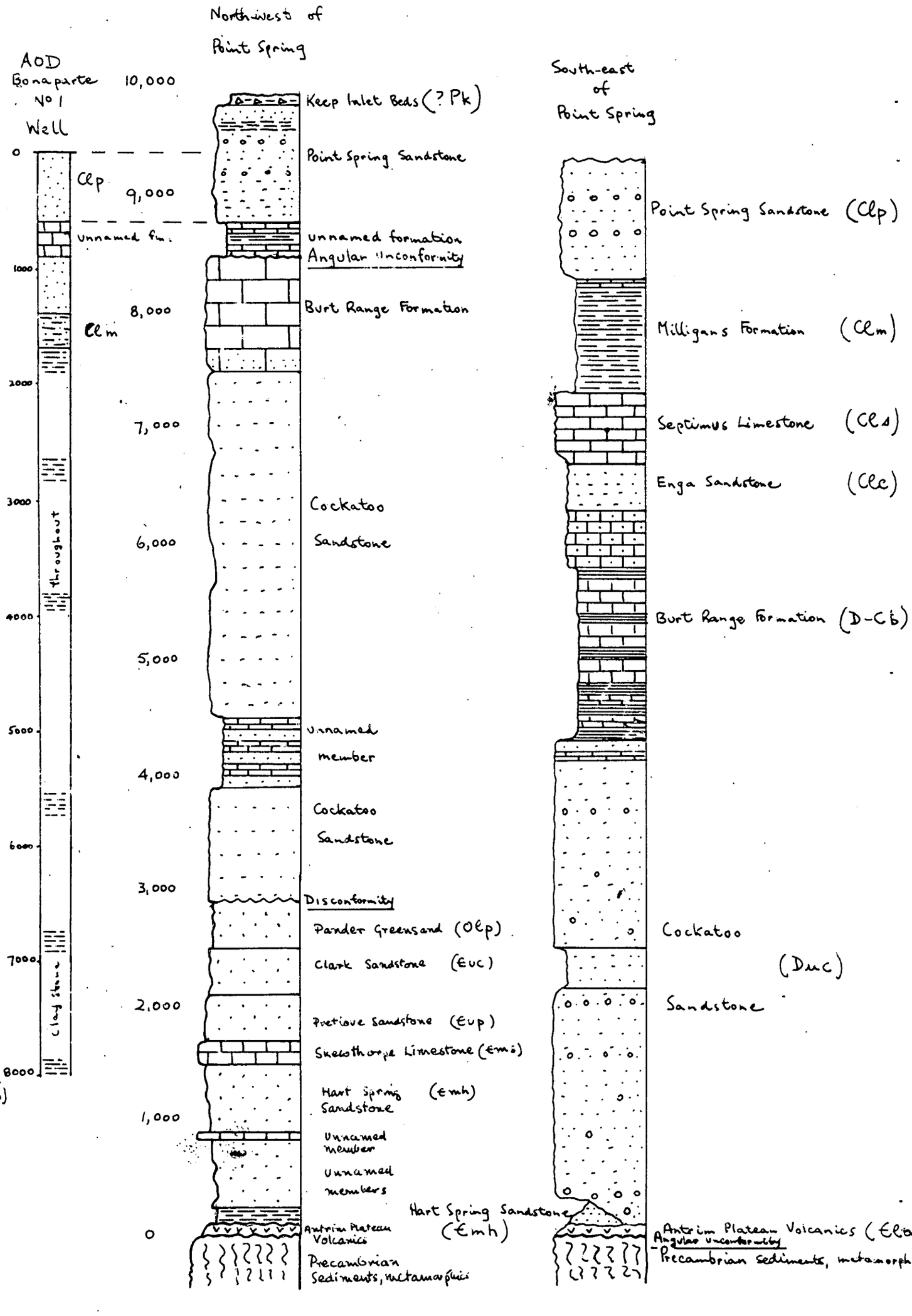
4. The following outcrops, hitherto regarded as Cambrian, were found to contain Devonian fossils: Pretlove Hills (at least 2,000 feet) and the bulk of the Ragged Range (1350 feet).

5. The following outcrops, hitherto regarded as Precambrian, are now regarded as Devonian: the core of Mount Cecil, and the white sandstone (at least 2000 feet thick) unconformably overlying the Cambrian rocks at Gap Point and at Mount Rob.

6. Hitherto, fossils in the 5000 feet thick Cockatoo Sandstone (Upper Devonian) were known from isolated outcrops only. In 1963, the Australian Aquitaine Petroleum and our party found abundant fossils in the middle part of the type section, aand in numerous other sections. At Westwood Creek, in the north-west part of the area, abundant fossils were found in a section of 600 foot of interbedded sandstone and limestone overlain by 1400 feet of quartz sandstone. Equivalent limestone with fossils was found in the northern part of the Onslow Hills.

* Refer to accompanying geological sketch map and diagrammatic section.

Diagrammatic sections
Southern part of Bonaparte Basin
WA and NT



7. The balance of evidence favours identifying the Nigli Gap Sandstone as the marginal part of the Cockatoo Sandstone.

8. Detailed sections were measured through the Upper Devonian - Lower Carboniferous sequence in the Burt Range area, and a large fauna, most of it undescribed, was collected. When described, this fauna will provide the basis for zoning.

9. An irregular upper surface on the Septimus Limestone is revealed in a series of six sections measured along the central Burt Range, and confirms the postulated disconformity between the Septimus Limestone and the overlying Point Spring Sandstone.

10. As a result of detailed fossil collecting in the Burt Range and the measuring of four sections at Spirit Hill, the limestone and overlying quartz sandstone at Spirit Hill are known to be equivalent to the upper part of the Burt Range Formation in the type area. A fauna of this age has been collected from the north-western tip of the Pincombe Range and from several scattered outcrops of limestone and silicified quartz sandstone extending from Spirit Hill to Flapper Hill, on the eastern margin of the Basin.

11. Black shale of the Milligans Formation crops out directly beneath Point Spring Sandstone west of Spirit Hill. This new occurrence of shale is worth mentioning because outcropping shale is virtually unknown in the Basin.

12. In the northern part of the area, detailed sections were measured through the Burt Range Formation at Ninbing, through a sequence of unnamed calcarenite overlying Point Spring Sandstone near Knob Peak, and through the Point Spring Sandstone in the Weaber Range. Extensive collections were made from scattered outcrops of the unnamed Lower Carboniferous (Visean) calcarenite along the valley north of Ninbing Homestead, and from the lowermost beds of the Point Spring Sandstone in the Weaber Range. Microfossils found in the Keep Inlet Beds may reveal the precise age of this poorly outcropping marine glacial deposit.

13. An intensive search for fossils in the Elder Sandstone of the Hardman Basin was fruitless. The balance of evidence favours regarding the Elder Sandstone as Devonian, and not Cambrian as hitherto believed.

14. The White Mountain Formation in the Hardman Basin was sampled for fossils in the hope that a closer estimate of age than Tertiary may be made.

Structural history

The Cambrian and Ordovician rocks, eroded to various stratigraphical levels, are overlain disconformably by Upper Devonian rocks, indicating that the Cambrian and Ordovician rocks were virtually undisturbed before the Upper Devonian. Along the eastern edge of the basin, the marginal deposits of the Upper Devonian Cockatoo Sandstone contain pebbles, cobbles, and boulders (up to 2 feet across) whereas farther west, the coarsest coeval deposit is a coarse-grained quartz sandstone. Hence, we infer that movements, probably block faulting, along the eastern edge of the basin preceded the deposition of the Cockatoo Sandstone.

Movements affecting the Devonian and Carboniferous rocks of the basin were local. In the east, the Devonian and Carboniferous sequence is punctuated by many minor breaks, contains thick conglomerate, is block-faulted, and the carbonate rocks contain abundant minerals. In the west the sequence is broken by a major angular unconformity, but the products of strong relief - conglomerates, and detrital minerals in carbonates - are lacking, and strike faulting in the rocks beneath the unconformity is the main structural element.

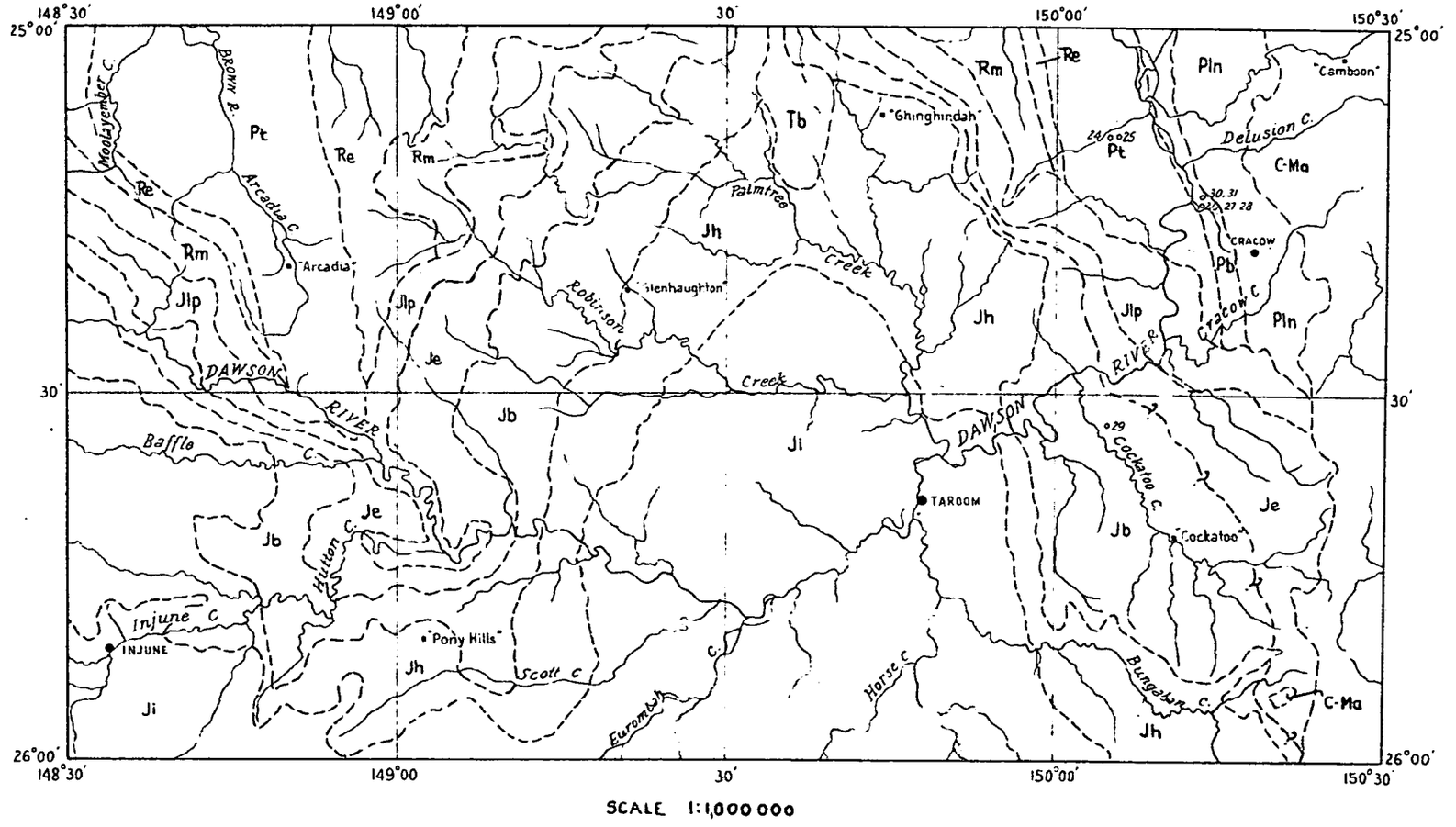
The angular unconformity is found in the area west of Point Spring, and it separates Upper Devonian and basal Lower Carboniferous rocks from younger Lower Carboniferous (Visean) rocks. From the depth of erosion beneath the unconformity, we infer that the tilting and strike faulting took place very early in the Lower Carboniferous. The Cambrian and Ordovician sequence and the Upper Devonian Cockatoo Sandstone were strike faulted and tilted to dip 20° to 30° northeastward, and the Upper Devonian and lowermost Lower Carboniferous limestone was faulted and gently folded. The Visean rocks above the unconformity are virtually horizontal, and overlap the limestone to rest on the Cockatoo Sandstone. This early Carboniferous movement was probably responsible also for the block-faulting of the southern part of the basin now represented by various outliers, among which the Ragged Range is the largest.

The only other movement recorded in the western part of the basin took place after the deposition of the later Lower Carboniferous (Namurian) sandstone, and is indicated by basinward dips (locally up to 30°) in those strata.

In the eastern part of the basin, the first movement is recorded by the unconformity separating the sandy limestone of the Burt Range Formation from slightly younger sandstone at Spirit Hill. Conglomerate in the easternmost Enga Sandstone is probably the result of local downfaulting. The next movement is expressed by the disconformity between the Septimus Limestone and the overlying Point Spring Sandstone. The Septimus Limestone is 600 feet at Mt.Septimus, indicating down-faulting to the north. Whether the Milligans Formation is missing south of Milligans Hills by downfaulting or by lateral change into part of the Point Spring Sandstone will be tested by a study of the fossils collected from key outcrops. Likewise we hope to determine by fossils whether the thick claystone sequence penetrated by the AOD Bonaparte No.1 Well is a thick wedge of Milligans Formation or a lateral equivalent of the rest of the Devonian and Carboniferous sequence.

BOWEN BASIN

GEOLOGICAL SKETCH MAP OF AREA MAPPED BY TAROOM PARTY



TERTIARY	Tb	
JURASSIC	Ji	Injune Coal Measures
	Jh	Hutton Sandstone
	Jb	Boxvale Sandstone
	Je	Evergreen Shale
	Jlp	Precipice Sandstone
TRIASSIC	Rm	Mooloyember Shale
	Re	Clematis Sandstone
PERMIAN	Pt	Theodore Group
	Pb	Back Creek Group
	Pln	Camboon Andesite
	C-Ma	Auburn Complex

o 26 B M R shallow drill hole

INTRODUCTION

Regional mapping of the Bowen Basin was continued during 1963 by the Taroom, Baralaba and Springsure parties, combined Bureau of Mineral Resources and Geological Survey of Queensland parties. These parties mapped the Taroom, Springsure and Baralaba 1:250,000 Sheets, the western one-third of the Mundubbera Sheet and adjacent corners of the Duaringa, Rockhampton and Monto Sheets.

In addition to the regional mapping, about 7,000 feet of section was measured in the Duaringa and St.Lawrence Sheet areas as a follow-up to the 1962 season mapping. Also a shallow drilling and coring programme was completed during October in the area mapped during 1963. This programme consisted of 31 holes totalling 4,415 feet drilled and 187 feet cored. These holes were located to give cuttings and core material from important parts of the Lower Permian to Mesozoic section, particularly in areas of poor outcrop. The location of the drill holes are shown on the geological sketch map illustrating each party's summary of activities.

Seven hours flying in a light aircraft was used to examine the Eddystone Sheet which is to be mapped during 1964.

TAROOM PARTY

During the 1963 field season the Taroom party, consisting of A.R.Jenson andC.M.Gregory (B.M.R.), and V.R.Forbes (G.S.Q.), mapped the Taroom Sheet area and the western third of the Mundubbera Sheet area, (between 25° and 26°S, and 148°30 and 150°30 E), as part of the programme of mapping in the Bowen Basin. A sketch map showing areal distribution of the units mapped accompanies this report.

The Lower Permian Camboon Andesite forms the basement in the eastern part of the area. These volcanics are intruded by the Auburn Complex and are overlain by the Permian marine Back Creek Group. The sequence then passes upwards into the Theodore Group and the Triassic Clematis Sandstone and the Moolayember Shale. Overlying these are the relatively flat lying Jurassic Precipice Sandstone, Evergreen Shale, Boxvale Sandstone, Hutton Sandstone and Injune Coal measures. Several very small areas of acid volcanics, presumably Mesozoic, were mapped in the north east of the area. Tertiary basalt flows crop out in some areas. Laterite is quite extensive and has developed a capping over a number of units.

The oldest unit in the area, theCamboon Andesite, consists of massive acid and intermediate flows and pyroclastics, and minor conglomerate. This unit appears to be lithologically similar to the Lower Bowen Volcanics which crop out in the northern part of the Bowen Basin; the main difference between the two units being the general lack of fine grained sedimentary rocks in the Camboon Andesite.

Intrusive into the Camboon Andesite is the Auburn Complex. This Complex consists essentially of granite, adamellite and granodiorite together with dykes of andesite and dacite. The intrusion has caused silicification and some brecciation in the Camboon Andesite near the intrusive contacts.

The Back Creek Group, a Lower to Upper Permian marine unit, overlies the Camboon Andesite with a possible slight time break between the two. The Back Creek Group consists of a basal unit, roughly 50 ft. thick, composed of calcarenite and coquinite, which contains abundant marine fossils belonging to the lowest part of the Middle Bowen Beds (as mapped in other areas of the Bowen Basin). Above this basal member is the Oxtrack Formation. This formation, which is approximately 100 ft. thick, consists of fossiliferous calcarenite and coquinite, grading laterally into calcareous siltstone. The fossil fauna of brachiopods, pelecypods and gastropods is typical of that found in the highest part of the Middle Bowen Beds, indicating a significant time break. Conformably overlying the Oxtrack Limestone is the Barfield Formation; a 3000 ft. sequence of mudstone, lithic and tuffaceous sandstone and calcilutite. The mudstone contains a rich marine fauna similar to that of the Oxtrack Formation. Above the Barfield Formation the sequence passes conformably into the Mt. Steel Formation (or Flat Top Formation) which is about 1400 ft. thick and composed of hard white argillite with minor marine fossils, and fine, possibly tuffaceous sandstone.

The Theodore Group overlies the Back Creek Group and is roughly equivalent in position in the stratigraphic column to the Upper Bowen Coal Measures. Three formations have been recognized within it: the basal Gyranda Formation, overlain by the Baralaba Coal Measures and the Rewan Formation. The Gyranda Formation consists of 900 ft. of lithic sandstone and siltstone with minor mudstone and conglomerate. The overlying Baralaba Coal Measures contain a basal 1000 ft. of tuffaceous and conglomeratic beds, directly under coal, followed by 2000 ft. of interbedded conglomerate, conglomeratic sandstone, mudstone and calcareous sandstone. The Rewan Formation, about 8000 ft. thick, consists of micaceous sandstone and red claystone.

The Clematis Sandstone, a Triassic unit, consists of massive and cross-bedded kaolinitic quartz sandstone with some interbeds of siltstone.

Above the Clematis Sandstone the Moolayember Shale was deposited conformably. This unit consists of at least 1500 feet of lithic sandstone, mudstone and calcareous mudstone, the latter in places carrying a rich fossil flora. Conglomerate is abundant in this unit in the eastern part of the Taroom Sheet area.

Unconformably overlying the Moolayember Shale, and in some areas the Clematis Sandstone, is the Lower Jurassic Precipice Sandstone. This unit has a maximum thickness of 300 ft. and consists predominantly of medium grained coarse, cross-bedded quartz sandstone.

The Evergreen Shale is a sequence of thin to medium-bedded shale, siltstone and quartz sandstone, with minor lithic sandstone. The unit generally crops out poorly; it is in the order of 100 ft. thick.

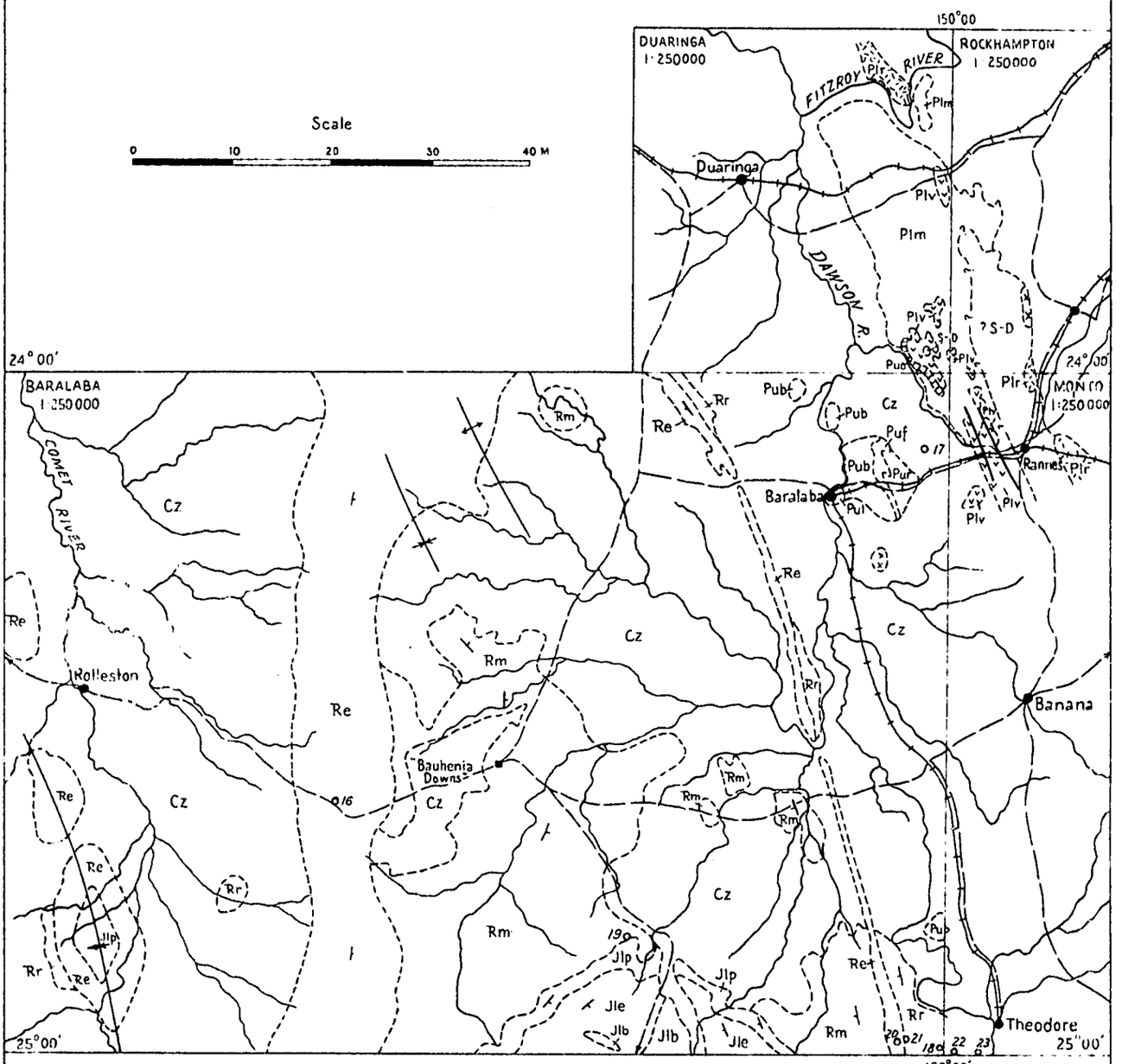
Overlying the Evergreen Shale is the Boxvale Sandstone characterized by clean quartz sandstone together with shale and siltstone. This unit is about 150 ft. thick. Near the top is a ferruginous band of varying thickness, from a few inches to 20 ft., which sometimes takes the form of an oolite bed.

Next in the sequence is the Hutton Sandstone, conformably overlying the Boxvale Sandstone, and consisting of brown, iron-rich argillaceous quartz sandstone and minor fine grained sediments.

SUMMARY OF ROCK UNITS, TAROOM-MUNDUBBERA AREA

Age	Unit	Thickness in feet	Lithology
Tertiary		100	Laterite
		80	Basalt and quartz sandstone
Mesozoic Undif.		-	Rhyolite
Jurassic	Injune Coal Measures	-	Calcareous lithic sandstone, carbonaceous shale, shale, coal
	Hutton Sandstone	200	Brown argillaceous quartz sandstone
	Boxvale Sandstone	150	Quartz sandstone, shale, siltstone, limonitic oolite
	Evergreen Shale	100	Shale, siltstone, quartz sandstone
	Precipice Sandstone	300	Cross-bedded quartz sandstone
	Unconformity		
Triassic	Moolayember Shale	1500-3000	Lithic sandstone, mudstone, calcareous mudstone
	Clematis sandstone	700	Cross-bedded quartz sandstone, siltstone
	Theodore Group Rewan Formation	8000	Micaceous sandstone and red claystone
Permian	Baralaba Coal Measures	3000	Tuff, conglomerate, sandstone, coal
	Gyranda Formation	900	Lithic sandstone, siltstone, conglomerate
	Back Creek Group Mt.Steel Formation	1400	Argillite and fine possibly tuffaceous sandstone
	Barfield Formation	3000	Mudstone, lithic and tuffaceous sandstone
	Oxtrack Formation	100	Calcarenite, coquinite, calcareous siltstone
	Disconformity		
Permian	(basal member)	50	Calcarenite, coquinite
	Camboon Andesite	-	Acid and intermediate volcanics and pyroclasts
Post Permian	Auburn Complex	-	Granite and granodiorite with andesite and dacite dykes.

GEOLOGICAL SKETCH MAP OF AREA MAPPED BY BARALABA PARTY 1963



REFERENCE

CAINOZOIC	Undifferentiated	Cz
JURASSIC	Boxvale Sandstone	Jlb
	Evergreen Shale	Jle
	Precipice Sandstone	Jlp
TRIASSIC	Moolayember Formation	Rm
	Clematis Sandstone	Re
	Rewan Formation	Rr
PERMIAN	Upper Bowen Coal Measures: Baralaba Coal Measures	Pul
	Upper Bowen Coal Measures: Undifferentiated	Pub
	Middle Bowen Beds (Plm): Flat Top Formation	Puf
	Middle Bowen Beds (Plm): Barfield Formation	Pur
	Middle Bowen Beds (Plm): Oxtrack Formation	Puo
	Lower Bowen Volcanics	Plv
	Rookwood Volcanics	Plr
SILURIAN-DEVONIAN	Undifferentiated	S-D
INTRUSION		X X

o 20 B.M.R. Shallow drill hole

The Injune Coal Measures are the youngest Mesozoic unit in the area. They crop out poorly and consist of calcareous, carbonaceous lithic sandstone, shale, carbonaceous shale, and thin coal seams (some of which have been mined).

Several outcrops of rhyolitic acid volcanics, covering an area of only a few acres, in the north-east part of the area are thought to be mesozoic and are correlated with reported Mesozoic volcanics on the Monto Sheet area to the north.

Basalt, thought to be Tertiary in age, crops out in the north-eastern part of the Taroom Sheet area. This basalt is both vesicular and massive and occurs interbedded with quartz sandstone. The unit has a maximum thickness of 80 ft.

Laterite has developed covering many units including the Injune Coal Measures, Hutton Sandstone, Camboon Andesite, the Auburn Complex and Tertiary basalt. The laterite profiles vary from a few feet to 100 ft. thick.

Gold is mined at Cracow from the Golden Plateau Mine, and there have been other, but smaller mines, around Cracow.

Towards the south and west of the area potential oil reservoir rocks occur in the Mesozoic and Permian units and a number of oil wells have been drilled; others are in progress. So far all the oil wells have been barren.

BARALABA PARTY

The Baralaba Party, consisting of F.Olgers, A.W.Webb, J.J.J.Smit of the Bureau of Mineral Resources, and B.A.Coxhead of the Geological Survey of Queensland, mapped the Baralaba 1:250,000 Sheet area and parts of the Duaringa, Rockhampton and Monto Sheet areas. Field work commenced on the 3rd June and was completed on the 15th October.

Baralaba Area

The Stratigraphy of the Baralaba Sheet area is illustrated on the accompanying table. The total thickness of the sequence is approximately 30,000 feet. The Permian-Triassic sequence is a conformable one, unconformably overlain by Jurassic rocks. The greater part of the Baralaba area lies within the Mimosa Syncline. Dips in the Triassic rocks range up to 22°; the Jurassic formations dip at angles up to 5°. In the north-east corner of the Sheet area, the Permian rocks are tightly folded, and are part of the Dawson Tectonic Zone of the Duaringa-St.Lawrence area.

Over 1000 crossbed measurements were made in the Clematis Sandstone in the Expedition and Shotover Ranges in the western limb of the Mimosa Syncline, and in the Dawson Range which forms the eastern limb of the Syncline. The work shows that the provenance of the formation lies to the north and north-west of the Baralaba area, probably in the Anakie Inlier and the Urannah Complex. Some of the sand in the south-east of the Sheet was derived from the east, probably from the Auburn Complex.

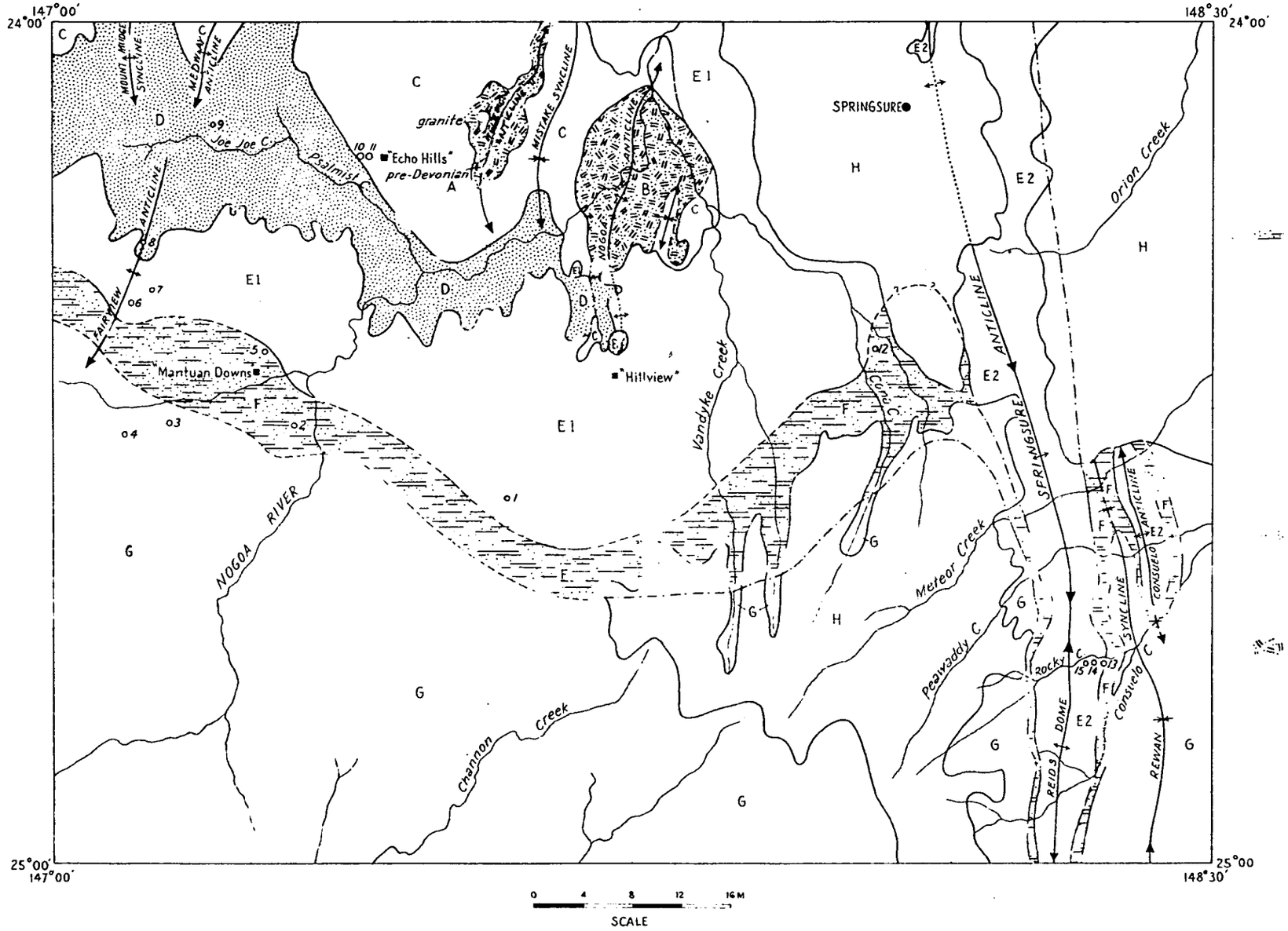
Four-corner area

The north-east corner of the Baralaba Sheet area and the adjacent corners of the Duaringa, Rockhampton and Monto Sheet areas has been referred to as the 4-corner area. It is largely made up of range country and access is generally poor.

STRATIGRAPHY OF THE BARALABA 1:250,000 SHEET AREA

AGE	FORMATION	DISTRIBUTION	LITHOLOGY	PALAEONTOLOGY	THICKNESS
Tertiary	-	Scattered over the Sheet area	Mainly poorly sorted sediments; basalt	-	Unknown
JURASSIC	Boxvale Sandstone	In the central south	Clean fine to med.grained grey sandstone	Poor stem impressions	140 ft.
	Evergreen Shale	In the Mimosa Syncline	Grey-green shales and siltstone, micaceous in places	Poor leaf & stem fragments.	290 ft.
	Precipice Sandstone		Poorly sorted, strongly cross bedded quartz sandstone.	-	240 ft.
TRIASSIC	Moolayember Formation	In the Mimosa Syncline	Lithic Sandstone, shale and some conglomerate	Rich flora in places	Up to 10,000 ft.
	Clematis Sandstone	Dawson, Expedition and Shotover Ranges	Med.grained, cross bedded quartz sandstone with interbeds of micaceous siltstone	-	1,000 ft. - 1,500 ft.
	Rowan Formation	East of Dawson Ra. and in places in S-W of Sheet area	Buff, lithic sst. and siltstone and red-brown siltstone and shale.	Fragmentary plant remains	Up to 14,000 ft.
PERMIAN	UPPER PERMIAN BOWEN MEASURES — Baralaba Coal Measures	Baralaba Town area	Feldspathic limestone, sandy shale, shale & coal	Rich flora in places	Tightly folded, thickness unknown
		Small area north and east of Baralaba	Calcareous lithic sst. and sandy shale	Fragmentary plant remains	
	Flat Top Formation	Kalewa Siding area, 4-miles east of Baralaba	Olive green siltstone and some coquinite	Abundant marine fossils	1,000 ft.
	Barfield Formation	Small area 5 miles east of Baralaba	Dark grey siltstone	Marine fossils	Unknown
	Oxtrack Fm.	Scattered outcrops east of the Don River	Decalcified & recrystallized limestone	Rich marine fauna in places	Unknown
	Lower Bowen Volcanics	Small area in the N.E. of the Baralaba Sheet area	Basic flows, agglomerate crystall tuff, tuff	-	Unknown
Post Permian	-	Intrusion at Mount Ramsay	Micro-Syenite	-	-

DISTRIBUTION OF ROCK FORMATIONS IN THE SPRINGSURE SHEET AREA



REFERENCE

H	TERTIARY	Minerva Hills Volcanics Tertiary basalt
G	JURASSIC	Precipice Sandstone
	TRIASSIC	Moolayember Formation Clematis Sandstone Rewan Formation
F	UPPER PERMIAN	Bandanna Formation
E2	LOWER PERMIAN	Mantuan Productus Bed unnamed Formation Catherine Sandstone Ingelara Formation Aldebaran Sandstone Sirius Formation Staircase Sandstone Stanleigh Formation Cattle Creek Formation Orion Formation
E1	LOWER PERMIAN	(Mantuan Productus Bed) unnamed Formation Colinlea Sandstone Siltstone
D	?UPPER CARBONIFEROUS	Joe Joe Formation
C	LOWER CARBONIFEROUS	Ducabrook Formation Raymond Sandstone Mount Hall Conglomerate
B	?UPPER DEVONIAN	Telemon Formation
	?lower MIDDLE DEVONIAN	Dunstable Formation
A		Pre-Devonian schist and gneiss

- reliable geological boundary
- approximate geological boundary
- obscured geological boundary
- obscured, inferred geological boundary
- fold axis showing plunge
- obscured fold axis
- 03 B.M.R. shallow drill hole

The oldest rocks exposed are the Silurian-Devonian limestones with associated slates and volcanics at Thuriba Homestead. Similar rocks occur along the eastern edge of the Gogango Ranges in the Rannes-Wowan area. No fossils have been found in this area.

At Thuriba Homestead, the Silurian-Devonian rocks are overlain by andesitic volcanics of the Lower Bowen Volcanics, which in turn are overlain by fossiliferous decalcified and recrystallized limestones of the Oxtrack Formation and the tightly folded lithic sandstones and shales of the undifferentiated Middle BowenBeds. In the eastern part of the Gogango Ranges, the probable Silurian-Devonian rocks are unconformably overlain by andesitic pillow lavas, which can be correlated with the Rookwood Volcanics of the Duaringa Sheet area. The pillow lavas are overlain by a sequence of folded lithic sandstone and shale of the Middle Bowen Beds.

The rocks in the area are tightly folded and in many places overfolded; numerous faults are present. No fossils have been found east of Thuriba Homestead and the age of the most of the rocks is unknown.

During the season, 80 granite samples were collected for age determination from the Bowen, Proserpine, Mount Coolon, Mackay, Clermont, St.Lawrence, Emerald, Duaringa, Springsure, Baralaba, Monto and Mundubbera 1:250,000 Sheet areas.

Planet Warrinilla North No.1:AAO., Purbrook No.1, and AAO Rolleston No.1 wells were drilled in the south-west corner of the Sheet area during the year.

SPRINGSURE PARTY

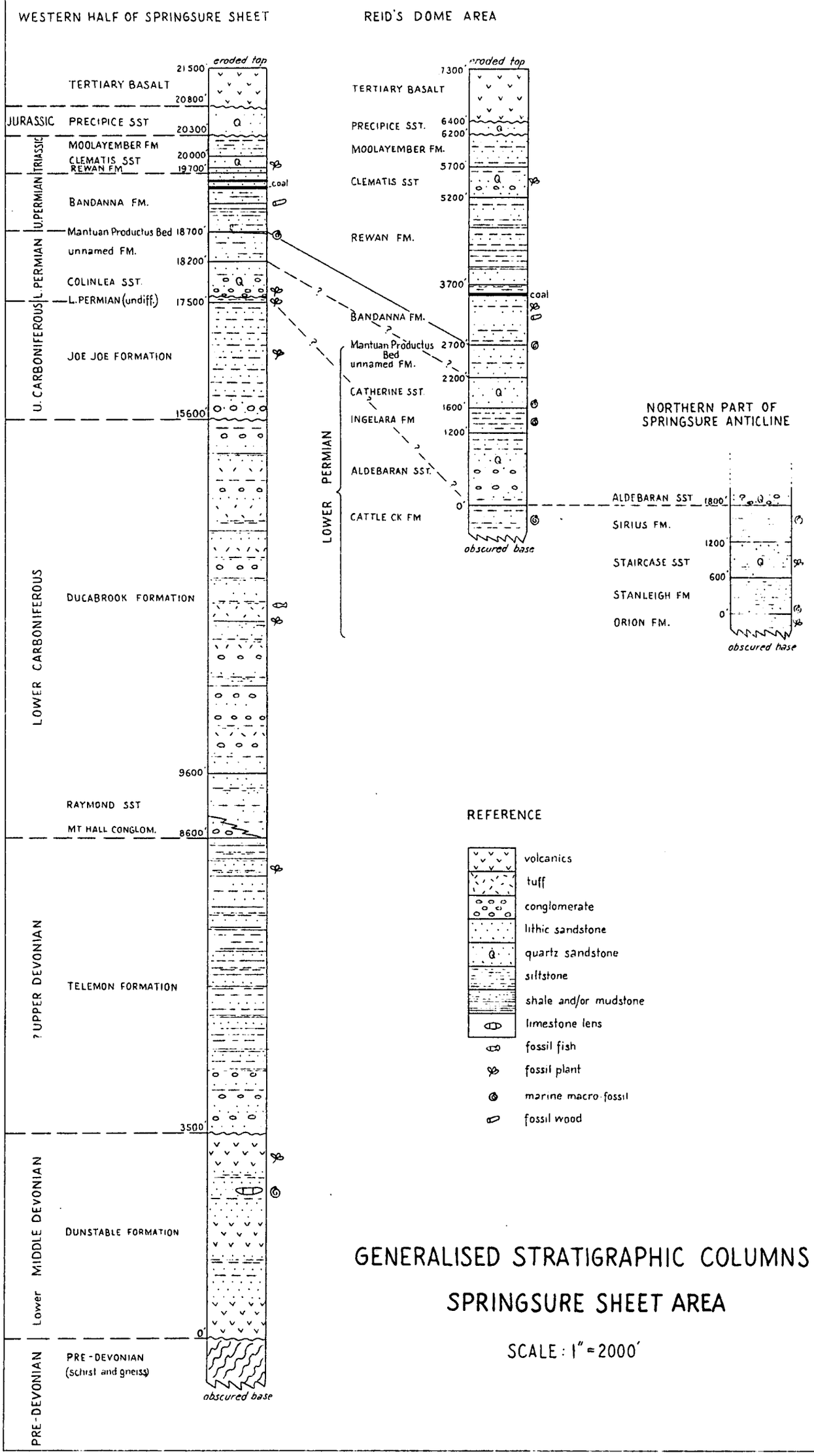
Personnel: R.G.Mollan and N.F.Exon, (Bureau of Mineral Resources) and A.G.Kirkegaard (Queensland Geological Survey).

The party commenced mapping the Springsure 1:250,000 Sheet at the beginning of June and returned to Canberra towards the end of October.

The accompanying sketch map and stratigraphic sections illustrate the distribution of the rocks, the main points of the stratigraphy, and tentative correlations across the Sheet. Advances on previous work in the area include:

1. The Telemon Anticline has volcanics exposed along the crest. These volcanics are lithologically comparable with volcanics in the Dunstable Formation, exposed in the Nogoa Anticline. These volcanics were previously thought to be Tertiary but are overlain by a conglomerate at the base of the Telemon Formation containing boulders of lithologically similar volcanics. The Telemon Formation in the Telemon Anticline is intruded by granite.

2. Sediments in the Dunstable Formation in the Nogoa Anticline form lenticular masses within volcanics. The unconformity between the Dunstable Formation and the overlying Telemon Formation in the Nogoa Anticline appears to be only locally strong; there is no evidence of a regional overlap. The persistence southward of the Nogoa Anticline was established by the discovery of rocks of the Dunstable Formation and Telemon Formation near Hillview Homestead.



GENERALISED STRATIGRAPHIC COLUMNS
SPRINGSURE SHEET AREA

SCALE: 1" = 2000'

3. The Mount Hall Conglomerate lies disconformably on the Telemon Formation. It is extremely lenticular, and is essentially a lensing basal quartz conglomerate of the Raymond Sandstone.

4. An anticline closed in Telemon Formation and complicated by flank folds and faulting was mapped in the area several miles north-west of Euneeke Homestead, adjacent to the east flank of the Nogoa Anticline.

5. The Joe Joe Formation lies unconformably on rocks of the Ducabrook Formation and, north of Hillview Homestead, the Telemon Formation. It includes fluvial polymictic conglomerates which consist of rounded and sub-rounded pebbles and boulders. The boulders are striated and faceted in places suggesting a glacial origin. The formation also contains siltstone with "varve structures". The Joe Joe Formation is probably Upper Carboniferous on palaeobotanical evidence.

6. The Colinlea Sandstone is regionally unconformable on the Joe Joe Formation and overlaps it along the Nogoa Anticline. In places the Sandstone overlies a few feet (10-20 feet) of siltstone containing Glossopteris flora which appears to be slightly unconformable with both the Colinlea Sandstone and the Joe Joe Formation. TheColinlea Sandstone is 450 feet thick in the west of the Sheet and 600 feet thick east of the Nogoa Anticline. It is overlain by about 450 feet of shale and lithic sandstone including a lenticular coquinite (the Mantuan Downs Productus Bed) at the top.

7. The Stanleigh Formation, the Staircase Sandstone, and the Sirius Formation in the northern part of the Springsure Anticline are probably equivalent to the Cattle Creek Formation in Reid's Dome, on marine fossil evidence.

8. The Aldebaran Sandstone is lenticular in the Springsure Anticline ranging from about 1000 feet to 1500 feet thick. Lithologically, it is similar to the Colinlea Sandstone, being predominantly a cross-bedded conglomeratic, kaolinitic quartz sandstone with pebbles of fine quartz sandstone and scattered acid volcanics; similar pebbles are common in the Colinlea Sandstone.

9. The Catherine Sandstone, about 600 feet of quartz sandstone in the northern part of the Springsure Anticline, 'wedges out' near the southern plunge of Reid's Dome. It is overlain by about 500 feet of lithic sandstone, carbonaceous siltstone, and shale which contains a lenticular coquinite at the top (the Mantuan Productus Bed). The unit overlying the Colinlea Sandstone west of the Springsure Anticline is probably equivalent to the unit overlying the Catherine Sandstone.

10. The Bandanna Formation, Rewan Formation, andClematis Sandstone are mapped across the Sheet area. The Rewan Formation thins from 1500 feet on the east flank of Reid's Dome area to less than 100 feet in the west of the Sheet area. Similarly the Clematis Sandstone thins from 500 feet in the east to 200 feet in the west. The Bandanna Formation contains tuffaceous clay in the lower part and coal in the upper part. A horizon of fossil wood separates the upper and lower parts of the Bandanna Formation.

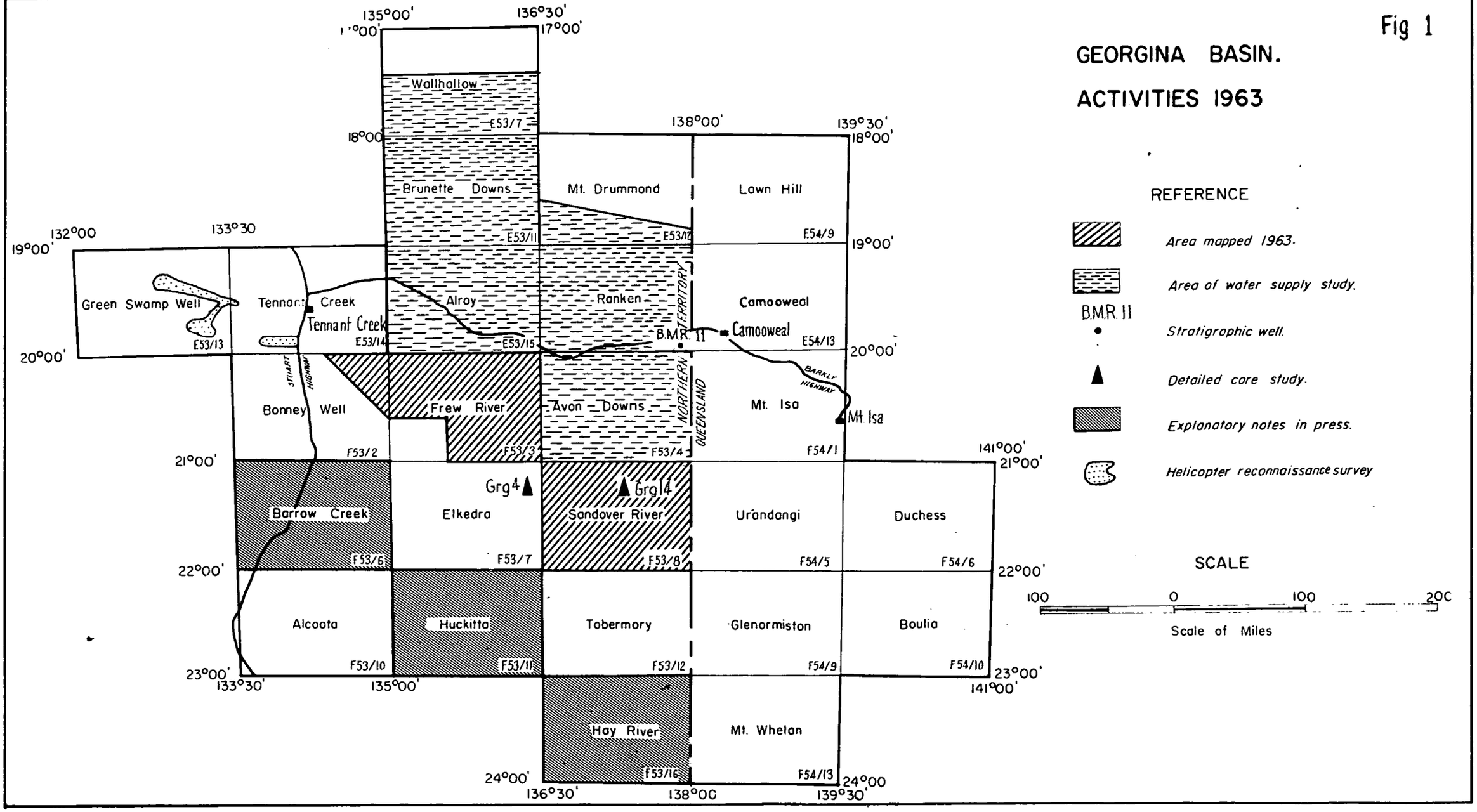
11. Tertiary alkaline olivine basalt is very widespread in the eastern half of the Sheet. It is about 900 feet thick near Springsure with interbedded rhyolitic pyroclastics, vesicular trachybasalt flows, and trachyte flows. Highly differentiated peralkaline rhyolite forms plugs, domes and multiple dyke intrusions north of Springsure. They appear to have been emplaced along north west trending rifts.

GEORGINA BASIN

Fig 1

GEORGINA BASIN.

ACTIVITIES 1963



REFERENCE

- *Area mapped 1963.*
- *Area of water supply study.*
- B.M.R. 11 — *Stratigraphic well.*
- *Detailed core study.*
- *Explanatory notes in press.*
- *Helicopter reconnaissance survey*

SCALE

100 0 100 200

Scale of Miles

GEORGINA BASIN PARTIES, 1963

Personnel: K.G.Smith, M.A.Randal (part time), E.N.Milligan, R.A.H.Nichols, N.E.A.Johnson (part time). W.H.Morton, of the Resident Geologist's staff, Alice Springs, spent three weeks with the Sandover River field party.

Areas and specific localities of various activities are shown in Fig.1. These activities were:

Field Mapping: Sandover River Sheet - Completed.

Frew River Sheet (excluding Davenport Range area) - Completed

Bonney Well Sheet - north-east quadrant completed.

Tennant Creek and Green Swamp Well Sheets - reconnaissance made by helicopter to parts of these Sheet areas.

Drilling: Stratigraphic Well BMR 11 spudded on 6th July, 1963, at a site about 25 miles west of Camooweal and had reached a depth of 901 feet at 0800 hrs. on 28th October, 1963.

Reporting: Records 1963/86, concerning the 1962 core-hole programme in the Georgina Basin, was issued. EXPLANATORY NOTES for each of the Hay River, Huckitta and Barrow Creek Sheets were compiled.

Work currently in progress includes the preparation of Preliminary Editions of the Sandover River, Frew River and Alcoota Sheets, Records on the geology of Sandover River and Alcoota Sheets, and Explanatory Notes on the Frew River Sheet.

Research: M.A.Randal has worked part-time on a study of water supplies in the Barkly Tableland area, N.T. R.A.H.Nichols has worked part-time, with A.Fehr of I.F.P., on carbonate studies of core from the BMR 1962 core-hole programme in the Georgina Basin. I.F.P. Report AUS/85, on Hole Grg4 was issued and a study of Hole Grg 14 is in progress.

Miscellaneous Activities: All available company reports dealing with the Georgina Basin have been examined. Cores and cuttings from selected intervals in Lake Nash No.1, Morstone No.1 and both Ammaroo wells have been examined. Core from the bottom of Ammaroo No.1 has been described in Farmout Drillers Completion Report as 'chloritic mica schist' of the Lower Proterozoic Hatches Creek Group; our examination of part of this core showed that abundant garnets are present, and since this grade of metamorphism is unknown in the Hatches Creek Group there is a strong possibility that Ammaroo No.1 bottomed in the Archaean Arunta Complex.

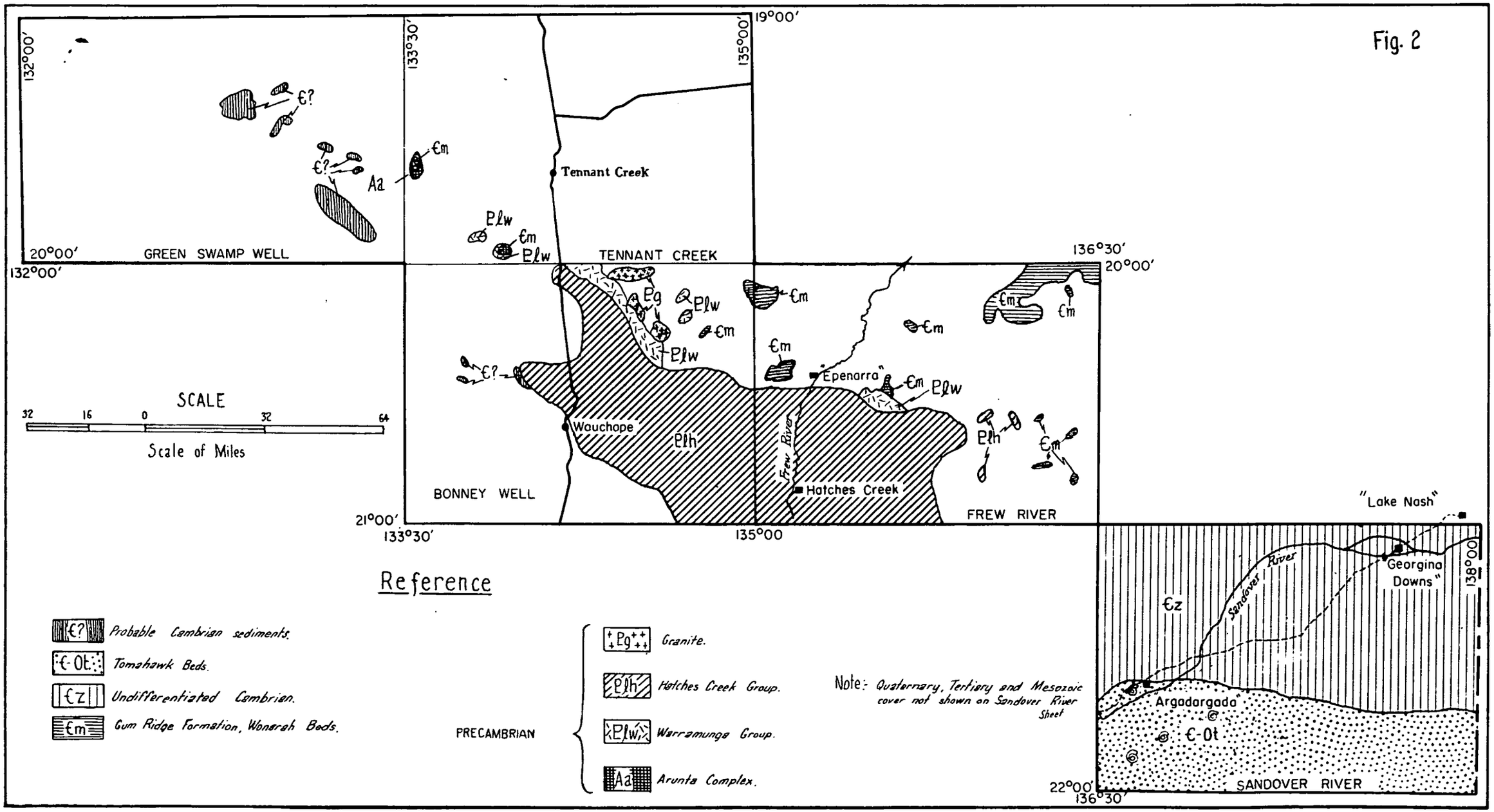
SUMMARY OF RESULTS

1. Field Mapping

(a) Sandover River Sheet. With the exception of the Frew River Sheet, all Sheets adjoining Sandover River had been mapped previously by BMR parties.

Most of the outcrops on the Sheet area are Palaeozoic carbonate rocks, but there are some outcrops of Tertiary Austral Downs Limestone in the north-east and east, and numerous small exposures of Mesozoic conglomerate, 2 - 20 feet thick, except in the north-

Fig. 2


132°00'
133°30'
135°00'
19°00'
20°00'
GREEN SWAMP WELL
TENNANT CREEK
136°30'
132°00'
20°00'
SCALE
32 16 0 32 64
Scale of Miles
Tennant Creek
Wauchope
Epenarra"
Hatches Creek
Frew River
BONNEY WELL
FREW RIVER
21°00'
133°30'
135°00
"Lake Nash"
Georgina Downs"
Sandover River
Argadargada"
SANDOVER RIVER
22°00'
136°30'
138°00
Reference
Probable Cambrian sediments.
Tomahawk Beds.
Undifferentiated Cambrian.
Gum Ridge Formation, Wonarah Beds.
PRECAMBRIAN
Granite.
Hatches Creek Group.
Warramunga Group.
Arunta Complex.
Note:- Quaternary, Tertiary and Mesozoic cover not shown on Sandover River Sheet

eastern quadrant. There are two sequences of Palaeozoic carbonate rocks; the older sequence occupies the northern two-thirds of the Sheet area, and the younger - the Tomahawk Beds - crops out in the southern third.

The older Palaeozoic sequence usually crops out poorly in low hills separated by wide tracts of alluvium; there is no continuity with outcrops on Sheets to the north and east but continuity has been established with carbonate outcrops on the westerly-adjoining Elkedra Sheet.

The older Palaeozoic sequence consists of thin and medium-bedded, oolitic and pelletal dolomite, with numerous bands of pelletal chert, and thin to medium-bedded, red, ripple-marked sandstone. The thickest dolomite-chert sequence exposed measures 70 feet; the sandstone beds range in thickness from 2 to 30 feet. Fossils have not been found in the unit, either on the Sandover River or Elkedra Sheet. It is almost certainly of Cambrian age, and could be either Middle Cambrian, or Upper Cambrian (equivalent to the Arrinthrunga Formation of the Huckitta, Tobermory and Elkedra Sheets). Several water bores which spudded in this older Palaeozoic unit have penetrated about 800 feet of carbonate rocks, and one (No.16 Lake Nash) penetrated 1036 feet of them. No fossils have been found in the samples from water bores, but one indeterminate fossil has been found in core from the Bureau's hole No.Grg 14.

Dips in the older Palaeozoic sequence are very low, except where slumping has occurred; a few broad folds, trending north-east, have been mapped.

The younger Palaeozoic sequence is also a predominantly carbonate unit; it is continuous with the Upper Cambrian-Lower Ordovician Tomahawk Beds of the Huckitta, Elkedra and Tobermory Sheets in the west, and in the east is continuous with fossiliferous Lower Ordovician Ninmaroo Formation of the Urandangi Sheet.

The unit is fairly well exposed on the Sandover River Sheet. In the west there are numerous beds of sandstone and siltstone in the sequence, but east of Longitude 137 degrees (approximately) the sequence is composed almost entirely of medium and thick-bedded dolomite, with some siltstone bands. In the west, the maximum thickness exposed is 175 feet, but 430 feet has been measured in the east. Fossils have been found in the west, but not in the east of the Sandover River Sheet. In the west, the unit is late Upper Cambrian in age, and in the east it is probably Lower Ordovician. Regional dip is to the south-south west, at an angle less than 1 degree; the unit has several small synclines developed on east-trending axes, but the outcrop is generally not good enough to detect anticlines.

The boundary between the Tomahawk Beds and the (unnamed) older sequence is ill-defined, but may be disconformable.

(b) Frew River Sheet: The Davenport Range area of this Sheet had previously been mapped; the remainder of the Sheet area was mapped in 1963, mainly by use of helicopter transport. Several small outcrops of fossiliferous chert of lower Middle Cambrian age were located in the north-east quadrant of the Sheet, some outcrop of the Lower Proterozoic Hatches Creek Group in the east-central part, and low rises of limestone and banded chert in the south east quadrant; no fossils were found in this last area, but the outcrops are almost certainly of Cambrian age.

(c) Bonney Well Sheet: The north-east quadrant of this Sheet was mapped by helicopter. A few thin outcrops of the

Cambrian Gum Ridge Formation overlie the Lower Proterozoic Warramunga Group and Precambrian igneous rocks, but in many places the Precambrian rocks have no Cambrian cover.

(d) Tennant Creek Sheet: A few outcrops on this Sheet were examined by helicopter. In the south-west quadrant, there are a few outcrops of the Warramunga Group; some of these are overlain by 15-20 feet of Middle Cambrian chert. Near the western margin of the central-western part of the Sheet, 20 feet of fossiliferous Lower Middle Cambrian chert overlies gneiss of presumed Archaean age.

(e) Green Swamp Well Sheet: Two helicopter traverses were made on this Sheet, to examine outcrops within range of the aircraft. All outcrops were of almost-horizontal apparently unfossiliferous sediments consisting of sandstone (some glauconitic) with interbedded siltstone. The thickness ranged from 15 to 35 feet. The base of the sequence was not exposed. The lithology resembles that of fossiliferous Upper Cambrian sediments exposed in the central-eastern part of the Barrow Creek Sheet.

An old road leading west from Tennant Creek to an unknown destination was examined at several localities on the Green Swamp Well Sheet and found to be in reasonable condition. It was last observed at a point about 80 miles west of Tennant Creek, and can be traced on the air photographs (taken in 1950) for another 20 miles to the west. It has been constructed by grading, but its origin is unknown. It is believed that it will offer easy vehicle access to country at least 100 miles west of Tennant Creek.

(f) Water Bores: All available records of water bores on the Sandover River Sheet have been compiled by W.H.Morton. Records pertaining to bores on the Frew River Sheet have been copied in the office of the Resident Geologist, Alice Springs.

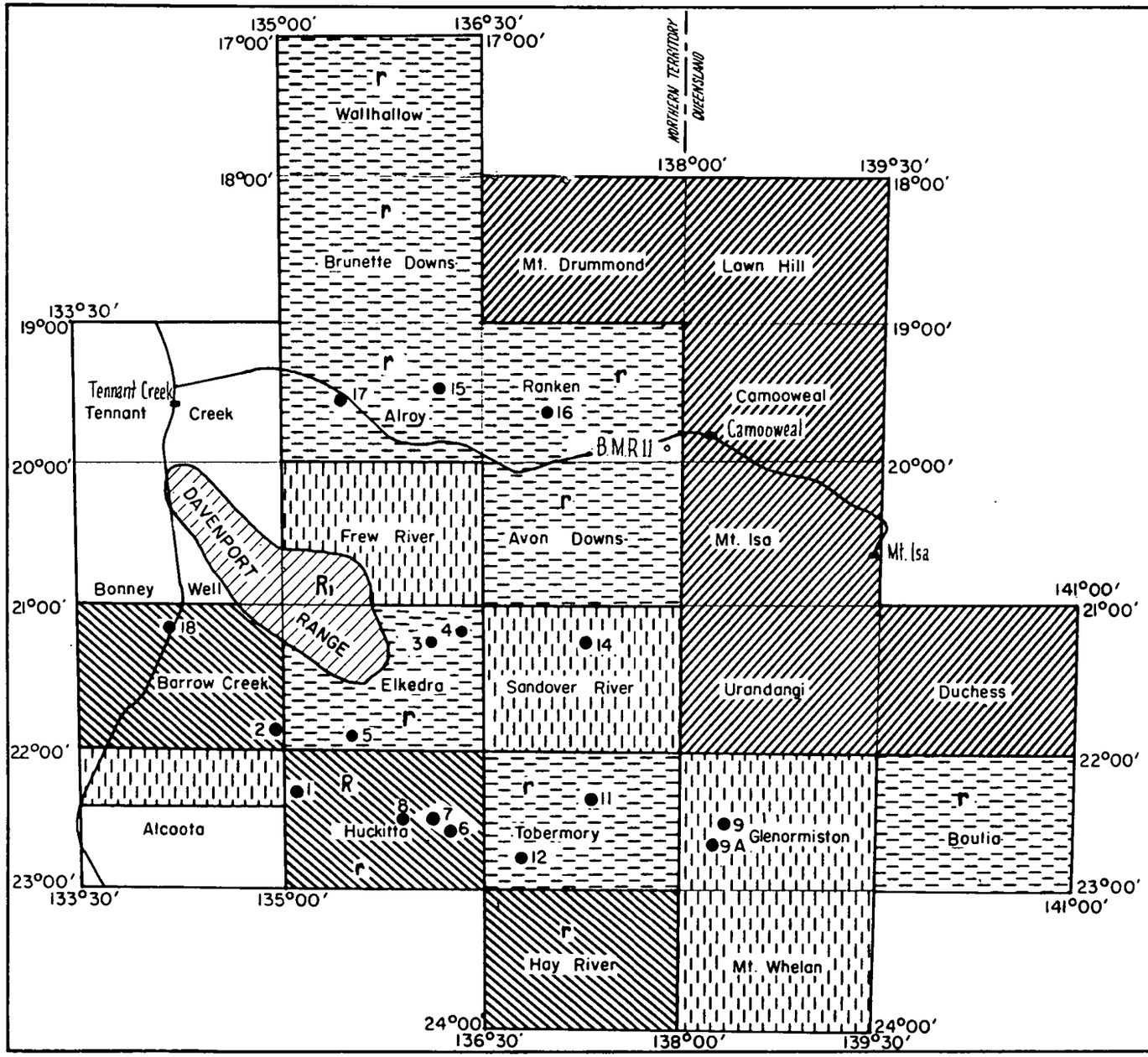
2. Stratigraphic Drilling

A contract to drill three wells in the Georgina Basin was awarded to W.L.Sides & Son Pty.Ltd. The first well, DMR 11, was spudded on 6th July, 1963. A $6\frac{3}{4}$" hole was drilled, under sub-contract, by Southern Cross Development Ltd. with a Mayhew 1000 rig equipped with air hammer. The contractor's Failing 2500 rig arrived on site on 11/7/63, reamed the hole to $8\frac{1}{2}$", then drilled ahead to 411 feet. 7" casing was set at 410 feet, and SP, Resistivity and gamma-ray logs run to this depth by means of the Bureau's Failing Logmaster unit. The hole size was then reduced to $6\frac{1}{4}$". From surface to 525 feet the Failing 2500 rig was operated by compressed air, but the hydrostatic head of water in the well prevented this type of operation at greater depth, and mud was then used as the drilling fluid. On 28th October, 1963, the well had reached 901 feet. A summary of the log is:

Cuttings:	Surface to 15'	Soil and chert gravel
	15' - 630'	Alternating layers of porous and tight dolomite; white, grey and brown, microcrystalline, pelletal, silitic in part, ruggy iron-stained in part, with local developments of chert. Some staining and particles of manganese.
	630' - 735'	Dolutite; grey to brown, and dolomite: finely crystalline, argillaceous, with some chert. Rare fragments of fossils.
	735' - 901'	Dolomite; finely crystalline and microcrystalline in part; white and brown, vuggy, with some chert. Rare fragments of fossils.

Fig.3

PROGRESS, GEORGINA BASIN 1963



Scale

100 0 100 200 Miles

Reference

- Map Published
- Map and Explanatory Notes in press
- R — Report in press
- R1 — Report Issued
- Preliminary Edition Issued
- r — B.M.R. Record Issued
- Preliminary Edition in preparation
- ● 1 — B.M.R. Core Holes, Grg. 1,2,3 etc.... NOTE: Nos. 10 and 13 do not exist
- B.M.R 11 ○ — B.M.R. Statigraphic drill hole

Cores

No.1 from 220' to 229'; rec.3'	Dolomite; white and light brown, micro to medium-crystalline, hard, vuggy, ironstained, pelletal in part.
No.2 from 547' to 560'; rec.1'	Dolomite: white, microcrystalline, vuggy, ironstained, glauconitic. Contains one brachiopod shell fragment.
No.3 from 701' to 720'; rec.6"	Dolutite, dark-grey, slightly micaceous, with some chert.
No.4 from 782' to 783'; rec.10½"	Dolomite; grey and brown, finely crystalline, hard, tight, stylolitic, pelletal in part, some fragmentary manganese.

3. Research

(a) Water Supplies: M.A.Randal has worked part-time on a study of water supply in the Barkly Tableland area, N.T. This work began in the field in 1962, when all available bore date was collected and an extensive programme of barometric levelling was completed and samples of water collected from 230 bores. The date, together with analyses of water samples, has been collated during 1963.

The regional piezometric surface delineates two "sub-basins" of the underground water system; one of these is centred on the Georgina River and the other on the Barkly Internal Drainage Basin. These basins are also delineated by contours of some chemical parameters obtained by analysis. A zonation evident in chemical characteristics seems to be controlled mainly by water flow and not by vertical geological features. However, the chemical types of water, together with the hydrodynamical data, may indicate regional sub-surface geological structure and directions of water movement. One aim of the study is the prediction of depth to aquifers and the approximate chemical content of the water in them.

(b) Detailed Core Study: R.A.H.Nichols has assisted A.Fehr of I.F.P., on detailed study of core from selected holes in the BMR Georgina Basin coring programme. A study of core from Hole No.Grg 4 has been completed, and a report issued. No fossils were found in core from this hole. A study of core from Hole No.Grg 14 is in progress. To date only one indeterminate fossil has been found in this core.

PROGRESS OF MAPPING AND REPORTING IN GEORGINA BASIN AND ENVIRONS

Progress to date is shown on Fig.3. Some of the work has been done by Parties from the Metalliferous Section of the Geological Branch.

GREAT ARTESIAN BASIN

GREAT ARTESIAN BASIN
1963 Mapping

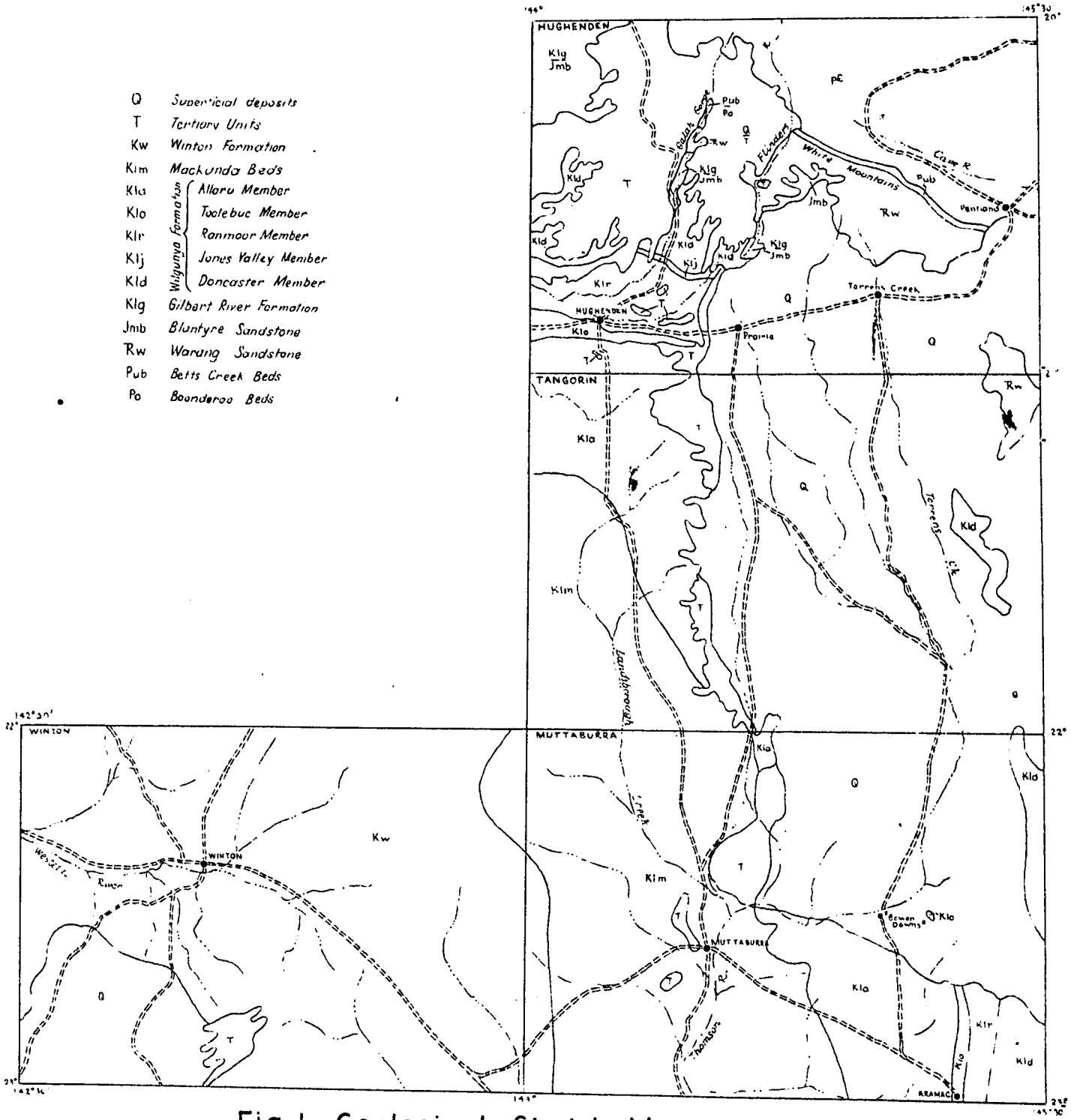


Fig. 1. Geological Sketch Map

GREAT ARTESIAN BASIN PARTY

by

R.R. VINE

The early part of the year was spent on the preparation of the report covering the 1962 mapping (Vine, Bastian & Casey, 1963). Preliminary editions of the Manuka and Richmond 1:250,000 Sheets were prepared.

For the 1963 field season the programme of the party was to complete the mapping of the sedimentary part of the Hughenden Sheet and to map the Tangorin, Muttaburra and Winton Sheets. Helicopters were used for access to rugged country of the White Mountains (Hughenden Sheet) and strongly dissected sandstone country in the north-west of the Hughenden Sheet area. In addition a short programme of core drilling was carried out approximately 25 miles west of Hughenden (Richmond Sheet). The object of the drilling was to obtain fresh material in an attempt to relate lithological units to palynological and macropalaeontological divisions, and to provide control for establishing the foraminiferal succession in sediments of Lower Cretaceous age.

Field mapping was carried out during the months of June to September, and the programme was completed. The party consisted of R.R.Vine (Party Leader), D.J.Casey (Geological Survey of Queensland), N.E.A.Johnson, I.Chertok (Draftsman) and three field assistants.

Distribution of the geological units is shown on the attached sketch map (Fig.1). The succession, with a summary of the stratigraphy, is shown in the stratigraphic column (Fig.2). Most of the mapping consisted of tracing previously recognised units to east and south of mapped areas; full descriptions of these units were given in the report on the 1962 mapping. The most important results of the 1963 season's mapping are as follows:-

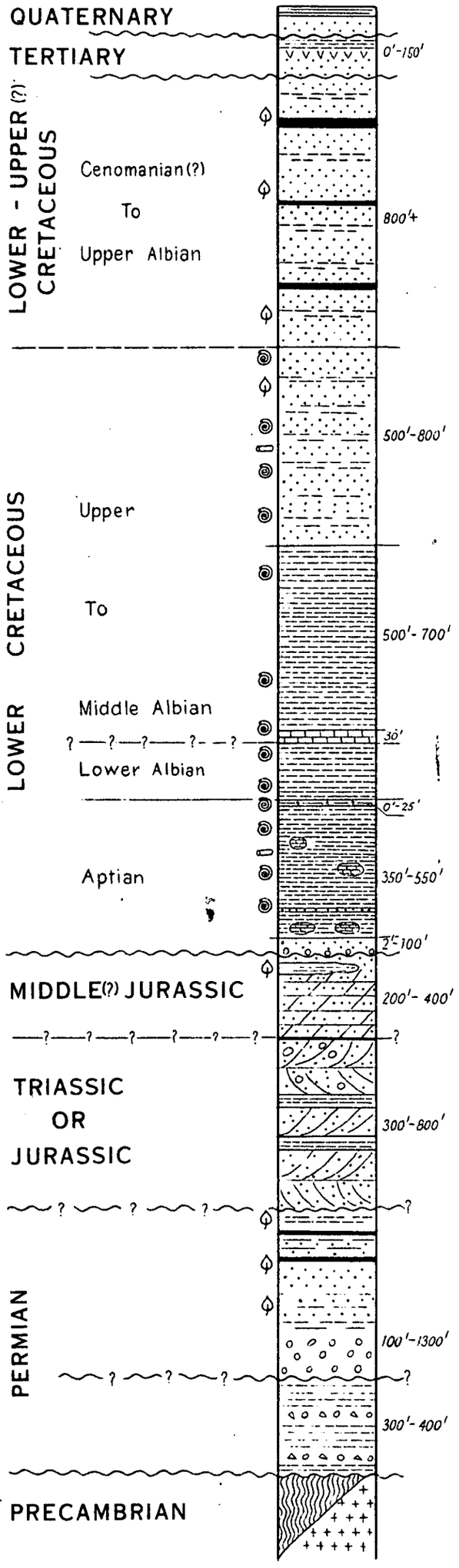
A. The discovery of a Permian glacial sequence at the northern end of Galah Gorge (Hughenden Sheet), identified by the presence of common striated pebbles and cobbles, varved mudstones and tillite(?) beds.

B. The sandstone of the White Mountains (Warang Sandstone) is a mappable unit. No fossils were found and its age is still in doubt. It overlies the Upper Permian Betts Creek Beds unconformably, but the relationship with the overlying Blantyre Sandstone is not clear.

C. The unit mapped as Gilbert River Formation in 1962 consists of two sandstone units separated by a regional unconformity. The lower unit, the Blantyre Sandstone, contains lenses of carbonaceous shale and rare coal near the top with plant fossils tentatively regarded as Middle or possibly Upper Jurassic age. 'Gilbert River Formation' is now restricted to the upper unit, of Lower Cretaceous age. In the Flinders River, the Gilbert River Formation has a minimum thickness of two feet and is overlain directly by mudstone of the Doncaster Member with an Aptian fauna. It is probable, therefore, that the Gilbert River Formation in the Hughenden area is also restricted to the Aptian and no Neocomian rocks are preserved.

D. The Jones Valley Member could only be traced as far east as the Flinders River where the thickness is only six feet. Southwards to within 20 miles of Aramac this part of the section is concealed by later deposits, but no trace of the unit could be found in the Aramac area.

Fig.2 - STRATIGRAPHIC COLUMN



Werite Beds : *Mudstone, quartz sandstone*
Sturgeon Basalt : *Olivine basalt*
Glendower Formation: *Sandstone, conglomerate, mudstone*

Winton Formation : *Fine grained, lithic sandstone and calcareous, lithic sandstone, mudstone, coal*

Mackunda Beds : *Very fine grained lithic sandstone and calcareous lithic sandstone, with thinly interbedded mudstone*

Wilgunya Formation

Allaru Member: *Mudstone, with calcareous siltstone grading to very fine grained sandstone near top and bottom of unit*

Toolebuc Member: *Nodular limestone coquinite platy limestone, calcareous shale*

Ranmoor Member : *Mudstone, with local development of calcareous siltstone and sandstone.*

Jones Valley Member: *Coarse siltstone and calcareous siltstone.*

Doncaster Member : *Mudstone, concretionary limestone, glauconitic mudstone and with interbeds of glauconitic sandstone near base.*

Gilbert River Formation: *Ill sorted sandstone and polymictic conglomerate*

Blantyre Sandstone: *Medium-grained quartz sandstone, strongly cross-bedded; lenticular carbonaceous shale and coal near top.*

Warang Sandstone: *Fine-grained sandstone, commonly pebbly or gritty and with large scale festoon bedding; thick lenses of red and green siltstone grading to very fine grained sandstone*

Betts Creek Beds. *Felspathic (?) sandstone, conglomerate, tuffaceous (?) sandstone, carbonaceous shale and coal. Includes 8' coal seam at Oxley Creek.*

Boonderoo Beds : *Varved (?) mudstone, tillite (?), unbedded sandstone and mudstone.*

Metamorphic and igneous basement.

E. Detailed fossil collecting along the Flinders River established the presence of a fauna of Lower Albian age in the Ranmoor Member. There is, therefore, no 'non-sequence' (Whitehouse, 1954) between the Roma and Tambo faunas in the Hughenden area.

F. Concretionary limestone with abundant fossils, which is one characteristic lithology of the Toolebuc Member on the western and northern margins of the Eromanga Basin, is not found in outcrops of the member near Aramac and Bowen Downs, although this type of limestone is present near Hughenden. This part of the sequence is concealed by later deposits between these outcrops. Outcrops near Bowen Downs and Aramac are of a platy limestone with numerous shells of Aucellina and with interbedded calcareous shale.

G. The discovery of basalt cobbles in lateritised sediments of the Glendower Formation, and the recognition that un-lateritised basalt flows of the Sturgeon Province preserve three separate erosion surfaces, established that there were at least four phases of vulcanicity. The Glendower Formation is therefore considered to be an inter-basaltic unit.

H. The recognition of reworked lateritic material in which ferruginous material has been remobilised to give "pseudo-laterite". Confirmatory evidence of this was the presence of thin conglomerate bands, containing reworked iron pisolites, within mottled sandstone.

J. The discovery of a manganese prospect in the Forsyth Range. The occurrence is pisolitic, overlain by pisolitic ironstone at the top of a laterite profile. Analyses of the samples are not available as yet.

References:

Vine, R.R., Bastian, L.V., & Casey, D.J., 1963 - Progress report on the geology of part of the northern Eromanga Basin, 1962 Bur.Min.Resour.Aust. Rec.1963/75 (unpubl.)

Whitehouse, F.W., 1954 - The geology of the Queensland portion of the Great Australian Artesian Basin. Appendix G to Artesian water supplies in Queensland. Dept.Co-ord. Gen.Public Works

PHOTOGEOLOGY

REPORT OF PHOTOGEOLOGICAL SECTION

by

W.J.Perry

Personnel: In January the staff of the photogeological group consisted of:

B.de Lassus R.Richard	I.F.P.
W.J.Perry R.Ruker	B.M.R.

F.Olgers (BMR) and V.Forbes (QGS) worked with the group temporarily during the first quarter of the year.

R.Ruker resigned at the end of March.

B. de Lassus finished work at the end of May and returned to Paris.

At the end of June the Bureau concluded its contract with the I.F.P. Mission as a whole, and from that date the French personnel remaining in Australia became responsible to the relevant Bureau Chief Officers. Since then the staff of the BMR Photogeological Section has consisted of:

W.J.Perry Vacant Grade 3 position	B.M.R.
R.Richard	I.F.P, attached

Perry visited the Bowen Basin Parties from June 28th to July 24th to help with problems of photo-interpretation and to visit the Tambo area which was scheduled for field mapping in 1964. Richard visited the Bonaparte Gulf Party from August 16th to September 5th.

The Photogeological Sheets completed during 1963 are shown on the following list.

PHOTOGEOLOGICAL SHEETS COMPLETED - 1963

(at 1:250,000 scale except where otherwise indicated)

Pilbara Area, W.A.

Roy Hill

Bowen Basin, Q.

Springsure
Baralaba
Taroom
Mundubbera (western part)
Eddystone

Drummond Basin, Q.

Buchanan*

Bonaparte Gulf Basin, W.A., N.T.

Cambridge Gulf
Auvergne
Burt Range Area (4 Sheets at 1:50,000 scale)
Port Keats*
Cape Scott*

Kimberley Area, N.T.

Waterloo

*In progress, October, 1963.

MACROPALAEONTOLOGY

MACROPALAEONTOLOGY

ANNUAL REPORTS BY INDIVIDUAL AUTHORS

A.A. Öpik

SUMMARY: Continued preparation of papers to present the results of his study of Cambrian palaeontology and stratigraphy; he spent three months in the U.S.A. and Canada visiting geological surveys, universities, and museums to examine type specimens and other collections of Cambrian fossils, and discussing problems of lower Palaeozoic stratigraphy and palaeontology. He also identified fossils and ages of strata from bore cores and other collections in the course of office activity.

Presentation of Results

Published: (1) Early Upper Cambrian fossils from Queensland. Bur.Min.Resour. Bull.64

(2) Joint author of: The geology of Tasmania. J.Geol. Soc. Aust., vol.9

In press: Nepea and the nepeids. J.Geol.Soc.Aust.

In preparation: Trilobites from the Upper Cambrian Mindyallan Stage of Queensland. Bur.Min.Resour. Bull.73 (This paper deals with 185 species illustrated on 67 plates; it also presents the palaeontological foundation of zoning, and means of identification and correlation of zones.).

Identification of fossils (selected item). Identified fossils from the Heritage Range, Ellsworth Mountains, Antarctica, collected by Dr.Craddock and party (University of Minnesota), and suggested their Franconian (Upper Cambrian) age.

Personal: The Geological Society of Stockholm presented A.A. Öpik with the diploma of a corresponding member (Membre d'honneur correspondant).

J.GILBERT TOMLINSON

SUMMARY: Continued the study of lower Palaeozoic faunas of northern Australia. Routine examination of fossils from the Amadeus and Georgina Basins was carried out, Cambrian and Ordovician fossils being determined in collections made by B.M.R. field parties and Resident Geologists in the Northern Territory, and Cambrian fossils in subsurface samples from the Northern Territory and Queensland. During a visit to field parties in the Amadeus Basin, N.T., particular attention was paid to Cambrian deposits. Several new localities for Cambrian fossils were found, and a better understanding of Cambrian geology was gained. The known extent of Ordovician sediments was greatly enlarged, and the presence of a number of hitherto-unknown species was established. A talk on the Cambrian geology of the eastern part of the Amadeus Basin was given to the Geological Society in Canberra.

Cambrian fossils in northern Australia: The Amadeus Basin has yielded a number of new localities for diagnostic Cambrian fossils: two for Lower Cambrian in the area east of the Telegraph Line, two for Middle Cambrian in the Gardiner and Waterhouse Ranges, and several for Upper Cambrian in the Gardiner, James, Waterhouse, and Fergusson

Ranges. In addition, undiagnostic Cambrian fossils have been found over a wide area on Henbury and Kulgera Sheets. A new locality for Cambrian algae was discovered in the western part of the James Range.

Middle Cambrian fossils have been recovered from cuttings from a water bore in the Tennant Creek area, and from the core of Morstone No.1 Well and several of the B.M.R. Georgina stratigraphic holes. Two of the latter have yielded Upper Cambrian fossils. Middle and Upper Cambrian fossils were identified in core from Phillips Black Mountain No.1 Well, Boulia area, Queensland.

Fragmentary trilobites, probably Upper Cambrian in age, were noted in sandstone core from Alice No.1 Well during a brief inspection at the well-site.

Ordovician fossils from northern Australia: Current field studies in the Amadeus Basin have revealed many new localities for shelly Ordovician fossils. The two sandstone bodies, Pacoota and Stairway, have yielded many new forms not previously detected. Preservation is good, and in some sections it has been possible to establish the sequence of faunas. The Lower Ordovician Horn Valley Formation is now known to extend well into the south-eastern part of the Henbury Sheet area. In the same part of the sheet area, a new lithological type, a dark grey limestone, with a new fauna, lies between the Horn Valley Formation and the Stairway Sandstone.

Fish-like fossils in the Amadeus Basin: Sandstones at various levels have yielded fragmentary fossils with ornament resembling that of ostracoderm fish. Investigation of these fossils and associated faunas is proceeding. Vertebrates have not previously been noted in the Amadeus Basin, though they are known to occur in the western part of the Georgina Basin. The most obvious thing is that more material is needed and a programme of detailed collecting of the younger sandstones, Mereenie and Pertnjara, is considered an urgent project.

Miscellaneous: (1) A brief report on Cambrian fossils from the south-western part of Hermannsburg Sheet and Ordovician fossils from Lake Amadeus Sheet was completed and issued as an appendix to the Record on the geology of the Lake Amadeus Sheet area by A.T.Wells, L.C. Ranford, and P.J.Cook.

(2) A day was spent in the Tharwa area, A.C.T., with P.Hancock collecting Devonian fossils.

(3) The talk given to the geological society on the Cambrian geology of the eastern part of the Amadeus Basin was based almost entirely on unpublished work. It was decided to write up this work in the form of a record, and illustrations are now in preparation. As far as possible, the results of the current season's work will be incorporated.

J.M.DICKENS

SUMMARY: J.M.Dickins continued work on the palaeontology and stratigraphy of the Bowen Basin. Faunal and stratal subdivisions previously recognized have been further elaborated. Fossils have also been examined from the Sydney Basin, New South Wales, and from the Perth and Carnarvon Basins, Western Australia. Reports have been prepared on the geology of the sedimentary basins of Australia and on the palaeontology and stratigraphy of the Perth, Carnarvon, Sydney and Bowen Basins. Administrative and supervising duties have been carried out in the Sedimentary Basins Section.

Field Work: The Bowen Basin was visited in April in connection with exploration for coal and phosphate and problem areas were examined with geologists of Utah Development Company. In July visits to the Sydney and Maryborough Basins were organised with the I.F.P. Mission, which was reviewing the petroleum resources of Australia. July to September was spent with the Taroom, Baralaba and Springsure parties in the Bowen Basin, co-ordinating the work and examining specific stratigraphic and palaeontological problems.

Examination of Fossil Collections: Cores from Wapet Woolmulla No.1 and Quail No.1 and from Planet East Maitland No.1 were examined and reports prepared. Permian fossils from the Hunter Valley N.S.W. from north of Blackwater, Queensland, forwarded by Utah Development Co. The large collection made by the joint B.M.R. - Q.G.S. parties from the St.Lawrence, Mackay and Duaringa Sheet areas of the Bowen Basin were examined.

Reports: Writing of the geology of the Carnarvon, Perth, Sydney, Bowen, Drummond, Yarrol and Maryborough Basins was completed for the new edition of Report 41A "Summary of Oil Search Activities in Australia". Changes to palaeontological appendices for reports on Mt.Coolon, Emerald and Clermont and to the report "Correlation and Subdivision of the Middle Bowen Beds, Bowen Basin" were completed after editing. All four are now "in press" in the Report Series. A report on the Permian Marine Macrofossils from the St.Lawrence and Duaringa Sheet areas was prepared for inclusion in the Record on these areas. Correction of proofs for Bulletin 63 "Permian Pelecypods and Gastropods from Western Australia", was completed and the Bulletin has now returned from the Printer.

Miscellaneous: Administrative and supervisory duties in connection with the Bowen Basin Regional Survey, the Palaeontology Section, and the Museum have been carried out including examination and preparation of comments on reports prepared by other geologists. Applications and reports received under the Petroleum Search Subsidy Acts have been examined and where appropriate, comments prepared.

Main Results: Previously recognised faunal subdivisions of the Middle Bowen Beds have been further elaborated and have been applied to the solution of the local and regional geological problems. Results of field investigations are included in the reports of the Taroom, Baralaba and Springsure parties.

S.K.SKWARKO

Up to the first week in June, S.K.Skwarko was at the Head Office in Canberra where he continued his work on Mesozoic faunas of Australia and New Guinea: he also did some work on the Canberra and New Zealand graptolites. The following are the results of this work:

Published Papers: "New Mesozoic Stratigraphic Units in New Guinea" Aust.J.Sci.26(I)

Papers with Publishers: "Australian Mesozoic Trigoniids" Bur.Min. Aust.Bull.67; "A new Upper Cretaceous Ophiuroid from Australia". Palaeont. 6(3)

Papers in Preparation: a. Work on the MS for a B.M.R. Bulletin on the "Cretaceous Fossils of the Northern Territory" was unavoidably held up because of a seven-month delay in photography. However, the plates are now ready to be sent to England for collotype reproduction, and the MS is at an Advanced stage of preparation and will be passed on to the editor before the 1964 field season.

b. The MS for the Bulletin on "The Mesozoic stratigraphy of the Northern Territory" is similarly at an advanced stage and it is hoped that it will be handed over to the editor by May, 1964.

Distributed Records:

1963/2 "Mesozoic fossils from the Gibson Desert, Central Western Australia".

1963/II "Observations on occurrences of Cretaceous strata in Queensland and Northern Territory, Progress Report, 1962".

1962/31 "Mesozoic fossils from Ramu 1:250,000 Sheet area, Territory of New Guinea".

In addition to these, S.K.Skwarko examined a collection of graptolites submitted by the New Zealand Geological Survey, and dated it as middle Upper Ordovician, probably Eastonian. This dating throws new light on the age of the Wangapeka Formation, north-west Nelson, New Zealand, which hitherto was regarded on stratigraphy as Silurian. S.K.Skwarko intends to apply to the Director for permission to publish his results in the N.Z. Journal of Geology and Geophysics under a joint authorship.

Collections of graptolites from Canberra 1:250,000 Sheet submitted for dating were all of Upper Ordovician age, the youngest assemblage being of uppermost Eastonian age.

Some further descriptive work was done on the Mesozoic fauna of the Territory of New Guinea. It was decided to refrain from completing the MS before the content of the additional collections made during the 1963 field season became known. It was suggested that ultimately the results of this work should be published as a B.M.R. Bulletin.

From the beginning of June S.K.Skwarko has spent three and a half months as a member of the Kulgera Field Party under the leadership of A.T.Wells. His duties consisted of mapping the gently dipping post-Devonian sediments on an area covered by Kulgera and Charlotte Waters 1:250,000 Sheet areas, in the southern portion of the Northern Territory. The results of this survey are included in the annual Summary of Activities for 1963, Sedimentary Basins Section.

C.G.GATEHOUSE

SUMMARY: C.G.Gatehouse participated in the examination of core material from Lake Nash No.1 Well, Morstone No.1 Well and Orientos No.1 Well; and from core holes 6, 15, 15A and 16 of the Georgina Basin. Work is continuing on fossils from the Daly River area (N.T.) and the Comet Slate from Tasmania. Field trips were made to Tasmania and the Amadeus Basin. Assisted in the palaeontological collections in the sub-basement of the Administrative Building. Delivered a lecture on the "Restoration of Tectonically Distorted Fossils" to B.M.R. geologists. Photographed Cambrian trilobites for Dr.A.A.Öpik.

Examination of bore cores:

1. Participated in the palaeontological examination of core material from Lake Nash No.1 Well (Amalgamated Petroleum N.L.) (File 106G/13/129).

2. Took part in the palaeontological examination of "Middle Cambrian Fossils" from Morstone No.1 Well, Camooweal 1:250,000 Sheet, Queensland. (File 106G/24/28).

3. Examined Orientos No.1 Well core material.

4. Material from core holes 6, 15, 15A and 16 of the Georgina Basin is currently being examined.

Current Palaeontological Projects:

1. Palaeontological material from the Daly River area (N.T.)is being examined and cleaned for further study.

2. A previously unknown early Upper Cambrian fauna in the Comet Slate near Dundas, Tasmania, is being investigated, together with former collections from the same area.

Field Work:

1. From 4th to 18th January, 1963, was spent in Tasmania collecting palaeontological material from near Dundas.

2. June 12th to August 19th was occupied with a visit to the Henbury and Kulgera Field Parties. During the trip Cambrian and Ordovician fossils were collected.

Palaeontological Collections:

1. Assisted Miss J.Gilbert-Tomlinson with organizing fossil collections in the sub-basement store in the Administrative Building.

2. Fossils collected by field parties have been stored systematically in the sub-basement store.

Lecture: A lecture was delivered to B.M.R. geologists on the "Restoration of Tectonically Distorted Fossils".

Photography: Photography of Dr.A.A.Öpik's Cambrian trilobites continued on from 1962.

Technical Assistant: R.Miniotas cleaned fossils, photographed fossils, assisted in local palaeontological collections, accompanied Gatehouse on field trip to Tasmania.

Vacation Student: C.Glazebrock assisted R.Miniotas with photography, fossil collections and cleaning of fossils.

R.MINIOTAS - Technical Assistant

1. Photographed Cambrian trilobites for Dr.A.A.Öpik
2. Assisted in sub-basement store.
3. Assisted in palaeontological collections locally and in Tasmania.
4. Prepared plaster and rubber casts of fossils as required.
5. Cleaned fossils for Dr.A.A.Opik and C.G.Gatehouse
6. Washed specimens received by the macropalaeontological section.
7. Prepared maps and drawings for lectures for Miss J.Gilbert-Tomlinson and C.G.Gatehouse.
8. Prepared graphic logs for Miss J.Gilbert-Tomlinson.
9. Labelling and packing of specimens delivered to the macro-palaeontological section.

H.M.DOYLE

During 1963 H.M.Doyle performed the duties of a technical assistant in the macropalaeontological section.

His duties consisted mainly of photographing fossils, unpacking and numbering specimens which arrived from the field, making rubber moulds of fossils, extraction and preparation of fossils, making out file cards for literature on different topics, and colouring and preparing maps.

For Dr.J.M.Dickins he:

1. Photographed about 260 plates
2. Unpacked and numbered fossils which arrived from the field
3. Made numerous rubbers of fossils.
4. Coloured maps
5. Prepared and extracted fossils from their rock matrix
6. Labelled cabinets
7. Packed fossils for despatching
8. Labelled bore-cores.

For S.K.Skwarko he:

1. Made numerous rubbers of Mesozoic fossils
2. Helped to prepare a map of Cretaceous sediments in the northern portion of the Northern Territory
3. Coloured in maps
4. Made plaster casts of type specimens
5. Assisted in drawing of stratigraphical columns

For C.G.Gatehouse he:

1. Unpacked material which arrived from the field
2. Prepared fossils for study
3. Made rubbers of fossils

For T.Nicholas he:

1. Wrote file cards for type specimens

MICROPALAEONTOLOGY

PALAEONTOLOGY

ACTIVITIES OF THE MICROPALAEONTOLOGICAL SECTION FROM 1st NOVEMBER, 1962 to 31st OCTOBER, 1963

by

G.R.J.Terpstra

GENERAL: No changes in the staff of the Micropalaentological Section occurred during 1963.

D.J.Belford resumed work with the Bureau on 1st August after completing a two-year Commonwealth Public Service Post Graduate Scholarship.

Some time was spent by the staff considering the requirements and design of the Micropalaeontological Laboratory in the proposed new Bureau building. The cutting room in the present laboratory has been modernised and a fume cabinet and some new equipment have been installed.

The "Chapman Library", which suffered considerable damage by a fire in 1953, has been partly restored and catalogued.

A new arrangement came into force during 1963, whereby all the samples of cores and cuttings of subsidized and non-subsidized wells, and of water bores and seismic shot-holes are being received, recorded and stored in the recently established B.M.R. Core and Cuttings Laboratory at Fyshwick.

Three hundred and twenty-three thin sections were prepared, 987 samples were washed for foraminifera some of which also contained ostracoda, and all these samples were picked and examined. Two hundred samples were treated with acetic acid in order to extract conodonts. These were all picked together with 108 treated previously.

558 samples were treated to extract pollens and spores.

The registration of slides for the micropalaenntological collections continued. Two supplements to the Ellis and Messina Catalogue of Foraminifera were received during the past year.

Foraminifera: G.R.J.Terpstra was engaged in the examination of surface samples collected by the field parties in Queensland, Northern Territory and Papua-New Guinea, and on the study of cores and cuttings from subsidized wells. Thirty-eight wells have been examined and stratigraphical sequences of Tertiary, Marine Lower Cretaceous, Marine Permian and Upper Devonian have been established. Also samples from New Britain containing Lower Miocene faunas and from islands in the Bay of Bengal (Burma) containing Miocene, Eocene and Upper Cretaceous faunas have been studied and reported on. Lower Cretaceous microfossils have been reported on from Andado Station, (Northern Territory) and from Mornington Island and the Eromanga Basin (Queensland). These studies have contributed to the knowledge of the stratigraphic ranges of the arenaceous foraminifera occurring in Lower Cretaceous sediments. This work will be continued as new stratigraphical sections of lower Cretaceous sediments are expected to be received. Permian microfossils have been reported from A.O.G. Jerilderie No.1 Well (Murray Basin, Queensland) Coorabin Bore J (New South Wales) and Planet Oil Warrinilla No.1 (Queensland). These faunas are usually poorly preserved and rare in quantity.

Comments were prepared on completion reports of subsidized wells and administrative work was carried out in relation to the Section, and in connection with reports issued by Mrs.M.E.White, Sydney, the consulting specialist on fossil plants.

D.J.Belford examined samples of Bathurst Island bores No.1 and 2. He started a detailed investigation of the endathyroid foraminifera from core 6 at 1842 feet in the A.O.D. Bonaparte No.1 Bore (WA). During early October he set out on a field trip to Liaiagan, New Guinea.

A.R.Lloyd examined outcrop samples from the Permian sediments of the Bowen Basin, Queensland for foraminifera but in the main the samples were barren. The faunas obtained were poor and did not permit use for correlation purposes. The examination of cores and cuttings from Westgrove No.2 Well,Queensland was commenced.

Cores 1 and 5 from WAPET Wandagee Corehole No.2, Carnarvon Basin, Western Australia, yielded rare forams. which suggested a possible correlation of these horizons with the Cundlego Formation, Carnarvon Basin, and with the Noonkanbah Formation, Canning Basin.

Foraminifera were obtained from outcrop samples from the Hunter Valley, New South Wales. The faunas were composed mainly of arenaceous species, but calcareous forms were obtained from samples from the Mulbring Formation. It had been considered by a previous worker that calcareous foraminifera did not extend above the Branxton Formation in the Hunter Valley.

Foraminifera and megaspores were obtained from drilling samples taken from water bores on Cressy Station, Queensland. The bores penetrated the Lower Cretaceous Mackunda Beds and the faunas assisted in establishing a better understanding of the vertical distribution of the various species.

A possible Radiolaria was found in samples from the Bejah Beds, Gibson Desert. This form had been previously identified as the Radiolaria Lithocyclia exilis Hinde, but it was shown that this form does not belong to the genus Lithocyclia and may not be a Radiolaria as it is known only from thin sections. Its stratigraphic value is also considered to be questionable.

The study of the Miocene and younger foraminifera from Wreck Is. and Heron Is. bores, Queensland, was continued. This is a detailed study to determine the faunal sequence for correlation purposes and to obtain a better understanding of the history of the Great Barrier Reef. Rich planktonic and larger foraminiferal assemblages have been picked which permit such an investigation.

Outcrop samples from the Gazelle Peninsula, New Britain, were submitted. Some samples contained diagnostic Lower Miocene larger foraminifera; other samples contained rich foram and ostracod faunas which were non-diagnostic but were considered to be Lower Miocene in age by virtue of their stratigraphic position.

Miscellaneous Tertiary samples were examined from Burma.

Comments were made on the palaeontological appendices in some Well Completion Reports. An evaluation of published palaeontological date from Fiji was made for Dr.I.McDougal of the A.N.U.

From June 3rd to July 20th, A.R.Lloyd was Party Leader of the Tertiary Vertebrate Field Study Party. He accompanied Dr.R.H.Tedford of the University of California on a reconnaissance of the Amadeus and southern Georgina Basins in the Northern Territory and of the Springvale and Riversleigh areas in Queensland. One new vertebrate

locality was found near Deep Well Station, about 50 miles south-west of Alice Springs and the first systematic collection was made at Riversleigh. The fauna included a kangaroo jaw, crocodile, turtle and bird bones at Deep Well; crocodile, turtle and bird bones, as well as crocodile, kangaroo and diprotodont jaws at Riversleigh. The faunas will permit a correlation with the Ettadanna fauna of South Australia and the Alcoota Bone Bed of the Northern Territory. Collections of molluscs and ostracods were also made.

P.J.JONES

CONDONONTS & OSTRACODS: Examination of surface and subsurface samples for conodonts formed the major part of the years activities. At the request of Mr.J.N.Casey, seventeen B.M.R. Core-holes, two company wells, and two hundred seismic shot-hole samples were examined from the Lower Palaeozoic of the Georgina Basin. In previous years, the only samples selected for conodont examination were those well-dated by means of macrofossils. This is the quickest method to establish a vertical succession of conodont faunas, on which to base a time-scale, which, when completed, will permit the dating of conodonts found in random samples. Naturally, this goal will take longer to achieve, now that random samples have to be examined. On the other hand, such un-coordinated studies cover a wide field, and have led to important results, that would have taken longer to find, by more systematic methods.

A field laboratory was established in theBonaparte Gulf Basin, which processed 170 samples, collected from measured sections of the Cambrian-Ordovician and the Upper Devonian-Lower Carboniferous. All sections are controlled by macrofossils, in particular brachiopods, trilobites, pelecypods, and goniatites. Processing in the field, helped to determine which of the samples were fossiliferous, so that more of this material could be collected, in preference to the barren samples. Ostracods recovered from the Upper Devonian and Lower Carboniferous samples will be used to check and amplify the ostracod succession, already established from previous work. Conodonts were found in the Ordovician, but they are rare in the Upper Devonian-Lower Carboniferous sequence.

Permian ostracods have been studied from three wells in the Bowen Basin, and from one well in the Murray Basin. An ostracod from the Tertiary Brunette Limestone of the Barkly Tableland was also studied.

Brief reports were prepared on the stratigraphy and structure of the Bonaparte Gulf and the Ord Basins, for B.M.R. Report 41B (Summary of Oil Search Activities). Various company reports on the geology of the Fitzroy and Bonaparte Gulf Basins were critically read, and commented upon in some detail.

The stratigraphical results of these activities are outlined below:

Georgina Basin

1. Recognition of an Upper Silurian-Lower Devonian sequence, which overlies the Middle Ordovician Mithaka Formation, in the Toko Range (Austral Geoprospectors Seismic Survey for Phillips-Sunray). A report is in preparation. A rich conodont fauna was found in the Mithaka Formation.

2. Recognition of Lower Ordovician (Tremadocian) Ninmaroo Formation in the north-east limb of the Toko Syncline, in the Sylvester Creek area (B.M.R. Seismic Survey, S.E. Georgina Basin, 1963).

3. Recognition of Upper Cambrian in B.M.R. Core-holes Grg 1 and 5. Examination of Grg 2, 3, 4, 7, 8, 9, 9A, 11, 14, 17 and 18 gave negative results. Examination of Grg 6, 15, 15A and 16 is in progress.

4. Recognition of early Middle Cambrian in Lake Nash No.1, and Morstone No.1 (jointly with A.A.Opik, Joyce Gilbert-Tomlinson, and C.G.Gatehouse), and in the B.M.R. Seismic survey of the Undilla Basin, 1961.

5. Discussion of the palaeoecological significance of the ostracod genus Haplocytheridea in the Tertiary Brunette Limestone of the Barkly Tableland, which indicates a shallow-water environment, either marine, estuarine, or lagoonal, supporting the conclusion of A.R.Lloyd, based on the presence of foraminifera and molluscs.

6. Time did not permit investigation of the B.M.R. collections from the Cambrian of the Barkly Tableland, although the material has been processed.

Bonaparte Gulf Basin

1. Recognition of Lower Ordovician in several new sections.

2. Recognition of Lower Carboniferous foraminifera and ostracods in Bonaparte No.1.

3. Recognition of Upper Devonian and Lower Carboniferous in the Burt Range Limestone of the Ninbing area.

Murray Basin

Identification of well-preserved ostracods in Jerilderie No.1, of a general Permian or Carboniferous age.

Bowen Basin

Recognition of Permian ostracods (previously found in outcrop, in the Reid's Dome area) in Warrinilla No.1, Westgrove No.1, and Arcadia A.A.O. 7.

Canberra area

Examination of limestone samples from the Captains Flat-Hoskintown area gave negative results.

Amadeus Basin

Time did not permit investigation of the B.M.R. collections from the Cambrian and the Ordovician of the Amadeus Basin, although the material has been processed.

P.R.EVANS and E.A.HODGSON

SPORES AND MICROPLANKTON: Studies of oil search wells continued to occupy the greatest proportion of the years activities; material from forty six wells was examined. Outcrop samples collected by B.M.R. and private company field parties in the Laura, Eromanga and Bowen Basins were also examined with limited success. Seismic shot-point samples, supplied by the Geophysical Branch and by private companies, gave useful results. P.R.Evans visited the Springsure and Taroom parties during September. He attended the March 1963 A.P.E.A. Conference in Brisbane.

The main stratigraphic results of these activities are summarized below:-

Great Artesian and Bowen Basins: These basins continued to be the major objects for study; particular emphasis was placed on the Permian.

1. Thick sections of non-marine Lower Permian (possibly Upper Carboniferous in part) were identified below the north-eastern margin of the Eromanga Sub-basin. Three units are recognizable, but their relationship to the outcropping Permian and Carboniferous of the nearby Springsure Shelf remains to be determined.

2. Well sections through the Permian of the northern Surat Basin and southern Bowen Basin are now satisfactorily correlated with outcrop on the Springsure anticline. Seven divisions of the Permian are recognizable.

3. Subdivisions of the Permo-Triassic Upper Bowen Coal Measures of the southern Bowen Basin, have been extended northwards as far as the Carborough Range.

4. The Permian of the Bowen Basin, north of the central railway line, provides little reward to palynological studies on account of the generally poor state of spore preservation.

5. Four thousand feet of non-marine Lower Permian was penetrated south-west of Roma below the Precipice Sandstone, in A.A.O. Arbroath No.1.

6. The Cretaceous appears to overlap directly onto the Lower Jurassic on the Birkhead structure, Eromanga Basin.

7. The Jurassic Hutton Sandstone overlaps the Precipice Sandstone and Evergreen Shale at the southern end of the Surat Sub-basin (U1K.A. Tingan No.1, Minima No.1, Boomi No.1).

8. Aptian and possibly Lower Albian microfossils occur in the Rumbalara Shale, south-eastern Northern Territory.

COONAMBLE
~~Otway~~ Basin:

9. Spores from three wells drilled in the Coonamble Basin (Amoseas Bohena No.1, Baradine West No.1, Wee Waa No.1) demonstrated the presence of Permian, Triassic and late Jurassic sediments.

OTWAY
~~Coonamble~~ Basin:

10. F.B.H. Pretty Hill and Euneralla No.1, the only two wells drilled in the Otway Basin during the year, penetrated non-marine Lower Cretaceous spore-bearing beds that permitted extension of correlations from Flaxmans Hill in the east to Penola No.1 and Mount Salt No.1 in the west.

Clarence Basin:

11. Two wells, Burma-Murphy Clifden No.3 and Mid-Eastern Kyogle No.1 were drilled into the Clarence Basin during the year. Triassic spores were recognized at Clifden but preservation was generally very poor, probably due to the factors similarly affecting the northern Bowen Basin.

12. Studies of seismic shot-point samples from the Kyogle area proved the existence of late Jurassic or early Cretaceous non-marine beds.

General Projects:

13. Compilation of palynological date from the Great Artesian and Bowen Basins occupied a substantial proportion of the year. This project is planned for completion in 1964.

Deductions arising from a revision of observations on B.M.R. 4 and 4a (Wallal), Canning Basin, W.A., led to a study of the Upper Jurassic - Lower Cretaceous spore and microplankton of the Canning Basin and Papuan Basin with a view to elucidating a similar sequence in eastern Australia. A zonation of the sequences that will also permit comparison between the mainland and the Papuan Mesozoic seems possible.

PUBLICATIONS

Irene Crespin:	Aronaceous Foraminifera from the Lower Cretaceous of Australia Aust.Bur.Min.Resour. Bull.66 1962
	Lower Cretaceous Foraminifera in Buckabie No.1 Well. Bur.Min.Resour. Aust.Petrol.Search Subs. Act. Pub.41 Appendix 6
P.R.Evans :	Palaeontological Appendices to P.S.S.A. reports on Frome Rocks No.1, Thangoo Nos. 1 and 1A, Betoota No.1.
P.J.Jones :	Preliminary notes on Upper Devonian Ostracoda from Frome Rocks No.2 Well. Bur.Min.Resour. Aust.Petrol.Search.Subs.Act Publ.8

PUBLICATIONS IN PRESS

P.R.Evans and P.J.Jones :	New Applications of Micropalaeontology in Australia U.N. Conference (Geneva, 1962) on Scientific Development of Under-developed Countries.

RECORDS BY THE MICROPALAEONTOLOGICAL SECTION

A.R.Lloyd :	Palaeontological Determinations of Specimens from between Pondo and Keravat, Gazelle Peninsula, New Britain. Appendix 2 in Geological Investigations of the Towanokoko - Pondo Hydro-Electric Scheme, New Britain, Territory of Papua and New Guinea by E.K.Carter 1962/120
P.R.Evans :	Appendix B. Preliminary notes on microplankton from B.M.R. 4 and B.M.R. 4A (Wallal), Canning Basin, W.A. in L.V.Bastian, 1962/168.
G.R.J.Terpstra and P.R.Evans :	Palaeontological Examination of samples from Delhi-Santos Mornington Island No.1 Well. Carpentaria Basin (Queensland). 1962/177

Publications continued.....

A.R.Lloyd	:	Foraminifera from A.A.O. Westgrove No.1 Well, Queensland 1962/189
P.R.Evans	:	Palynological Observations on Union-Kern-A.O.G. Cabawin East No.1 1963/21
A.R.Lloyd	:	Probable Radiolaria from the Lower Cretaceous Bejah Beds, Gibson Desert, West Australia 1963/30
A.R.Lloyd	:	Microfossils from the Lower Cretaceous Beds penetrated by water bores registered Nos. 15363 and 15364, Cressy Station, Great Artesian Basin, Queensland. 1963/48.
G.R.J.Terpstra	:	Report on core samples from Jerildire No.1 Well, Murray Basin, N.S.W. 1963/50
P.R.Evans	:	The microflora of F.B.H. Pretty Hill No.1 and F.B.H. Eumeralla No.1 Wells, Victoria, 1963/53.
G.R.J.Terpstra	:	Palaeontological Examination of surface samples from the Eromanga Basin 1963/85
A.R.Lloyd	:	Possible Tertiary Marine Fossils from the Brunette Limestone, Barkly Tableland, Northern Territory. 1963/90. With an appendix by P.J.Jones entitled: The occurrence of the Ostracode Haplocytheridea in the Brunette Limestone, Barkly Tableland, N.T.
A.R.Lloyd	:	Foraminifera and other fossils from the Tertiary of the Gazelle Peninsula, New Britain. 1963/91
P.R.Evans and E.A.Hodgson	:	A correlation of the Tertiary of A.O.G. Wentworth No.1, Woodside Oil Balranald No.1 and Woodside Oil Bundy No.1 Wells, Murray Basin. 1963/95
P.R.Evans	:	Spore preservation in the Bowen Basin.1963/100
G.R.J.Terpstra and P.R.Evans	:	Cretaceous Microfossils from Andado Station, N.T. 1963/108

APPENDICES TO COMPLETION REPORTS

P.R.Evans	:	Appendices were written on: A.A.O. Westgrove No.2, Westgrove No.3, Kildare No.1, Sunnybank No.1, Sunnybank No.2, Oil Dev. N.L. Maranda No.1, Exoil Brookwood No.1, Cabot-Blueberry Marina No.1
E.A.Hodgson	:	Appendix on well completion report Farmout Drillers N.L. Alice River No.1.